Chapter 2
Job-Order Costing: Calculating Unit Product Costs

Questions

2-1 Job-order costing is used in situations where many different products, each with individual and unique features, are produced each period.

2-2 In absorption costing, all manufacturing costs, both fixed and variable, are assigned to units of product—units are said to *fully absorb manufacturing costs*. Conversely, all nonmanufacturing costs are treated as period costs and they are not assigned to units of product.

2-3 Normal costing systems apply overhead costs to jobs by multiplying a predetermined overhead rate by the actual amount of the allocation incurred by the job.

2-4 Unit product cost is computed by taking the total manufacturing costs assigned to a job and dividing it by the number of units contained in the job.

2-5 The first step is to estimate the total amount of the allocation base (the denominator) that will be required for next period's estimated level of production. The second step is to estimate the total fixed manufacturing overhead cost for the coming period and the variable manufacturing overhead cost per unit of the allocation base. The third step is to use the cost formula $Y = a + bX$ to estimate the total manufacturing overhead cost (the numerator) for the coming period. The fourth step is to compute the predetermined overhead rate.

2-6 The job cost sheet is used to record all costs that are assigned to a particular job. These costs include direct materials costs traced to the job, direct labor costs traced to the job, and manufacturing overhead costs applied to the job. When a job is completed, the job cost sheet is used to compute the unit product cost.

2-7 Some production costs such as a factory manager's salary cannot be traced to a particular product or job, but rather are incurred as a result of overall production activities. In addition, some production costs such as indirect materials cannot be easily traced to jobs. If these costs are to be assigned to products, they must be allocated to the products.

2-8 If actual manufacturing overhead cost is applied to jobs, the company must wait until the end of the accounting period to apply overhead and to cost jobs. If the company computes actual overhead rates more frequently to get around this problem, the rates may fluctuate widely due to seasonal factors or variations in output. For this reason, most companies use predetermined overhead rates to apply manufacturing overhead costs to jobs.

2-9 The measure of activity used as the allocation base should drive the overhead cost; that is, the allocation base should cause the overhead cost. If the allocation base does not really cause the overhead, then costs will be incorrectly attributed to products and jobs and product costs will be distorted.

2-10 Assigning manufacturing overhead costs to jobs does not ensure a profit. The units produced may not be sold and if they are sold, they may not be sold at prices sufficient to cover all costs. It is a myth that assigning costs to products or jobs ensures that those costs will be recovered. Costs are recovered only by selling to customers—not by allocating costs.

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2-11 No, you would not expect the total applied overhead for a period to equal the actual overhead for that period. This is because the applied overhead relies on a predetermined overhead rate that is based on estimates in the numerator and denominator.

2-12 When a company applied less overhead to production than it actually incurs, it creates what is known as underapplied overhead. When it applies more overhead to production than it actually incurs, it results in overapplied overhead.

2-13 A plantwide overhead rate is a single overhead rate used throughout a plant. In a multiple overhead rate system, each production department may have its own predetermined overhead rate and its own allocation base. Some companies use multiple overhead rates rather than plantwide rates to more appropriately allocate overhead costs among products. Multiple overhead rates should be used, for example, in situations where one department is machine intensive and another department is labor intensive.

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Chapter 2: Applying Excel

The completed worksheet is shown below.

	A	B	C	D	E
1	Chapter 2: Applying Excel				
2					
3	**Data**				
4	Markup on job cost	75%			
5					
6		Department			
7		Milling	Assembly		
8	Machine-hours	60,000	3,000		
9	Direct labor-hours	8,000	80,000		
10	Total fixed manufacturing overhead cost	$390,000	$500,000		
11	Variable manufacturing overhead per machine-hour	$2.00			
12	Variable manufacturing overhead per direct labor-hour		$3.75		
13					
14	Cost summary for Job 407	Department			
15		Milling	Assembly		
16	Machine-hours	90	4		
17	Direct labor-hours	5	20		
18	Direct materials	$800	$370		
19	Direct labor cost	$70	$280		
20					
21	*Enter a formula into each of the cells marked with a ? below*				
22					
23	**Step 1: Calculate the estimated total manufacturing overhead cost for each department**				
24		Milling	Assembly		
25	Total fixed manufacturing overhead cost	$390,000	$500,000		
26	Variable manufacturing overhead per machine-hour or direct labor-hour	$2.00	$3.75		
27	Total machine-hours or direct labor-hours	60,000	80,000		
28	Total variable manufacturing overhead	$120,000	$300,000		
29	Total manufacturing overhead	$510,000	$800,000		
30					
31	**Step 2: Calculate the predetermined overhead rate in each department**				
32		Milling	Assembly		
33	Total manufacturing overhead	$510,000	$800,000		
34	Total machine-hours or direct labor-hours	60,000	80,000		
35	Predetermined overhead rate per machine-hour or direct labor-hour	$8.50	$10.00		
36					
37	**Step 3: Calculate the amount of overhead applied from both departments to Job 407**				
38		Milling	Assembly		
39	Predetermined overhead rate per machine-hour or direct labor-hour	$8.50	$10.00		
40	Machine-hours or direct labor-hours for the job	90	20		
41	Manufacturing overhead applied	$765.00	$200.00		
42					
43	**Step 4: Calculate the total job cost for Job 407**				
44		Milling	Assembly	Total	
45	Direct materials	$800.00	$370.00	$1,170.00	
46	Direct labor cost	$70.00	$280.00	$350.00	
47	Manufacturing overhead applied	$765.00	$200.00	$965.00	
48	Total cost of Job 407			$2,485.00	
49					
50	**Step 5: Calculate the selling price for Job 407**				
51	Total cost of Job 407			$2,485.00	
52	Markup			$1,863.75	
53	Selling price of Job 407			$4,348.75	
54					

Chapter 2 Form | **Filled in Chapter 2 Form** | (...

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Chapter 2: Applying Excel (continued)

The completed worksheet, with formulas displayed, is shown below.

	A	B	C	D
1	Chapter 2: Applying Excel			
2				
3	**Data**			
4	Markup on job cost	0.75		
5				
6		Department		
7		Milling	Assembly	
8	Machine-hours	60000	3000	
9	Direct labor-hours	8000	80000	
10	Total fixed manufacturing overhead cost	390000	500000	
11	Variable manufacturing overhead per machine-hour	2		
12	Variable manufacturing overhead per direct labor-hour		3.75	
13				
14	Cost summary for Job 407	Department		
15		Milling	Assembly	
16	Machine-hours	90	4	
17	Direct labor-hours	5	20	
18	Direct materials	800	370	
19	Direct labor cost	70	280	
20				
21	*Enter a formula into each of the cells marked with a ? below*			
22				
23	**Step 1: Calculate the estimated total manufacturing overhead co**			
24		Milling	Assembly	
25	Total fixed manufacturing overhead cost	=B10	=C10	
26	Variable manufacturing overhead per machine-hour or direct labor-hour	=B11	=C12	
27	Total machine-hours or direct labor-hours	=B8	=C9	
28	Total variable manufacturing overhead	=B26*B27	=C26*C27	
29	Total manufacturing overhead	=B25+B28	=C25+C28	
30				
31	**Step 2: Calculate the predetermined overhead rate in each depa**			
32		Milling	Assembly	
33	Total manufacturing overhead	=B29	=C29	
34	Total machine-hours or direct labor-hours	=B8	=C9	
35	Predetermined overhead rate per machine-hour or direct labor-hour	=B33/B34	=C33/C34	
36				
37	**Step 3: Calculate the amount of overhead applied from both dep**			
38		Milling	Assembly	
39	Predetermined overhead rate per machine-hour or direct labor-hour	=B35	=C35	
40	Machine-hours or direct labor-hours for the job	=B16	=C17	
41	Manufacturing overhead applied	=B39*B40	=C39*C40	
42				
43	**Step 4: Calculate the total job cost for Job 407**			
44		Milling	Assembly	Total
45	Direct materials	=B18	=C18	=B45+C45
46	Direct labor cost	=B19	=C19	=B46+C46
47	Manufacturing overhead applied	=B41	=C41	=B47+C47
48	Total cost of Job 407			=SUM(D45:D47)
49				
50	**Step 5: Calculate the selling price for Job 407**			
51	Total cost of Job 407			=D48
52	Markup			=B4*D51
53	Selling price of Job 407			=D51+D52
54				

Chapter 2 Formulas | Chapter 2 Requirement 1

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Chapter 2: Applying Excel (continued)

[Note: To display formulas in Excel 2013, select File > Options > Advanced > Display options for this worksheet > Show formulas in cells instead of their calculated amounts. To display the formulas in other versions of Excel, consult Excel Help.]

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Chapter 2: Applying Excel (continued)

1. When the total fixed manufacturing overhead cost for the Milling Department is changed to $300,000, the worksheet changes as show below:

	A	B	C	D	E
1	Chapter 2: Applying Excel				
2					
3	**Data**				
4	Markup on job cost	75%			
5					
6		Department			
7		Milling	Assembly		
8	Machine-hours	60,000	3,000		
9	Direct labor-hours	8,000	80,000		
10	Total fixed manufacturing overhead cost	$300,000	$500,000		
11	Variable manufacturing overhead per machine-hour	$2.00			
12	Variable manufacturing overhead per direct labor-hour		$3.75		
13					
14	Cost summary for Job 407	Department			
15		Milling	Assembly		
16	Machine-hours	90	4		
17	Direct labor-hours	5	20		
18	Direct materials	$800	$370		
19	Direct labor cost	$70	$280		
20					
21	*Enter a formula into each of the cells marked with a ? below*				
22					
23	**Step 1: Calculate the estimated total manufacturing overhead cost for each department**				
24		Milling	Assembly		
25	Total fixed manufacturing overhead cost	$300,000	$500,000		
26	Variable manufacturing overhead per machine-hour or direct labor-hour	$2.00	$3.75		
27	Total machine-hours or direct labor-hours	60,000	80,000		
28	Total variable manufacturing overhead	$120,000	$300,000		
29	Total manufacturing overhead	$420,000	$800,000		
30					
31	**Step 2: Calculate the predetermined overhead rate in each department**				
32		Milling	Assembly		
33	Total manufacturing overhead	$420,000	$800,000		
34	Total machine-hours or direct labor-hours	60,000	80,000		
35	Predetermined overhead rate per machine-hour or direct labor-hour	$7.00	$10.00		
36					
37	**Step 3: Calculate the amount of overhead applied from both departments to Job 407**				
38		Milling	Assembly		
39	Predetermined overhead rate per machine-hour or direct labor-hour	$7.00	$10.00		
40	Machine-hours or direct labor-hours for the job	90	20		
41	Manufacturing overhead applied	$630.00	$200.00		
42					
43	**Step 4: Calculate the total job cost for Job 407**				
44		Milling	Assembly	Total	
45	Direct materials	$800.00	$370.00	$1,170.00	
46	Direct labor cost	$70.00	$280.00	$350.00	
47	Manufacturing overhead applied	$630.00	$200.00	$830.00	
48	Total cost of Job 407			$2,350.00	
49					
50	**Step 5: Calculate the selling price for Job 407**				
51	Total cost of Job 407			$2,350.00	
52	Markup			$1,762.50	
53	Selling price of Job 407			$4,112.50	
54					

Chapter 2 Requirement 1 | Chapter 2 Requirem ...

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Chapter 2: Applying Excel (continued)

The selling price of Job 407 has dropped from $4,348.75 to $4,112.50 because the fixed manufacturing overhead in the Milling Department decreased from $390,000 to $300,000. This reduced the predetermined overhead rate in the Milling Department from $8.50 per machine-hour to $7.00 per machine-hour and hence the amount of overhead applied to Job 407 in the Milling Department.

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Chapter 2: Applying Excel (continued)

2. For the new Job 408, the worksheet should look like the following:

	A	B	C	D	E
1	Chapter 2: Applying Excel				
2					
3	**Data**				
4	Markup on job cost	75%			
5					
6		Department			
7		Milling	Assembly		
8	Machine-hours	60,000	3,000		
9	Direct labor-hours	8,000	80,000		
10	Total fixed manufacturing overhead cost	$390,000	$500,000		
11	Variable manufacturing overhead per machine-hour	$2.00			
12	Variable manufacturing overhead per direct labor-hour		$3.75		
13					
14	Cost summary for Job 408	Department			
15		Milling	Assembly		
16	Machine-hours	40	10		
17	Direct labor-hours	2	6		
18	Direct materials	$700	$360		
19	Direct labor cost	$50	$150		
20					
21	*Enter a formula into each of the cells marked with a ? below*				
22					
23	**Step 1: Calculate the estimated total manufacturing overhead cost for each department**				
24		Milling	Assembly		
25	Total fixed manufacturing overhead cost	$390,000	$500,000		
26	Variable manufacturing overhead per machine-hour or direct labor-hour	$2.00	$3.75		
27	Total machine-hours or direct labor-hours	60,000	80,000		
28	Total variable manufacturing overhead	$120,000	$300,000		
29	Total manufacturing overhead	$510,000	$800,000		
30					
31	**Step 2: Calculate the predetermined overhead rate in each department**				
32		Milling	Assembly		
33	Total manufacturing overhead	$510,000	$800,000		
34	Total machine-hours or direct labor-hours	60,000	80,000		
35	Predetermined overhead rate per machine-hour or direct labor-hour	$8.50	$10.00		
36					
37	**Step 3: Calculate the amount of overhead applied from both departments to Job 408**				
38		Milling	Assembly		
39	Predetermined overhead rate per machine-hour or direct labor-hour	$8.50	$10.00		
40	Machine-hours or direct labor-hours for the job	40	6		
41	Manufacturing overhead applied	$340.00	$60.00		
42					
43	**Step 4: Calculate the total job cost for Job 408**				
44		Milling	Assembly	Total	
45	Direct materials	$700.00	$360.00	$1,060.00	
46	Direct labor cost	$50.00	$150.00	$200.00	
47	Manufacturing overhead applied	$340.00	$60.00	$400.00	
48	Total cost of Job 408			$1,660.00	
49					
50	**Step 5: Calculate the selling price for Job 408**				
51	Total cost of Job 408			$1,660.00	
52	Markup			$1,245.00	
53	Selling price of Job 408			$2,905.00	
54					

Chapter 2 Requirement 2 | Chapter 2 Requirem ...

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3. When the total number of machine-hours in the Assembly Department increases from 3,000 machine-hours to 6,000 machine-hours, the worksheet looks like the following:

	A	B	C	D	E
1	Chapter 2: Applying Excel				
2					
3	**Data**				
4	Markup on job cost	75%			
5					
6		Department			
7		Milling	Assembly		
8	Machine-hours	60,000	6,000		
9	Direct labor-hours	8,000	80,000		
10	Total fixed manufacturing overhead cost	$390,000	$500,000		
11	Variable manufacturing overhead per machine-hour	$2.00			
12	Variable manufacturing overhead per direct labor-hour		$3.75		
13					
14	Cost summary for Job 408	Department			
15		Milling	Assembly		
16	Machine-hours	40	10		
17	Direct labor-hours	2	6		
18	Direct materials	$700	$360		
19	Direct labor cost	$50	$150		
20					
21	*Enter a formula into each of the cells marked with a ? below*				
22					
23	**Step 1: Calculate the estimated total manufacturing overhead cost for each department**				
24		Milling	Assembly		
25	Total fixed manufacturing overhead cost	$390,000	$500,000		
26	Variable manufacturing overhead per machine-hour or direct labor-hour	$2.00	$3.75		
27	Total machine-hours or direct labor-hours	60,000	80,000		
28	Total variable manufacturing overhead	$120,000	$300,000		
29	Total manufacturing overhead	$510,000	$800,000		
30					
31	**Step 2: Calculate the predetermined overhead rate in each department**				
32		Milling	Assembly		
33	Total manufacturing overhead	$510,000	$800,000		
34	Total machine-hours or direct labor-hours	60,000	80,000		
35	Predetermined overhead rate per machine-hour or direct labor-hour	$8.50	$10.00		
36					
37	**Step 3: Calculate the amount of overhead applied from both departments to Job 408**				
38		Milling	Assembly		
39	Predetermined overhead rate per machine-hour or direct labor-hour	$8.50	$10.00		
40	Machine-hours or direct labor-hours for the job	40	6		
41	Manufacturing overhead applied	$340.00	$60.00		
42					
43	**Step 4: Calculate the total job cost for Job 408**				
44		Milling	Assembly	Total	
45	Direct materials	$700.00	$360.00	$1,060.00	
46	Direct labor cost	$50.00	$150.00	$200.00	
47	Manufacturing overhead applied	$340.00	$60.00	$400.00	
48	Total cost of Job 408			$1,660.00	
49					
50	**Step 5: Calculate the selling price for Job 408**				
51	Total cost of Job 408			$1,660.00	
52	Markup			$1,245.00	
53	Selling price of Job 408			$2,905.00	
54					

Chapter 2 Requirement 3 | Chapter 2 Requirem ...

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The selling price for Job 408 is not affected by this change. The reason for this is that the total number of machine-hours in the Assembly Department has no effect on any cost. There would have been a change in costs and in the selling price if the total machine-hours in the Milling Department would have changed. This is because the predetermined overhead rate in that department is based on machine-hours and any change in the total machine-hours would affect the magnitude of the predetermined overhead rate in that department.

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4. When the total number of direct labor-hours in the Assembly Department decreases from 80,000 direct labor-hours to 50,000 direct labor-hours, the worksheet looks like the following:

	A	B	C	D	E
1	Chapter 2: Applying Excel				
2					
3	**Data**				
4	Markup on job cost	75%			
5					
6		Department			
7		Milling	Assembly		
8	Machine-hours	60,000	3,000		
9	Direct labor-hours	8,000	50,000		
10	Total fixed manufacturing overhead cost	$390,000	$500,000		
11	Variable manufacturing overhead per machine-hour	$2.00			
12	Variable manufacturing overhead per direct labor-hour		$3.75		
13					
14	Cost summary for Job 408	Department			
15		Milling	Assembly		
16	Machine-hours	40	10		
17	Direct labor-hours	2	6		
18	Direct materials	$700	$360		
19	Direct labor cost	$50	$150		
20					
21	*Enter a formula into each of the cells marked with a ? below*				
22					
23	**Step 1: Calculate the estimated total manufacturing overhead cost for each department**				
24		Milling	Assembly		
25	Total fixed manufacturing overhead cost	$390,000	$500,000		
26	Variable manufacturing overhead per machine-hour or direct labor-hour	$2.00	$3.75		
27	Total machine-hours or direct labor-hours	60,000	50,000		
28	Total variable manufacturing overhead	$120,000	$187,500		
29	Total manufacturing overhead	$510,000	$687,500		
30					
31	**Step 2: Calculate the predetermined overhead rate in each department**				
32		Milling	Assembly		
33	Total manufacturing overhead	$510,000	$687,500		
34	Total machine-hours or direct labor-hours	60,000	50,000		
35	Predetermined overhead rate per machine-hour or direct labor-hour	$8.50	$13.75		
36					
37	**Step 3: Calculate the amount of overhead applied from both departments to Job 408**				
38		Milling	Assembly		
39	Predetermined overhead rate per machine-hour or direct labor-hour	$8.50	$13.75		
40	Machine-hours or direct labor-hours for the job	40	6		
41	Manufacturing overhead applied	$340.00	$82.50		
42					
43	**Step 4: Calculate the total job cost for Job 408**				
44		Milling	Assembly	Total	
45	Direct materials	$700.00	$360.00	$1,060.00	
46	Direct labor cost	$50.00	$150.00	$200.00	
47	Manufacturing overhead applied	$340.00	$82.50	$422.50	
48	Total cost of Job 408			$1,682.50	
49					
50	**Step 5: Calculate the selling price for Job 408**				
51	Total cost of Job 408			$1,682.50	
52	Markup			$1,261.88	
53	Selling price of Job 408			$2,944.38	
54					

Chapter 2 Requirement 4

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The selling price of Job 408 has increased from $2,905.00 to $2,944.38. This occurs because the decrease in the total number of direct labor-hours in the Assembly Department increases the predetermined overhead rate in that department from $10.00 per direct labor-hour to $13.75 per direct labor-hour. In effect, the same total fixed manufacturing overhead cost is spread across fewer total direct labor-hours.

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The Foundational 15

1. The first step is to calculate the estimated total overhead costs in Molding and Fabrication:

   Molding: Using the equation $Y = a + bX$, the estimated total manufacturing overhead cost is computed as follows:

   Y = \$10,000 + (\$1.40 per MH)(2,500 MHs)

Estimated fixed manufacturing overhead	\$10,000
Estimated variable manufacturing overhead:	
\$1.40 per MH × 2,500 MHs	3,500
Estimated total manufacturing overhead cost	\$13,500

   Fabrication: Using the equation $Y = a + bX$, the estimated total manufacturing overhead cost is computed as follows:

   Y = \$15,000 + (\$2.20 per MH)(1,500 MHs)

Estimated fixed manufacturing overhead	\$15,000
Estimated variable manufacturing overhead:	
\$2.20 per MH × 1,500 MHs	3,300
Estimated total manufacturing overhead cost	\$18,300

   The second step is to combine the estimated manufacturing overhead costs in Molding and Fabrication (\$13,500 + \$18,300 = \$31,800) to enable calculating the predetermined overhead rate as follows:

Estimated total manufacturing overhead (a) .	\$31,800	
Estimated total machine-hours (MHs) (b)........	4,000	MHs
Predetermined overhead rate (a) ÷ (b).........	\$7.95	per MH

2. The manufacturing overhead applied to Jobs P and Q is computed as follows:

	Job P	*Job Q*
Actual machine-hours worked (a)................	2,300	1,700
Predetermined overhead rate per MH (b)......	\$7.95	\$7.95
Manufacturing overhead applied (a) × (b)	\$18,285	\$13,515

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The Foundational 15

3. The total manufacturing cost assigned to Job P is computed as follows:

	Job P
Direct materials	$13,000
Direct labor	21,000
Manufacturing overhead applied	18,285
Total manufacturing cost	$52,285

4. Job P's unit product cost is computed as follows:

	Job P
Total manufacturing cost (a)	$52,285
Number of units (b)	20
Unit product cost (rounded) (a) ÷ (b)	$2,614

5. The total manufacturing cost assigned to Job Q is computed as follows:

	Job P
Direct materials	$ 8,000
Direct labor	7,500
Manufacturing overhead applied	13,515
Total manufacturing cost	$29,015

6. Job Q's unit product cost is computed as follows:

	Job P
Total manufacturing cost (a)	$29,015
Number of units (b)	30
Unit product cost (rounded) (a) ÷ (b)	$967

7. The selling prices are calculated as follows:

	Job P	Job Q
Total manufacturing cost	$52,285	$29,015
Markup (based on 80%)	41,828	23,212
Total price for the job (a)	$94,113	$52,227
Number of units in the job (b)	20	30
Selling price per unit (rounded) (a) ÷ (b)	$4,706	$1,741

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The Foundational 15

8. The cost of goods sold is the sum of the manufacturing costs assigned to Jobs P and Q:

Total manufacturing cost assigned to Job P	$52,285
Total manufacturing cost assigned to Job Q	29,015
Cost of goods sold	$81,300

9. Molding: Using the equation $Y = a + bX$, the estimated total manufacturing overhead cost is computed as follows:

$$Y = \$10,000 + (\$1.40 \text{ per MH})(2,500 \text{ MHs})$$

Estimated fixed manufacturing overhead	$10,000
Estimated variable manufacturing overhead:	
$1.40 per MH × 2,500 MHs	3,500
Estimated total manufacturing overhead cost	$13,500

The predetermined overhead rate in Molding is computed as follows:

Estimated total manufacturing overhead (a)	$13,500	
Estimated total machine-hours (MHs) (b)	2,500	MHs
Predetermined overhead rate (a) ÷ (b)	$5.40	per MH

Fabrication: Using the equation $Y = a + bX$, the estimated total manufacturing overhead cost is computed as follows:

$$Y = \$15,000 + (\$2.20 \text{ per MH})(1,500 \text{ MHs})$$

Estimated fixed manufacturing overhead	$15,000
Estimated variable manufacturing overhead:	
$2.20 per MH × 1,500 MHs	3,300
Estimated total manufacturing overhead cost	$18,300

The predetermined overhead rate in Fabrication is computed as follows:

Estimated total manufacturing overhead (a)	$18,300	
Estimated total machine-hours (MHs) (b)	1,500	MHs
Predetermined overhead rate (a) ÷ (b)	$12.20	per MH

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The Foundational 15

10. The applied overhead from Molding is computed as follows:

	Job P	*Job Q*
Machine-hours worked on job (a)	1,700	800
Molding overhead rate (b)	\$5.40	\$5.40
Manufacturing overhead applied (a) × (b)	\$9,180	\$4,320

11. The applied overhead from Fabrication is computed as follows:

	Job P	*Job Q*
Machine-hours worked on job (a)	600	900
Fabrication overhead rate (b)	\$12.20	\$12.20
Manufacturing overhead applied (a) × (b)	\$7,320	\$10,980

12. The unit product cost for Job P is computed as follows:

Direct materials		\$13,000
Direct labor		21,000
Manufacturing overhead applied:		
Molding Department	\$9,180	
Fabrication Department	7,320	16,500
Total manufacturing cost (a)		\$50,500
Number of units in the job (b)		20
Unit product cost (a) ÷ (b)		\$2,525

13. The unit product cost for Job Q is computed as follows:

Direct materials		\$8,000
Direct labor		7,500
Manufacturing overhead applied:		
Molding Department	\$4,320	
Fabrication Department	10,980	15,300
Total manufacturing cost (a)		\$30,800
Number of units in the job (b)		30
Unit product cost (rounded) (a) ÷ (b)		\$1,027

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The Foundational 15

14. The selling prices are calculated as follows:

	Job P	*Job Q*
Total manufacturing cost	$50,500	$30,800
Markup (based on 80%)	40,400	24,640
Total price for the job (a)	$90,900	$55,440
Number of units in the job (b)	20	30
Selling price per unit (a) ÷ (b)	$4,545	$1,848

15. The cost of goods sold is the sum of the manufacturing costs assigned to Jobs P and Q:

Total manufacturing cost assigned to Job P	$50,500
Total manufacturing cost assigned to Job Q	30,800
Cost of goods sold	$81,300

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Exercise 2-1 (10 minutes)

The estimated total manufacturing overhead cost is computed as follows:

$$Y = \$94,000 + (\$2.00 \text{ per DLH})(20,000 \text{ DLHs})$$

Estimated fixed manufacturing overhead	$ 94,000
Estimated variable manufacturing overhead: $2.00 per DLH × 20,000 DLHs.......................................	40,000
Estimated total manufacturing overhead cost...........	$134,000

The plantwide predetermined overhead rate is computed as follows:

Estimated total manufacturing overhead (a)......	$134,000
Estimated total direct labor hours (b)................	20,000 DLHs
Predetermined overhead rate (a) ÷ (b)............	$6.70 per DLH

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Exercise 2-2 (10 minutes)

Actual direct labor-hours (a)........................	10,800
Predetermined overhead rate (b)................	$23.40
Manufacturing overhead applied (a) × (b)....	$252,720

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Exercise 2-3 (10 minutes)

1. Total direct labor-hours required for Job A-500:

Direct labor cost (a)	$153
Direct labor wage rate per hour (b)	$17
Total direct labor hours (a) ÷ (b)	9

Total manufacturing cost assigned to Job A-500:

Direct materials	$231
Direct labor	153
Manufacturing overhead applied ($14 per DLH × 9 DLHs)	126
Total manufacturing cost	$510

2. Unit product cost for Job A-500:

Total manufacturing cost (a)	$510
Number of units in the job (b)	40
Unit product cost (a) ÷ (b)	$12.75

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Exercise 2-4 (10 minutes)

1 and 2.

The total direct labor-hours required for Job N-60:

	Assembly	Testing & Packaging
Direct labor cost (a)	$180	$40
Direct labor wage rate per hour (b)	$20	$20
Total direct labor hours (a) ÷ (b)	9	2

The total manufacturing cost and unit product cost for Job N-60 is computed as follows:

Direct materials ($340 + $25)		$365
Direct labor ($180 + $40)		220
Assembly Department ($16 per DLH × 9 DLHs)	$144	
Testing & Packaging Department ($12 per DLH × 2 DLHs)	24	168
Total manufacturing cost		$753

Total manufacturing cost (a)	$753
Number of units in the job (b)	10
Unit product cost (a) ÷ (b)	$75.30

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Exercise 2-5 (10 minutes)

1 and 2.

The total direct labor-hours required in Finishing for Job 700:

	Finishing
Direct labor cost (a)	$128
Direct labor wage rate per hour (b)	$16
Total direct labor hours (a) ÷ (b)	8

The total manufacturing cost and unit product cost for Job 700 is computed as follows:

Direct materials ($410 + $60)		$470
Direct labor ($128 + $48)		176
Finishing Department ($18 per DLH × 8 DLHs)	$144	
Fabrication Department (110% × $60)	66	210
Total manufacturing cost		$856

Total manufacturing cost (a)	$856
Number of units in the job (b)	15
Unit product cost (rounded) (a) ÷ (b)	$57.07

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Exercise 2-6 (10 minutes)

1. The estimated total overhead cost is computed as follows:

$$Y = \$680,000 + (\$0.50 \text{ per DLH})(80,000 \text{ DLHs})$$

Estimated fixed overhead cost	$680,000
Estimated variable overhead cost: $0.50 per DLH × 80,000 DLHs	40,000
Estimated total overhead cost	$720,000

The predetermined overhead rate is computed as follows:

Estimated total overhead (a)	$720,000	
Estimated total direct labor-hours (b)	80,000	DLHs
Predetermined overhead rate (a) ÷ (b)	$9.00	per DLH

2. Total manufacturing cost assigned to Xavier:

Direct materials	$38,000
Direct labor	21,000
Overhead applied ($9.00 per DLH × 280 DLHs)	2,520
Total manufacturing cost	$61,520

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Exercise 2-7 (20 minutes)

1. Step 1: The total direct labor-hours required for Job Omega:

Direct labor cost (a)	$345,000
Direct labor wage rate per hour (b)	$15
Total direct labor hours worked (a) ÷ (b)	23,000

Step 2: Derive the plantwide predetermined overhead rate:

Manufacturing overhead applied to Job Omega (a)	$184,000
Direct labor hours worked on Job Omega (b)	23,000
Plantwide predetermined overhead rate (a) ÷ (b)	$8.00 per DLH

2. The job cost sheet for Job Alpha is derived as follows: (note that direct materials is the plug figure)

Direct materials (plug figure)	$ 280,000
Direct labor (54,500 DLHs × $15 per DLH)	817,500
Manufacturing overhead applied ($8 per DLH × 54,500 DLHs)	436,000
Total job cost (given)	$1,533,500

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Exercise 2-8 (10 minutes)

Direct material	$10,000
Direct labor	12,000
Manufacturing overhead applied:	
$12,000 × 125%	15,000
Total manufacturing cost	$37,000

Total manufacturing cost (a)	$37,000
Number of units in job (b)	1,000
Unit product cost (a) ÷ (b)	$37

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Exercise 2-9 (30 minutes)

1. The estimated total overhead cost is computed as follows:

$$Y = \$1,980,000 + (\$2.00 \text{ per MH})(165,000 \text{ MHs})$$

Estimated fixed overhead	$1,980,000
Estimated variable overhead: $2.00 per MH × 165,000 MHs	330,000
Estimated total overhead cost	$2,310,000

The plantwide predetermined overhead rate is computed as follows:

Estimated total overhead (a)......................	$2,310,000	
Estimated total machine-hours (b)	165,000	MHs
Predetermined overhead rate (a) ÷ (b).......	$14.00	per MH

2. Total manufacturing cost assigned to Job P90:

Direct materials	$1,150
Direct labor	830
Overhead applied ($14 per MH × 72 MHs)	1,008
Total manufacturing cost...	$2,988

3a. Given that the company is operating at 50% of its manufacturing capacity, an argument can made that the company should pursue any business opportunities that generate a positive a contribution margin. Based on the information provided, it appears that Job P90 does generate a positive contribution margin as shown below:

Sales...		$2,500
Direct materials	$1,150	
Direct labor	830	
Variable overhead applied ($2.00 per MH × 72 MHs)	144	2,124
Contribution margin		$ 376

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Exercise 2-9 (continued)

3b. The CFO's argument is based on the assertion that Job P90 does not generate enough revenue to cover the cost of the manufacturing resources that it consumes. However, given that the company is operating at 50% of its manufacturing capacity, the overhead costs applied to Job P90 in requirement 2 do not represent the cost of the overhead resources consumed making Job P90. In other words, the overhead applied in requirement 2 includes a charge for used and unused capacity. This reality provides instructors an opportunity to introduce students to the main idea underlying Appendix 2B.

If we estimate a capacity-based overhead rate for the company and apply overhead costs to Job P90 using this rate, it reveals that the revenue generated by the job ($2,500) is still insufficient to cover its manufacturing costs of $2,556, as computed below:

The estimated total overhead cost (at capacity) is computed as follows (keep in mind that 165,000 MHs ÷ 50% = 330,000 MHs):

$$Y = \$1,980,000 + (\$2.00 \text{ per MH})(330,000 \text{ MHs})$$

Estimated fixed overhead	$1,980,000
Estimated variable overhead: $2.00 per MH × 330,000 MHs	660,000
Estimated total overhead cost	$2,640,000

The predetermined capacity-based overhead rate is computed as follows:

Estimated total overhead (a)	$2,640,000	
Estimated total machine-hours (b)	330,000	MHs
Predetermined overhead rate (a) ÷ (b)	$8.00	per MH

The total manufacturing cost assigned to Job P90 (using a capacity-based overhead rate):

Direct materials	$1,150
Direct labor	830
Overhead applied ($8 per MH × 72 MHs)	576
Total manufacturing cost	$2,556

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Exercise 2-10 (10 minutes)

1. Yes, overhead should be applied to Job W at year-end.

   Because $6,000 of overhead was applied to Job V on the basis of $8,000 of direct labor cost, the company's predetermined overhead rate must be 75% of direct labor cost.

Job W direct labor cost (a)	$4,000
Predetermined overhead rate (b)	0.75
Manufacturing overhead applied to Job W (a) × (b)	$3,000

2. The direct materials ($2,500), direct labor ($4,000), and applied overhead ($3,000) for Job W will be included in Work in Process on Sigma Corporation's balance sheet.

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Exercise 2-11 (30 minutes)

Note to the instructor: This exercise can be used as a launching pad for a discussion of Appendix 2B.

1. The estimated total fixed manufacturing overhead can be computed using the data from any of quarters 1-3. For illustrative purposes, we'll use the first quarter as follows:

Total overhead cost (First quarter)	$300,000
Variable cost element ($2.00 per unit × 80,000 units)	160,000
Fixed cost element	$140,000

2. The fixed and variable cost estimates from requirement 1 can be used to estimate the total manufacturing overhead cost for the fourth quarter as follows:

$$Y = \$140,000 + (\$2.00 \text{ per unit})(60,000 \text{ units})$$

Estimated fixed manufacturing overhead	$140,000
Estimated variable manufacturing overhead	
$2.00 per unit × 60,000 units	120,000
Estimated total manufacturing overhead cost	$260,000

The estimated unit product cost for the fourth quarter is computed as follows:

Direct materials	$180,000
Direct labor	96,000
Manufacturing overhead	260,000
Total manufacturing costs (a)	$536,000
Number of units to be produced (b)	60,000
Unit product cost (rounded) (a) ÷ (b)	$8.93

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Exercise 2-11 (continued)

3. The fixed portion of the manufacturing overhead cost is causing the unit product costs to fluctuate. The unit product cost increases as the level of production decreases because the fixed overhead is spread over fewer units.

4. The unit product cost can be stabilized by using a predetermined overhead rate that is based on expected activity for the entire year. The cost formula created in requirement 1 can be adapted to compute the annual predetermined overhead rate. The annual fixed manufacturing overhead is $560,000 ($140,000 per quarter × 4 quarters). The variable manufacturing overhead per unit is $2.00. The cost formula is as follows:

   $$Y = \$560{,}000 + (\$2.00 \text{ per unit} \times 200{,}000 \text{ units})$$

Estimated fixed manufacturing overhead	$560,000
Estimated variable manufacturing overhead	
$2.00 per unit × 200,000 units	400,000
Estimated total manufacturing overhead cost	$960,000

The annual predetermined overhead rate is computed as follows:

Estimated total manufacturing overhead (a)	$960,000	
Estimated total units produced (b)	200,000	
Predetermined overhead rate (a) ÷ (b)	$4.80	per unit

Using a predetermined overhead rate of $4.80 per unit, the unit product costs would stabilize as shown below:

	Quarter			
	First	*Second*	*Third*	*Fourth*
Direct materials	$240,000	$120,000	$ 60,000	$180,000
Direct labor	128,000	64,000	32,000	96,000
Manufacturing overhead:				
at $4.80 per unit	384,000	192,000	96,000	288,000
Total cost (a)	$752,000	$376,000	$188,000	$564,000
Number of units produced (b)	80,000	40,000	20,000	60,000
Unit product cost (a) ÷ (b)	$9.40	$9.40	$9.40	$9.40

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Exercise 2-12 (20 minutes)

1. The estimated total manufacturing overhead cost is computed as follows:

$$Y = \$650,000 + (\$3.00 \text{ per MH})(100,000 \text{ MHs})$$

Estimated fixed manufacturing overhead................	$650,000
Estimated variable manufacturing overhead: $3.00 per MH × 100,000 MHs	300,000
Estimated total manufacturing overhead cost	$950,000

The plantwide predetermined overhead rate is computed as follows:

Estimated total manufacturing overhead (a)	$950,000	
Estimated total machine-hours (b)	100,000	MHs
Predetermined overhead rate (a) ÷ (b).......	$9.50	per MH

2. Total manufacturing cost assigned to Job 400:

Direct materials	$ 450
Direct labor	210
Manufacturing overhead applied ($9.50 per MH × 40 MHs)	380
Total manufacturing cost..	$1,040

3. The unit product cost of Job 400 is computed as follows:

Total manufacturing cost (a)......................	$1,040
Number of units in the job (b)....................	52
Unit product cost (a) ÷ (b)	$20

4. The selling price per unit is computed as follows:

Total manufacturing cost	$1,040
Markup (120% of manufacturing cost)	1,248
Selling price for Job 400 (a).......................	$2,288
Number of units in Job 400 (b)	52
Selling price per unit (a) ÷ (b)	$44

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Exercise 2-12 (continued)

5. Possible critiques of Moody's pricing tactics include (1) relying on a plantwide overhead rate to allocate overhead costs to jobs may distort the cost base used for cost-plus pricing, (2) relying on an absorption approach may allocate unused capacity costs to jobs thereby distorting the cost base for cost-plus pricing, and (3) relying on absorption cost-plus pricing ignores the customers' willingness to pay based on their perceived value of the product or service.

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Exercise 2-13 (20 minutes)

1. Cutting Department:

   The estimated total manufacturing overhead cost in the Cutting Department is computed as follows:

$$Y = \$264,000 + (\$2.00 \text{ per MH})(48,000 \text{ MHs})$$

Estimated fixed manufacturing overhead	$264,000
Estimated variable manufacturing overhead	
$2.00 per MH × 48,000 MHs	96,000
Estimated total manufacturing overhead cost	$360,000

   The predetermined overhead rate is computed as follows:

Estimated total manufacturing overhead (a)	$360,000	
Estimated total machine-hours (b)	48,000	MHs
Predetermined overhead rate (a) ÷ (b)	$7.50	per MH

   Finishing Department:

   The estimated total manufacturing overhead cost in the Finishing Department is computed as follows:

$$Y = \$366,000 + (\$4.00 \text{ per DLH})(30,000 \text{ DLHs})$$

Estimated fixed manufacturing overhead	$366,000
Estimated variable manufacturing overhead	
$4.00 per DLH × 30,000 DLHs	120,000
Estimated total manufacturing overhead cost	$486,000

   The predetermined overhead rate is computed as follows:

Estimated total manufacturing overhead (a)	$486,000	
Estimated total direct labor-hours (b)	30,000	DLHs
Predetermined overhead rate (a) ÷ (b)	$16.20	per DLH

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Exercise 2-13 (continued)

2. Total manufacturing cost assigned to Job 203:

Direct materials ($500 + $310)		$ 810
Direct labor ($108 + $360)		468
Cutting Department (80 MHs × $7.50 per MH)	$600	
Finishing Department (20 DLH × $16.20 per DLH)	324	924
Total manufacturing cost		$2,202

3. Yes; if some jobs require a large amount of machine time and a small amount of labor time, they would be charged substantially less overhead cost if a plantwide overhead rate based on direct labor hours were used. It appears, for example, that this would be true of Job 203 which required considerable machine time to complete, but required a relatively small amount of labor hours.

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Exercise 2-14 (10 minutes)

1. The estimated total overhead cost is computed as follows:

$$Y = \$4,800,000 + (\$0.05 \text{ per DL\$})(\$8,000,000)$$

Estimated fixed overhead	$4,800,000
Estimated variable overhead: $0.05 per DL$ × $8,000,000 DL$	400,000
Estimated total overhead cost	$5,200,000

The predetermined overhead rate is computed as follows:

Estimated total overhead (a)	$5,200,000	
Estimated total direct labor-dollars (b)	8,000,000	DL$
Predetermined overhead rate (a) ÷ (b)	$0.65	per DL$

2. Total cost assigned to *You Can Say That Again*:

Direct materials	$1,259,000
Direct labor	2,400,000
Overhead applied ($0.65 per DL$ × $2,400,000)	1,560,000
Total job cost	$5,219,000

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Exercise 2-15 (45 minutes)

1a. The first step is to calculate the estimated total overhead costs in Molding and Fabrication:

Molding: Using the equation $Y = a + bX$, the estimated total manufacturing overhead cost would be calculated as follows:

$$Y = \$700{,}000 + (\$3.00 \text{ per MH})(20{,}000 \text{ MHs})$$

Estimated fixed manufacturing overhead..................	$700,000
Estimated variable manufacturing overhead: $3.00 per MH × 20,000 MHs..	60,000
Estimated total manufacturing overhead cost...........	$760,000

Fabrication: Using the equation $Y = a + bX$, the estimated total manufacturing overhead cost would be calculated as follows:

$$Y = \$210{,}000 + (\$1.00 \text{ per MH})(30{,}000 \text{ MHs})$$

Estimated fixed manufacturing overhead..................	$210,000
Estimated variable manufacturing overhead: $1.00 per MH × 30,000 MHs..	30,000
Estimated total manufacturing overhead cost...........	$240,000

The second step is to combine the estimated manufacturing overhead costs in Molding and Fabrication ($760,000 + $240,000 = $1,000,000) to enable calculating the predetermined overhead rate as follows:

Estimated total manufacturing overhead (a)	$1,000,000	
Estimated total machine-hours (b)	50,000	MHs
Predetermined overhead rate (a) ÷ (b)	$20.00	per MH

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Exercise 2-15 (continued)

1b. Total manufacturing cost assigned to Jobs D-70 and C-200:

	D-70	*C-200*
Direct materials	$ 700,000	$ 550,000
Direct labor	360,000	400,000
Manufacturing overhead applied ($20.00 per MH × 20,000 MHs; $20.00 per MH × 30,000 MHs)	400,000	600,000
Total manufacturing cost	$1,460,000	$1,550,000

1c. Bid prices for Jobs D-70 and C-200:

	D-70	*C-200*
Total manufacturing cost (a)	$1,460,000	$1,550,000
Markup percentage (b)	150%	150%
Bid price (a) × (b)	$2,190,000	$2,325,000

1d. Because the company has no beginning or ending inventories and only Jobs D-70 and C-200 were started, completed, and sold during the year, the cost of goods sold is equal to the sum of the manufacturing costs assigned to both jobs of $3,010,000 (=$1,460,000 + $1,550,000).

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Exercise 2-15 (continued)

2a. Molding Department:

Using the equation $Y = a + bX$, the estimated total manufacturing overhead cost would be depicted as follows:

$$Y = \$700,000 + (\$3.00 \text{ per MH})(20,000 \text{ MHs})$$

Estimated fixed manufacturing overhead	$700,000
Estimated variable manufacturing overhead: $3.00 per MH × 20,000 MHs	60,000
Estimated total manufacturing overhead cost	$760,000

The predetermined overhead rate is computed as follows:

Estimated total manufacturing overhead (a)	$760,000	
Estimated total machine-hours (b)	20,000	MHs
Predetermined overhead rate (a) ÷ (b)	$38.00	per MH

Fabrication Department:

Using the equation $Y = a + bX$, the estimated total manufacturing overhead cost would be depicted as follows:

$$Y = \$210,000 + (\$1.00 \text{ per MH})(30,000 \text{ MHs})$$

Estimated fixed manufacturing overhead	$210,000
Estimated variable manufacturing overhead: $1.00 per MH × 30,000 MHs	30,000
Estimated total manufacturing overhead cost	$240,000

The predetermined overhead rate is computed as follows:

Estimated total manufacturing overhead (a)	$240,000	
Estimated total direct labor-hours (b)	30,000	MHs
Predetermined overhead rate (a) ÷ (b)	$8.00	per MH

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Exercise 2-15 (continued)

2b. Total manufacturing costs assigned to Jobs D-70 and C-200:

	D-70	*C-200*
Direct materials	$ 700,000	$ 550,000
Direct labor	360,000	400,000
Molding Department (14,000 MHs × $38 per MH; 6,000 MHs × $38 per MH)	532,000	228,000
Fabrication Department (6,000 MH × $8 per MH; 24,000 MH × $8 per MH)	48,000	192,000
Total manufacturing cost	$1,640,000	$1,370,000

2c. Bid prices for Jobs D-70 and C-200:

	D-70	*C-200*
Total manufacturing cost (a)	$1,640,000	$1,370,000
Markup percentage (b)	150%	150%
Bid price (a) × (b)	$2,460,000	$2,055,000

2d. Because the company has no beginning or ending inventories and only Jobs D-70 and C-200 were started, completed, and sold during the year, the cost of goods sold is equal to the sum of the manufacturing costs assigned to both jobs of $3,010,000 (=$1,640,000 + $1,370,000).

3. The plantwide and departmental approaches for applying manufacturing overhead costs to products produce identical cost of goods sold figures. However, these two approaches lead to different bid prices for Jobs D-70 and C-200. The bid price for Job D-70 using the departmental approach is $270,000 (=$2,460,000 – $2,190,000) higher than the bid price using the plantwide approach. This is because the departmental cost pools reflect the fact that Job D-70 is an intensive user of Molding machine-hours. The overhead rate in Molding ($38) is much higher than the overhead rate in Fabrication ($8). Conversely, Job C-200 is an intensive user of the less-expensive Fabrication machine-hours, so its departmental bid price is $270,000 lower than the plantwide bid price.

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Exercise 2-15 (continued)

Whether a job-order costing system relies on plantwide overhead cost allocation or departmental overhead cost allocation does not usually have an important impact on the accuracy of the cost of goods sold reported for the company as a whole. However, it can have a huge impact on internal decisions with respect to individual jobs, such as establishing bid prices for those jobs. Job-order costing systems that rely on plantwide overhead cost allocation are commonly used to value ending inventories and cost of goods sold for external reporting purposes, but they can create costing inaccuracies for individual jobs that adversely influence internal decision making.

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Problem 2-16 (30 minutes)

1a. The estimated total overhead cost is computed as follows:

Y = $784,000 + ($2.00 per DLH)(140,000 DLHs)

Estimated fixed manufacturing overhead	$ 784,000
Estimated variable manufacturing overhead: $2.00 per DLH × 140,000 DLH	280,000
Estimated total manufacturing overhead cost	$1,064,000

The predetermined overhead rate is computed as follows:

Estimated total manufacturing overhead (a)	$1,064,000	
Estimated total direct labor-hours (b)	140,000	DLH
Predetermined overhead rate (a) ÷ (b)	$7.60	per DLH

1b. Total manufacturing cost assigned to Job 550:

Direct materials	$175
Direct labor	225
Manufacturing overhead applied ($7.60 per DLH × 15 DLH)	114
Total manufacturing cost of Job 550	$514

1c. The selling price for Job 550 is computed as follows:

	Job 550
Total manufacturing cost	$ 514
Markup (200%)	1,028
Selling price	$1,542

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Problem 2-16 (continued)

2a. The estimated total overhead cost is computed as follows:

$$Y = \$784{,}000 + (\$4.00 \text{ per MH})(70{,}000 \text{ MHs})$$

Estimated fixed manufacturing overhead	$ 784,000
Estimated variable manufacturing overhead: $4.00 per MH × 70,000 MHs	280,000
Estimated total manufacturing overhead cost	$1,064,000

The predetermined overhead rate is computed as follows:

Estimated total manufacturing overhead (a)	$1,064,000	
Estimated total machine-hours (b)	70,000	MHs
Predetermined overhead rate (a) ÷ (b)	$15.20	per MH

2b. Total manufacturing cost assigned to Job 550:

Direct materials	$175
Direct labor	225
Manufacturing overhead applied ($15.20 per MH × 5 MH)	76
Total manufacturing cost of Job 550	$476

2c. The selling price for Job 550 is computed as follows:

	Job 550
Total manufacturing cost	$ 476
Markup (200%)	952
Selling price	$1,428

3. The price for Job 550 using direct labor-hours as the allocation base ($1,542) is $114 higher than the price derived using machine-hours as the allocation base ($1,428). If machine-hours is the better choice for an allocation base, then if Landen continues to use direct labor-hours as its overhead allocation base, it will overprice jobs that are intensive users of direct labor-hours and non-intensive users of machine-hours. In a bidding situation, Landen will tend to lose bids on jobs such as Job 550 if its competitors have more accurate cost accounting systems.

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Problem 2-17 (20 minutes)

1. The predetermined plantwide overhead rate is computed as follows:

Estimated manufacturing overhead (a)	$1,400,000	
Estimated total direct labor-hours (b)	80,000	DLHs
Predetermined overhead rate (a) ÷ (b)	$17.50	per DLH

The overhead applied to Job Bravo is computed as follows:

Direct labor-hours worked on Bravo (a)	14	
Predetermined overhead rate (b)	$17.50	per DLH
Overhead applied to Bravo (a) × (b)	$245	

2. The predetermined overhead rate in Assembly is computed as follows:

Estimated manufacturing overhead (a)	$600,000	
Estimated total direct labor-hours (b)	50,000	DLHs
Predetermined overhead rate (a) ÷ (b)	$12.00	per DLH

The predetermined overhead rate in Fabrication is computed as follows:

Estimated manufacturing overhead (a)	$800,000	
Estimated total machine-hours (b)	100,000	MHs
Predetermined overhead rate (a) ÷ (b)	$8.00	per MH

The overhead applied to Job Bravo is computed as follows:

	Assembly	Fabrication	Total
Quantity of allocation base used (a)	11	6	
Predetermined overhead rate (b)	$12.00	$8.00	
Overhead applied to Bravo (a) × (b)	$132	$48	$180

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Problem 2-18 (15 minutes)

1. The estimated total overhead cost is computed as follows:

$$Y = \$350{,}000 + (\$1.00 \text{ per DLH})(20{,}000 \text{ DLHs})$$

Estimated fixed overhead	$350,000
Estimated variable overhead: $1.00 per DLH × 20,000 DLHs	20,000
Estimated total overhead cost	$370,000

The predetermined overhead rate is computed as follows:

Estimated total overhead (a)	$370,000	
Estimated total direct labor-hours (b)	20,000	DLHs
Predetermined overhead rate (a) ÷ (b)	$18.50	per DLH

2. Total manufacturing cost assigned to Mr. Wilkes:

Direct materials	$590
Direct labor	109
Overhead applied ($18.50 per DLH × 6 DLH)	111
Total cost assigned to Mr. Wilkes	$810

3. The price charged to Mr. Wilkes is computed as follows:

	Job 550
Total manufacturing cost	$ 810
Markup (40%)	324
Selling price	$1,134

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Problem 2-19 (20 minutes)

1. Molding Department:

The estimated total manufacturing overhead cost in the Molding Department is computed as follows:

$$Y = \$497,000 + \$1.50 \text{ per MH} \times 70,000 \text{ MHs}$$

Estimated fixed manufacturing overhead	$497,000
Estimated variable manufacturing overhead:	
$1.50 per MH × 70,000 MHs	105,000
Estimated total manufacturing overhead cost	$602,000

The predetermined overhead rate is computed as follows:

Estimated total manufacturing overhead (a)	$602,000	
Estimated total machine-hours (b)	70,000	MHs
Predetermined overhead rate (a) ÷ (b)	$8.60	per MH

Painting Department:

The estimated total manufacturing overhead cost in the Painting Department is computed as follows:

$$Y = \$615,000 + \$2.00 \text{ per DLH} \times 60,000 \text{ DLHs}$$

Estimated fixed manufacturing overhead	$615,000
Estimated variable manufacturing overhead:	
$2.00 per DLH × 60,000 DLHs	120,000
Estimated total manufacturing overhead cost	$735,000

The predetermined overhead rate is computed as follows:

Estimated total manufacturing overhead (a)	$735,000	
Estimated total DLHs (b)	60,000	DLHs
Predetermined overhead rate (a) ÷ (b)	$12.25	per DLH

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Problem 2-19 (continued)

2. Molding Department overhead applied:

Molding Department overhead applied:	
110 machine-hours × \$8.60 per machine-hour	\$ 946
Painting Department overhead applied:	
84 direct labor-hours × \$12.25 per DLH	1,029
Total overhead cost..	\$1,975

3. Total cost of Job 205:

	Molding Dept.	*Painting Dept.*	*Total*
Direct materials..........................	\$ 770	\$1,332	\$2,102
Direct labor................................	525	1,470	1,995
Manufacturing overhead applied..	946	1,029	1,975
Total manufacturing cost	\$2,241	\$3,831	\$6,072

Unit product cost for Job 205:

Total manufacturing cost (a)......................	\$6,072	
Number of units in the job (b)....................	50	units
Unit product cost (a) ÷ (b)	\$121.44	per unit

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Problem 2-20 (45 minutes)

1a. The first step is to calculate the total estimated overhead costs in ICU and Other:

ICU: Using the equation $Y = a + bX$, the estimated total overhead cost would be calculated as follows:

Y = $3,200,000 + ($236 per patient-day)(2,000 patient-days)

Estimated fixed overhead	$3,200,000
Estimated variable overhead:	
$236 per patient-day × 2,000 patient-days	472,000
Estimated total overhead cost	$3,672,000

Other: Using the equation $Y = a + bX$, the estimated total overhead cost would be calculated as follows:

Y = $14,000,000 + ($96 per patient-day)(18,000 patient-days)

Estimated fixed overhead	$14,000,000
Estimated variable overhead:	
$96 per patient-day × 18,000 patient-days	1,728,000
Estimated total overhead cost	$15,728,000

The second step is to combine the estimated overhead costs in ICU and Other ($3,672,000 + $15,728,000 = $19,400,000) to enable calculating the predetermined overhead rate as follows:

Estimated total overhead (a)	$19,400,000	
Estimated total patient-days (b)	20,000	patient-days
Predetermined overhead rate (a) ÷ (b)	$970	per patient-day

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Problem 2-20 (continued)

1b. The total cost assign to Patients A and B is computed as follows:

	Patient A	*Patient B*
Direct materials	$ 4,500	$ 6,200
Direct labor	25,000	36,000
Overhead applied ($970 per patient-day × 14 patient days; ($970 per patient-day × 21 patient days)	13,580	20,370
Total cost	$43,080	$62,570

2a. The overhead rate in ICU is computed as follows:

Y = $3,200,000 + ($236 per patient-day)(2,000 patient-days)

Estimated fixed overhead	$3,200,000
Estimated variable overhead:	
$236 per patient-day × 2,000 patient-days	472,000
Estimated total overhead cost	$3,672,000

The predetermined overhead rate is computed as follows:

Estimated total overhead (a)	$3,672,000	
Estimated total patient-days (b)	2,000	patient-days
Predetermined overhead rate (a) ÷ (b)	$1,836	per patient-day

The overhead rate in Other is computed as follows:

Y = $14,000,000 + ($96 per patient-day)(18,000 patient-days)

Estimated fixed overhead	$14,000,000
Estimated variable overhead:	
$96 per patient-day × 18,000 patient-days	1,728,000
Estimated total overhead cost	$15,728,000

The predetermined overhead rate is computed as follows:

Estimated total overhead (a)	$15,728,000	
Estimated total patient-days (b)	18,000	patient-days
Predetermined overhead rate (rounded) (a) ÷ (b)	$873.78	per patient-day

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Problem 2-20 (continued)

2b. The total cost assigned to Patient A:

Direct materials		$ 4,500
Direct labor		25,000
ICU ($1,836 per patient-day × 0 patient-days)	$ 0	
Other ($873.78 per patient day × 14 patient-days) (rounded to nearest dollar)	12,233	12,233
Total cost assigned to Patient A		$41,733

The total cost assigned to Patient B:

Direct materials		$ 6,200
Direct labor		36,000
ICU ($1,836 per patient-day × 7 patient-days)	$12,852	
Other ($873.78 per patient day × 14 patient-days) (rounded to nearest dollar)	12,233	25,085
Total cost assigned to Patient B		$67,285

3. Relying on just one predetermined overhead rates overlooks the fact that some departments are more intensive users of overhead resources than others. As the name implies, patients in the ICU require more intensive (and expensive) care than other patients in other departments. Broadly, speaking, relying on only one overhead rate, will most likely overcost patients with less severe illnesses and undercost patients with more severe illnesses.

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Problem 2-21 (30 minutes)

1. The plantwide predetermined overhead rate is computed as follows:

Estimated manufacturing overhead (a)	$600,000	
Estimated total direct labor-hours (b)	60,000	DLHs
Predetermined overhead rate (a) ÷ (b)	$10	per DLH

The overhead applied to Job A is computed as follows:

Direct labor-hours worked on Job A (a)	15	
Predetermined overhead rate (b)	$10	per DLH
Overhead applied to Job A (a) × (b)	$150	

The overhead applied to Job B is computed as follows:

Direct labor-hours worked on Job B (a)	9	
Predetermined overhead rate (b)	$10	per DLH
Overhead applied to Job B (a) × (b)	$90	

2. The predetermined overhead rate in Machining is computed as follows:

Estimated manufacturing overhead (a)	$500,000	
Estimated total machine-hours (b)	50,000	MHs
Predetermined overhead rate (a) ÷ (b)	$10	per MH

The predetermined overhead rate in Assembly is computed as follows:

Estimated manufacturing overhead (a)	$100,000	
Estimated total direct labor-hours (b)	50,000	DLHs
Predetermined overhead rate (a) ÷ (b)	$2	per DLH

The overhead applied to Job A is computed as follows:

	Machining	Assembly	Total
Quantity of allocation base used (a) .	11	10	
Predetermined overhead rate (b)	$10	$2	
Overhead applied to Job A (a) × (b).	$110	$20	$130

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Problem 2-21 (continued)

The overhead applied to Job B is computed as follows:

	Machining	Assembly	Total
Quantity of allocation base used (a) .	12	5	
Predetermined overhead rate (b)	$10	$2	
Overhead applied to Job B (a) × (b).	$120	$10	$130

3. The plantwide approach will overcost jobs that are intensive users of Assembly and minimal users of Machining. Conversely, it will undercost products that are intensive users of Machining and minimal users of Assembly. These cost distortions will adversely impact the company's pricing process. Jobs that get overcosted will have selling prices that are greater than the prices that would be established using departmental overhead allocation. Jobs that get undercosted will have selling prices that are less than the prices that would be established using departmental overhead allocation.

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Case 2-22 (60 minutes)

1. a.

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$840{,}000}{\$600{,}000 \text{ direct labor cost}} = 140\% \text{ of direct labor cost}$$

b. The manufacturing overhead cost applied to the Koopers job is computed as follows:

$9,500 × 140% = $13,300

2. a.

	Fabricating Department	*Machining Department*	*Assembly Department*
Estimated manufacturing overhead cost (a)	$350,000	$400,000	$ 90,000
Estimated direct labor cost (b)	$200,000	$100,000	$300,000
Predetermined overhead rate (a) ÷ (b)	175%	400%	30%

b.

Fabricating Department:	
$2,800 × 175%	$4,900
Machining Department:	
$500 × 400%	2,000
Assembly Department:	
$6,200 × 30%	1,860
Total applied overhead	$8,760

3. The bulk of the labor cost on the Koopers job is in the Assembly Department, which incurs very little overhead cost. The department has an overhead rate of only 30% of direct labor cost as compared to much higher rates in the other two departments. Therefore, as shown above, use of departmental overhead rates results in a relatively small amount of overhead cost being charged to the job.

   Use of a plantwide overhead rate in effect redistributes overhead costs proportionately between the three departments (at 140% of direct labor

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cost) and results in a large amount of overhead cost being charged to the Koopers job, as shown in Part 1. This may explain why the company bid too high and lost the job. Too much overhead cost was assigned to the job for the kind of work being done on the job in the plant.

On jobs that require a large amount of labor in the Fabricating or Machining Departments the opposite will be true, and the company will tend to charge too little overhead cost to the jobs if a plantwide overhead rate is being used. The reason is that the plantwide overhead rate (140%) is much lower than the rates would be if these departments were considered separately.

4. The company's bid was:

Direct materials	$ 4,600
Direct labor	9,500
Manufacturing overhead applied (see requirement 1b)	13,300
Total manufacturing cost	$27,400
Bidding rate	× 1.5
Total bid price	$41,100

If departmental overhead rates had been used, the bid would have been:

Direct materials	$ 4,600
Direct labor	9,500
Manufacturing overhead applied (see requirement 2b)	8,760
Total manufacturing cost	$22,860
Bidding rate	× 1.5
Total bid price	$34,290

Note that if departmental overhead rates had been used, Teledex Company would have been the low bidder on the Koopers job because the competitor underbid Teledex by only $2,000.

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Appendix 2A
Activity-Based Absorption Costing

Exercise 2A-1 (20 minutes)

1. Activity rates are computed as follows:

Activity Cost Pool	*(a) Estimated Overhead Cost*	*(b) Expected Activity*	*(a) ÷ (b) Activity Rate*
Machine setups......	$72,000	400 setups	$180 per setup
Special processing..	$200,000	5,000 MHs	$40 per MH
General factory......	$816,000	24,000 DLHs	$34 per DLH

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Exercise 2A-1 (continued)

2. Overhead is assigned to the two products as follows:

Hubs:

Activity Cost Pool	*(a)* *Activity Rate*	*(b)* *Activity*	*(a) × (b)* *ABC Cost*
Machine setups	$180 per setup	100 setups	$ 18,000
Special processing	$40 per MH	5,000 MHs	200,000
General factory	$34 per DLH	8,000 DLHs	272,000
Total..................................			$490,000

Sprockets:

Activity Cost Pool	*(a)* *Activity Rate*	*(b)* *Activity*	*(a) × (b)* *ABC Cost*
Machine setups	$180 per setup	300 setups	$ 54,000
Special processing	$40 per MH	0 MHs	0
General factory	$34 per DLH	16,000 DLHs	544,000
Total..................................			$598,000

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Exercise 2A-1 (continued)

2. Each product's unit product cost is computed as follows:

	Hubs	*Sprockets*
Direct materials	$32.00	$18.00
Direct labor:		
$15 per DLH × 0.80 DLHs per unit	12.00	
$15 per DLH × 0.40 DLHs per unit		6.00
Overhead:		
$490,000 ÷ 10,000 units	49.00	
$598,000 ÷ 40,000 units		14.95
Unit product cost	$93.00	$38.95

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Exercise 2A-2 (45 minutes)

1. The unit product costs under the company's traditional costing system would be computed as follows:

	Rascon	*Parcel*	*Total*
Number of units produced (a)	20,000	80,000	
Direct labor-hours per unit (b)	0.40	0.20	
Total direct labor-hours (a) × (b)	8,000	16,000	24,000

Total manufacturing overhead (a)	$576,000
Total direct labor-hours (b)	24,000 DLHs
Predetermined overhead rate (a) ÷ (b)	$24.00 per DLH

	Rascon	*Parcel*
Direct materials	$13.00	$22.00
Direct labor	6.00	3.00
Manufacturing overhead applied:		
0.40 DLH per unit × $24.00 per DLH	9.60	
0.20 DLH per unit × $24.00 per DLH		4.80
Unit product cost	$28.60	$29.80

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Exercise 2A-2 (continued)

2. The unit product costs using activity-based absorption costing can be computed as follows:

Activity Cost Pool	*Estimated Overhead Cost**	*(b) Expected Activity*	*(a) ÷ (b) Activity Rate*
Labor related	$288,000	24,000 direct labor-hours	$12.00 per direct labor-hour
Engineering design...	$288,000	6,000 engineering-hours	$48.00 per engineering-hour
	$576,000		

*The total estimated manufacturing overhead cost of $576,000 is split evenly between the two activity cost pools.

Manufacturing overhead is assigned to the two products as follows:

Rascon:

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Labor related	$12 per DLH	8,000 DLHs	$ 96,000
Engineering design .	$48 per engineering-hour	3,000 engineering-hours	144,000
Total.....................			$240,000

Parcel:

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Labor related	$12 per DLH	16,000 DLHs	$192,000
Engineering design .	$48 per engineering-hour	3,000 engineering-hours	144,000
Total.....................			$336,000

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Exercise 2A-2 (continued)

The unit product costs combine direct materials, direct labor, and overhead costs:

	Rascon	*Parcel*
Direct materials	$13.00	$22.00
Direct labor	6.00	3.00
Manufacturing overhead ($240,000 ÷ 20,000 units; $336,000 ÷ 80,000 units)	12.00	4.20
Unit product cost	$31.00	$29.20

3. The unit product cost of the high-volume product, Parcel, declines under the activity-based approach, whereas the unit product cost of the low-volume product, Rascon, increases. This occurs because half of the overhead is applied on the basis of engineering design hours instead of direct labor-hours. When the overhead was applied on the basis of direct labor-hours, most of the overhead was applied to the high-volume product. However, when the overhead is applied on the basis of engineering-hours, more of the overhead cost is shifted over to the low-volume product. Engineering-hours is a product-level activity, so the higher the volume, the lower the unit cost and the lower the volume, the higher the unit cost.

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Exercise 2A-3 (45 minutes)

1. The predetermined overhead rate is computed as follows:

$$\text{Predetermined overhead rate} = \frac{\$325{,}000}{50{,}000 \text{ DLHs}} = \$6.50 \text{ per DLH}$$

The unit product costs under the company's traditional costing system are computed as follows:

	Deluxe	*Stand-ard*
Direct materials	$72.00	$53.00
Direct labor	19.00	15.20
Manufacturing overhead (1.0 DLH × $6.50 per DLH; 0.8 DLH × $6.50 per DLH)	6.50	5.20
Unit product cost	$97.50	$73.40

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Exercise 2A-3 (continued)

2. The activity rates are computed as follows:

Activity Cost Pool	*(a) Estimated Overhead Cost*	*(b) Total Expected Activity*		*(a) ÷ (b) Activity Rate*	
Supporting direct labor...	$200,000	50,000	DLHs	$4	per DLH
Batch setups	$75,000	300	setups	$250	per setup
Safety testing	$50,000	100	tests	$500	per test

Manufacturing overhead is assigned to the two products as follows:

Deluxe Product:

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Supporting direct labor	$4 per DLH	10,000 DLHs	$ 40,000
Batch setups	$250 per setup	200 setups	50,000
Safety testing........................	$500 per test	30 tests	15,000
Total....................................			$105,000

Standard Product:

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Supporting direct labor	$4 per DLH	40,000 DLHs	$160,000
Batch setups	$250 per setup	100 setups	25,000
Safety testing........................	$500 per test	70 tests	35,000
Total....................................			$220,000

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Exercise 2A-3 (continued)

Activity-based absorption costing unit product costs are computed as follows:

	Deluxe	*Standard*
Direct materials	$ 72.00	$53.00
Direct labor	19.00	15.20
Manufacturing overhead ($105,000 ÷ 10,000 units; $220,000 ÷ 50,000 units)	10.50	4.40
Unit product cost	$101.50	$72.60

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Problem 2A-4 (60 minutes)

1. a. When direct labor-hours are used to apply overhead cost to products, the company's predetermined overhead rate would be:

$$\text{Predetermined overhead rate} = \frac{\text{Manufacturing overhead cost}}{\text{Direct labor-hours}}$$

$$= \frac{\$1{,}800{,}000}{36{,}000\text{DLHs}} = \$50 \text{ per DLH}$$

b.

	Model	
	X200	*X99*
Direct materials..	$ 72	$ 50
Direct labor:		
$20 per hour × 1.8 hours and 0.9 hours ...	36	18
Manufacturing overhead:		
$50 per hour × 1.8 hours and 0.9 hours ...	90	45
Total unit product cost...............................	$198	$113

2. a. Predetermined overhead rates for the activity cost pools:

Activity Cost Pool	*(a) Estimated Total Cost*	*(b) Estimated Total Activity*	*(a) ÷ (b) Activity Rate*
Machine setups......	$360,000	150 setups	$2,400 per setup
Special processing .	$180,000	12,000 MHs	$15 per MH
General factory......	$1,260,000	36,000 DLHs	$35 per DLH

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Problem 2A-4 (continued)

The overhead applied to each product can be determined as follows:

Model X200

Activity Cost Pool	(a) Activity Rate	(b) Activity	(a) × (b) ABC Cost
Machine setups	$2,400 per setup	50 setups	$120,000
Special processing	$15 per MH	12,000 MHs	180,000
General factory	$35 per DLH	9,000 DLHs	315,000
Total manufacturing overhead cost (a)			$615,000
Number of units produced (b)			5,000
Overhead cost per unit (a) ÷ (b)			$123.00

Model X99

Activity Cost Pool	(a) Activity Rate	(b) Activity	(a) × (b) ABC Cost
Machine setups	$2,400 per setup	100 setups	$ 240,000
Special processing	$15 per MH	0 MHs	0
General factory	$35 per DLH	27,000 DLHs	945,000
Total manufacturing overhead cost (a)			$1,185,000
Number of units produced (b)			30,000
Overhead cost per unit (a) ÷ (b)			$39.50

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Problem 2A-4 (continued)

b. The unit product cost of each model under the activity-based approach would be computed as follows:

	Model	
	X200	*X99*
Direct materials	$ 72.00	$50.00
Direct labor:		
$20 per DLH × 1.8 DLHs, 0.9 DLHs	36.00	18.00
Manufacturing overhead (above)	123.00	39.50
Total unit product cost	$231.00	$107.50

Comparing these unit cost figures with the unit costs in Part 1(b), we find that the unit product cost for Model X200 has increased from $198 to $231, and the unit product cost for Model X99 has decreased from $113 to $107.50.

3. It is especially important to note that, even under activity-based costing, 70% of the company's overhead costs continue to be applied to products on the basis of direct labor-hours:

Machine setups (number of setups)	$ 360,000	20%
Special processing (machine-hours)	180,000	10
General factory (direct labor-hours)	1,260,000	70
Total overhead cost	$1,800,000	100%

Thus, the shift in overhead cost from the high-volume product (Model X99) to the low-volume product (Model X200) occurred as a result of reassigning only 30% (=20% + 10%) of the company's overhead costs.

The increase in unit product cost for Model X200 can be explained as follows: First, where possible, overhead costs have been traced to the products rather than being lumped together and spread uniformly over production. Therefore, the special processing costs, which are traceable to Model X200, have all been assigned to Model X200 and none assigned to Model X99 under the activity-based approach. It is common in industry to have some products that require special handling or special processing of some type. This is especially true in modern factories that produce a variety of products. Activity-based costing provides a vehicle for assigning these costs to the appropriate products.

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Problem 2A-4 (continued)

Second, the costs associated with the batch-level activity (machine setups) have also been assigned to the specific products to which they relate. These costs have been assigned according to the number of setups completed for each product. However, because a batch-level activity is involved, another factor affecting unit costs comes into play. That factor is batch size. Some products are produced in large batches and some are produced in small batches. *The smaller the batch, the higher the per unit cost of the batch activity.* In the case at hand, the data can be analyzed as follows:

Model X200:		
Cost to complete one setup (see requirement 2a)........	$2,400	(a)
Number of units processed per setup (5,000 units per setup ÷ 50 setups = 100 units).......	100 units	(b)
Setup cost per unit (a) ÷ (b)......................................	$24	
Model X99:		
Cost to complete one setup (see requirement 2a)........	$2,400	(a)
Number of units processed per setup (30,000 units per setup ÷ 100 setups = 300 units)...	300 units	(b)
Setup cost per unit (a) ÷ (b)......................................	$8	

Thus, the cost per unit for setups is three times as great for Model X200, the low-volume product, as it is for Model X99, the high-volume product. Such differences in cost are obscured when direct labor-hours (or any other volume measure) is used as a basis for applying overhead cost to products.

In sum, overhead cost has shifted from the high-volume product to the low-volume product as a result of more appropriately assigning some costs to the products on the basis of the activities involved, rather than on the basis of direct labor-hours.

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Problem 2A-5 (60 minutes)

1. The company's estimated direct labor-hours can be computed as follows:

Deluxe model: 5,000 units × 2 DLHs per unit	10,000 DLHs
Regular model: 40,000 units × 1 DLH per unit...	40,000 DLHs
Total direct labor hours	50,000 DLHs

Using just direct labor-hours as the base, the predetermined overhead rate would be:

$$\frac{\text{Estimated overhead cost}}{\text{Estimated direct labor-hours}} = \frac{\$900{,}000}{50{,}000\text{DLHs}} = \$18 \text{ per DLH}$$

The unit product cost of each model using the company's traditional costing system would be:

	Deluxe	*Regular*
Direct materials......................	$ 40	$25
Direct labor............................	38	19
Manufacturing overhead:		
$18 per DLH × 2 DLHs.........	36	
$18 per DLH × 1 DLH		18
Total unit product cost	$114	$62

2. Predetermined overhead rates are computed below:

Activity Cost Pool	*(a) Estimated Overhead Cost*	*(b) Expected Activity*	*(a) ÷ (b) Activity Rate*
Purchasing................	$204,000	600 purchase orders	$340 per purchase order
Processing	$182,000	35,000 machine-hours	$5.20 per machine-hour
Scrap/rework	$379,000	2,000 orders	$189.50 per order
Shipping	$135,000	900 shipments	$150 per shipment

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Problem 2A-5 (continued)

3. a. The overhead applied to each product can be determined as follows:

The Deluxe Model

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Purchasing	$340 per PO	200 POs	$ 68,000
Processing	$5.20 per MH	20,000 MHs	104,000
Scrap/rework	$189.50 per order	1,000 tests	189,500
Shipping	$150 per shipment	250 shipments	37,500
Total overhead cost (a)			$399,000
Number of units produced (b)			5,000
Overhead cost per unit (a) ÷ (b)			$79.80

The Regular Model

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Purchasing	$340 per PO	400 POs	$136,000
Processing	$5.20 per MH	15,000 MHs	78,000
Scrap/rework	$189.50 per order	1,000 orders	189,500
Shipping	$150 per shipment	650 shipments	97,500
Total overhead cost (a)			$501,000
Number of units produced (b)			40,000
Overhead cost per unit (a) ÷ (b)			$12.53

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Problem 2A-5 (continued)

b. Using activity-based absorption costing, the unit product cost of each model would be:

	Deluxe	*Regular*
Direct materials	$ 40.00	$25.00
Direct labor	38.00	19.00
Manufacturing overhead (above)	79.80	12.53
Total unit product cost	$157.80	$56.53

4. Unit costs appear to be distorted as a result of using direct labor-hours as the base for assigning overhead cost to products. Although the deluxe model requires twice as much labor time as the regular model, it still is not being assigned enough overhead cost, as shown in the analysis in part 3(a).

   When the company's overhead costs are analyzed on an activities basis, it appears that the deluxe model is more expensive to manufacture than the company realizes. Note that the deluxe model accounts for a majority of the machine-hours worked, even though it accounts for only 20% (= 10,000 DLHs ÷ 50,000 DLHs) of the company's direct labor-hours. Also, it requires just as many scrap/rework orders as the regular model, and scrap/rework orders are very costly to the company.

   When activity-based absorption costing is used and the company's transactions are analyzed by product, the overhead cost increases for the deluxe model from $36.00 per unit to $79.80 per unit. This suggests that less than half the overhead cost is being assigned to the deluxe model that ought to be assigned, and unit costs for the deluxe model are understated. If these costs are being used as a basis for pricing, then the selling price for the deluxe model may be too low. This may be the reason why profits have been steadily declining over the last several years. It may also be the reason why sales of the deluxe model have been increasing rapidly.

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Case 2A-6 (90 minutes)

1. a. The predetermined overhead rate would be computed as follows:

$$\frac{\text{Expected manufacturing overhead cost}}{\text{Estimated direct labor-hours}} = \frac{\$2{,}200{,}000}{50{,}000\text{ DLHs}}$$

$$= \$44 \text{ per DLH}$$

b. The unit product cost per pound, using the company's present costing system, would be:

	Kenya Dark	*Viet Select*
Direct materials (given)	$4.50	$2.90
Direct labor (given)	0.34	0.34
Manufacturing overhead:		
0.02 DLH × $44 per DLH.....	0.88	0.88
Total unit product cost...........	$5.72	$4.12

2. a. Overhead rates for each activity cost pool:

Activity Cost Pools	*(a) Estimated Overhead Costs*	*(b) Expected Activity*	*(a) ÷ (b) Activity Rate*
Purchasing	$560,000	2,000 orders	$280 per order
Material handling ..	$193,000	1,000 setups	$193 per setup
Quality control	$90,000	500 batches	$180 per batch
Roasting...............	$1,045,000	95,000 hours	$11 per hour
Blending...............	$192,000	32,000 hours	$6 per hour
Packaging	$120,000	24,000 hours	$5 per hour

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Before we can determine the amount of overhead cost to assign to the products we must first determine the activity for each of the products in the six activity centers. The necessary computations follow:

Number of purchase orders:
Kenya Dark: 80,000 pounds ÷ 20,000 pounds per order = 4 orders
Viet Select: 4,000 pounds ÷ 500 pounds per order = 8 orders
Number of setups:
Kenya Dark: (80,000 pounds ÷ 5,000 pounds per batch) × 2 setups per batch = 32 setups
Viet Select: (4,000 pounds ÷ 500 pounds per batch) × 2 setups per batch = 16 setups
Number of batches:
Kenya Dark: 80,000 pounds ÷ 5,000 pounds per batch = 16 batches
Viet Select: 4,000 pounds ÷ 500 pounds per batch = 8 batches
Roasting hours:
Kenya Dark: 1.5 hours × (80,000 pounds ÷ 100 pounds) = 1,200 hours
Viet Select: 1.5 hours × (4,000 pounds ÷ 100 pounds) = 60 hours
Blending hours:
Kenya Dark: 0.5 hour × (80,000 pounds ÷ 100 pounds) = 400 hours
Viet Select: 0.5 hour × (4,000 pounds ÷ 100 pounds) = 20 hours
Packaging hours:
Kenya Dark: 0.3 hour × (80,000 pounds ÷ 100 pounds) = 240 hours
Viet Select: 0.3 hour × (4,000 pounds ÷ 100 pounds) = 12 hours

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Case 2A-6 (continued)

The overhead applied to each product can be determined as follows:

Kenya Dark

Activity Cost Pool	*Activity Rate*	*Expected Activity*	*Amount*
Purchasing	$280 per order	4 orders	$ 1,120
Material handling	$193 per setup	32 setups	6,176
Quality control	$180 per batch	16 batches	2,880
Roasting..................	$11 per roasting hour	1,200 roasting hours	13,200
Blending..................	$6 per blending hour	400 blending hours	2,400
Packaging................	$5 per packaging hour	240 packaging hours	1,200
Total			$26,976

Viet Select

Activity Cost Pool	*Activity Rate*	*Expected Activity*	*Amount*
Purchasing	$280 per order	8 orders	$2,240
Material handling	$193 per setup	16 setups	3,088
Quality control	$180 per batch	8 batches	1,440
Roasting..................	$11 per roasting hour	60 roasting hours	660
Blending..................	$6 per blending hour	20 blending hours	120
Packaging................	$5 per packaging hour	12 packaging hours	60
Total			$7,608

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Case 2A-6 (continued)

b. According to the activity-based absorption costing system, the manufacturing overhead cost per pound is:

	Kenya Dark	*Viet Select*
Total overhead cost assigned (above) (a) ...	$26,976	$7,608
Number of pounds manufactured (b)..........	80,000	4,000
Cost per pound (a) ÷ (b)	$0.34	$1.90

c. The unit product costs according to the activity-based absorption costing system are:

	Kenya Dark	*Viet Select*
Direct materials (given)	$4.50	$2.90
Direct labor (given)	0.34	0.34
Manufacturing overhead	0.34	1.90
Total unit product cost.............	$5.18	$5.14

3. MEMO TO THE PRESIDENT: Analysis of JSI's data shows that several activities other than direct labor drive the company's manufacturing overhead costs. These activities include purchase orders issued, number of setups for material processing, and number of batches processed. The company's present costing system, which relies on direct labor time as the sole basis for assigning overhead cost to products, significantly undercosts low-volume products, such as the Viet Select coffee, and significantly overcosts high-volume products, such as our Kenya Dark coffee.

   An implication of the activity-based approach is that our low-volume products may not be covering the costs of the manufacturing resources they use. For example, Viet Select coffee is currently priced at $5.15 per pound ($4.12 plus 25% markup), which is only one cent higher than its activity-based cost of $5.14 per pound. Under our present costing and pricing system, our high-volume products, such as our Kenya Dark coffee, may be subsidizing our low-volume products. Some adjustments in prices may be required.

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Case 2A-6 (continued)

ALTERNATIVE SOLUTION:

Most students will compute the manufacturing overhead cost per pound of the two coffees as shown above. However, the per pound cost can also be computed as shown below. *This alternative approach provides additional insight into the data and facilitates emphasis of some points made in the chapter.*

	Kenya Dark		*Viet Select*	
	Total	*Per Pound (÷ 80,000)*	*Total*	*Per Pound (÷ 4,000)*
Purchasing	$ 1,120	$0.014	$2,240	$0.560
Material handling..	6,176	0.077	3,088	0.772
Quality control	2,880	0.036	1,440	0.360
Roasting	13,200	0.165	660	0.165
Blending	2,400	0.030	120	0.030
Packaging	1,200	0.015	60	0.015
Total	$26,976	$0.337	$7,608	$1.902

Note particularly how batch size impacts unit cost data. For example, the cost to the company to process a purchase order is $280, regardless of how many pounds of coffee are contained in the order. Twenty thousand pounds of the Kenya Dark coffee are purchased per order (with four orders per year), and just 500 pounds of the Viet Select coffee are purchased per order (with eight orders per year). Thus, the purchase order cost *per pound* for the Kenya Dark coffee is just 1.4 cents, whereas the purchase order cost *per pound* for the Viet Select coffee is 40 times as much, or 56 cents. As stated in the text, this is one reason why unit costs of low-volume products, such as the Viet Select coffee, increase so dramatically when activity-based costing is used.

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Appendix 2B
The Predetermined Overhead Rate and Capacity

Exercise 2B-1 (20 minutes)

1. There were no beginning or ending inventories, so all of the jobs were started, finished, and sold during the month. Therefore cost of goods sold equals the total manufacturing cost. We can verify that by computing the cost of goods sold as shown below:

Manufacturing costs charged to jobs:	
Direct materials	$ 5,350
Direct labor (all variable)	8,860
Manufacturing overhead applied (150 hours × $82 hour)	12,300
Total manufacturing cost charged to jobs	26,510
Add: Beginning work in process inventory	0
	26,510
Deduct: Ending work in process inventory	0
Cost of goods manufactured	$26,510
Beginning finished goods inventory	$ 0
Add: Cost of goods manufactured	26,510
Goods available for sale	26,510
Deduct: Ending finished goods inventory	0
Cost of goods sold	$26,510

At the end of the month, the cost of unused capacity is computed as shown below:

Amount of the allocation base at capacity (a)	180 hours
Actual amount of the allocation base (b)	150 hours
Unused capacity in hours (a) – (b)	30 hours
Unused capacity in hours (a)	30 hours
Predetermined overhead rate (b)	$82 per hour
Cost of unused capacity (a) × (b)	$2,460

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Exercise 2B-1 (continued)

Consequently, the income statement, prepared for internal management purposes, would appear as follows:

Wixis Cabinets
Income Statement

Sales		$43,740
Cost of goods sold (see above)		26,510
Gross margin		17,230
Other expenses:		
Cost of unused capacity	$2,460	
Selling and administrative expenses	8,180	10,640
Net operating income		$ 6,590

2. When the predetermined overhead rate is based on capacity, unused capacity costs ordinarily arise because manufacturing overhead usually contains significant amounts of fixed costs. Suppose, for example, that manufacturing overhead includes $10,000 of fixed costs and the capacity is 100 hours. Then the portion of the predetermined overhead rate that represents fixed costs is $10,000 divided by 100 hours or $100 per hour. Because the plant is seldom (if ever) operated beyond capacity, less than $10,000 will ordinarily be applied to jobs. In other words, $100 per hour multiplied by something less than 100 hours always yields less than $10,000. Therefore, unused capacity costs will arise.

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Exercise 2B-2 (30 minutes)

1. The overhead applied to Mrs. Brinksi's account would be computed as follows:

	Last Year	This Year
Estimated overhead cost (a)	$310,500	$310,500
Estimated professional staff hours (b)	4,600	4,500
Predetermined overhead rate (a) ÷ (b)	$67.50	$69.00
Professional staff hours charged to Ms. Brinksi's account	× 2.5	× 2.5
Overhead applied to Ms. Brinksi's account	$168.75	$172.50

2. If the actual overhead cost and the actual professional hours charged turn out to be exactly as estimated there would be no cost of unused capacity.

	Last Year	This Year
Predetermined overhead rate (see above)	$67.50	$69.00
Actual professional staff hours charged to clients' accounts (by assumption)	× 4,600	× 4,500
Overhead applied	$310,500	$310,500
Actual overhead cost incurred (by assumption)	310,500	310,500
Cost of unused capacity	$ 0	$ 0

3. If the predetermined overhead rate is based on the professional staff hours available, the computations would be:

	Last Year	This Year
Estimated overhead cost (a)	$310,500	$310,500
Professional staff hours available (b)	6,000	6,000
Predetermined overhead rate (a) ÷ (b)	$51.75	$51.75
Professional staff hours charged to Ms. Brinksi's account	× 2.5	× 2.5
Overhead applied to Ms. Brinksi's account	$129.38	$129.38

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Exercise 2B-2 (continued)

4. If the actual overhead cost and the actual professional staff hours charged to clients' accounts turn out to be exactly as estimated, the cost of unused capacity would be calculated as shown below.

	Last Year	*This Year*
Amount of the allocation base at capacity (a)......	6,000	6,000
Actual amount of the allocation base (b)............	4,600	4,500
Unused capacity in hours (a) – (b)......................	1,400	1,500
Unused capacity in hours (a)..............................	1,400	1,500
Predetermined overhead rate (b)........................	$51.75	$51.75
Cost of unused capacity (a) × (b).......................	$72,450	$77,625

Proponents of this method of computing predetermined overhead rates suggest that the cost of unused capacity should be treated as a period expense that is disclosed separately on the income statement.

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Problem 2B-3 (60 minutes)

1. The overhead applied to the Verde Baja job is computed as follows:

	Last Year	*This Year*
Estimated studio overhead cost (a)	$160,000	$160,000
Estimated hours of studio service (b)	1,000	800
Predetermined overhead rate (a) ÷ (b)	$160	$200
Verde Baja job's studio hours	× 40	× 40
Overhead applied to the Verde Baja job	$6,400	$8,000

2. If the predetermined overhead rate is based on the hours of studio service at capacity, the computations would be:

	Last Year	*This Year*
Estimated studio overhead cost at capacity (a)	$160,000	$160,000
Hours of studio service at capacity (b)	1,600	1,600
Predetermined overhead rate (a) ÷ (b)	$100	$100
Verde Baja job's studio hours	× 40	× 40
Overhead applied to the Verde Baja job	$4,000	$4,000

3. The cost of unused capacity for both years is computed as follows:

	Last Year	*This Year*
Amount of the allocation base at capacity (a)	1,600	1,600
Actual amount of the allocation base (b)	750	500
Unused capacity in hours (a) – (b)	850	1,100
Unused capacity in hours (a)	850	1,100
Predetermined overhead rate (b)	$100	$100
Cost of unused capacity (a) × (b)	$85,000	$110,000

Proponents of this method suggest that the cost of unused capacity should be treated as a period expense that is disclosed separately on the income statement.

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Problem 2B-3 (continued)

4. Platinum Track's fundamental problem is the competition that is drawing customers away. The competition is able to offer the latest equipment, excellent service, and attractive prices. The company must do something to counter this threat or it will ultimately face failure.

   Under the conventional approach in which the predetermined overhead rate is based on the estimated studio hours, the apparent cost of the Verde Baja job has increased between last year and this year. That happens because the company is losing business to competitors and therefore the company's fixed overhead costs are being spread over a smaller base. This results in costs that seem to increase as the volume declines. Under this method, Platinum Track's managers may be misled into thinking that the problem is rising costs and they may be tempted to raise prices to recover their apparently increasing costs. This would almost surely accelerate the company's decline.

   Under the alternative approach, the overhead cost of the Verde Baja job is stable at $4,000 and lower than the costs reported under the conventional method. Under the conventional method, managers may be misled into thinking that they are actually losing money on the Verde Baja job and they might refuse such jobs in the future—another sure road to disaster. This is much less likely to happen if the lower cost of $4,000 is reported. It is true that the cost of unused capacity under the alternative approach is much larger than under the conventional approach and is growing. However, if it is properly labeled as the cost of unused capacity, management is much more likely to draw the appropriate conclusion that the real problem is the loss of business (and therefore more idle capacity) rather than an increase in costs.

   While basing the predetermined rate on capacity rather than on estimated activity will not solve the company's basic problems, at least this method is less likely to send managers misleading signals.

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Case 2B-4 (120 minutes)

1a.

Vault Hard Drives, Inc.
Income Statement: Traditional Approach

Sales (150,000 units × $60 per unit)		$9,000,000
Cost of goods sold:		
Variable manufacturing (150,000 units × $15 per unit)	$2,250,000	
Manufacturing overhead applied (150,000 units × $25 per unit)	3,750,000	6,000,000
Gross margin		3,000,000
Selling and administrative expenses		2,700,000
Net operating income		$ 300,000

1b.

Vault Hard Drives, Inc.
Income Statement: New Approach

Sales (150,000 units × $60 per unit)		$9,000,000
Cost of goods sold:		
Variable manufacturing (150,000 units × $15 per unit)	$2,250,000	
Manufacturing overhead applied (150,000 units × $20 per unit)	3,000,000	5,250,000
Gross margin		3,750,000
Other expenses:		
Cost of unused capacity [(200,000 units – 160,000 units) × $20 per unit]		800,000
Selling and administrative expenses		2,700,000
Net operating income		$ 250,000

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Case 2B-4 (continued)

2. Under the traditional approach, all of the company's fixed manufacturing overhead must be included in either cost of goods sold (in the income statement) or ending inventory (in the balance sheet) at the end of an accounting period. For each additional unit produced but not sold, it enables the company to include an extra $25 of fixed overhead in ending inventory, which in turn lowers the company's cost of goods sold by $25.

   Since the company has net operating income of $300,000 when it produces 160,000 units and sells 150,000 units, it needs to produce enough additional units, beyond 160,000 units, to raise net operating by $200,000 to achieve a desired profit of $500,000. The following computations show that the company would need to produce 8,000 more units (or 168,000 units in total) to achieve net operating income of $500,000.

Additional net operating income required to attain target net operating income ($500,000 – $300,000) (a)	$200,000
Fixed overhead applied to each unit of additional inventory (b)	$25 per unit
Additional output required to attain target net operating income (a) ÷ (b)	8,000 units
Estimated number of units produced	160,000 units
Actual number of units to be produced	168,000 units

* Although overapplied overhead is not explored in detail until the next chapter, astute students may be curious to know that this answer of 168,000 units assumes that the overapplied overhead of $200,000 is closed entirely to Cost of Goods Sold.

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Case 2B-4 (continued)

3. Under the new approach, all of the company's fixed manufacturing overhead must be included in either cost of goods sold (in the income statement), ending inventory (in the balance sheet), or cost of unused capacity (in the income statement) at the end of an accounting period. For each additional unit produced but not sold, it enables the company to include an extra $20 of fixed overhead in ending inventory, which in turn lowers the company's cost of unused capacity by $20.

   Since the company has net operating income of $250,000 when it produces 160,000 units and sells 150,000 units, it needs to produce enough additional units, beyond 160,000 units, to raise net operating by $250,000 to achieve a desired profit of $500,000. The computations below show that the company would need to produce 12,500 more units (or 172,500 units in total) to achieve net operating income of $500,000.

Additional net operating income required to attain target net operating income ($500,000 – $250,000) (a)	$250,000
Fixed overhead applied to each unit of additional inventory (b)	$20 per unit
Additional output required to attain target net operating income (a) ÷ (b)	12,500 units
Estimated number of units produced	160,000 units
Actual number of units to be produced	172,500 units

4. Net operating income is more volatile under the new method than under the old method. The reason for this is that the reported profit per unit sold is higher under the new method by $5, the difference in the predetermined overhead rates. As a consequence, swings in sales in either direction will have a more dramatic impact on reported profits under the new method.

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Case 2B-4 (continued)

5. The "hat trick" is a bit harder to perform under the new method. Under the old method, the target net operating income can be attained by producing an additional 8,000 units. Under the new method, the production would have to be increased by 12,500 units. Again, this is a consequence of the difference in predetermined overhead rates. The drop in sales has had a more dramatic effect on net operating income under the new method as noted above in part (4). In addition, because the predetermined overhead rate is lower under the new method, producing excess inventories has less of an effect per unit on net operating income than under the traditional method and hence more excess production is required.

6. One can argue that whether the "hat trick" is unethical depends on the level of sophistication of the owners of the company and others who read the financial statements. If they understand the effects of excess production on net operating income and are not misled, it can be argued that the hat trick is not unethical. However, if that were the case, there does not seem to be any reason to use the hat trick. Why would the owners want to tie up working capital in inventories just to artificially attain a target net operating income for the period? And increasing the rate of production toward the end of the year is likely to increase overhead costs due to overtime and other costs. Building up inventories all at once is very likely to be much more expensive than increasing the rate of production uniformly throughout the year. In this case, we assumed that there would not be an increase in overhead costs due to the additional production, but that is likely not to be true.

   In our opinion, the hat trick is unethical unless there is a good reason for increasing production other than to artificially boost the current period's net operating income. It is certainly unethical if the purpose is to fool users of financial reports such as owners and creditors or if the purpose is to meet targets so that bonuses will be paid to top managers.

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Chapter 2
Lecture Notes

1 Chapter theme: Managers need to assign costs to products to facilitate internal decision making and external financial reporting. This chapter illustrates an **absorption costing** approach to calculating product costs known as **job-order costing**.

Helpful Hint: Briefly review the concepts of fixed and variable manufacturing costs to help students grasp the meaning of absorption costing. Mention that total fixed costs are constant and therefore change on a per unit basis. Variable costs are proportional to the number of units produced and are constant on a per unit basis.

2

I. **Job-order costing: an overview**

A. **Job-order costing systems** are used when:

i. **Many different products** are produced each period.

ii. Products are **manufactured to order**.

iii. The unique nature of each order requires **tracing or allocating costs to each job**, and maintaining cost records for each job.

3 B. **Examples of companies** that would use job-order costing include aircraft manufacturers, large-scale construction companies, and companies that produce movies.

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II. Job-order costing–an example

A. Types of **manufacturing costs** that are assigned to products using a job-order costing system:

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i. **Direct costs**

1. **Direct materials –** Traced directly to each job as the work is performed.
2. **Direct labor –** Traced directly to each job as the work is performed.

5

ii. **Indirect costs**

1. **Manufacturing overhead** (including indirect materials and indirect labor). These costs are **allocated** to jobs rather than directly traced to each job.

6

B. **The job cost sheet** – The accounting department relies upon a job cost sheet for tracking the **direct and indirect costs** associated with a given job.

i. An overview of a job cost sheet for a hypothetical company called PearCo:

1. **A** job number **uniquely identifies each job.**
2. **Direct material, direct labor, and manufacturing overhead costs are accumulated for each job.**
3. The job cost sheet is a **subsidiary ledger** to the Work in Process account.

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ii. Measuring direct materials cost

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1. Once a sales order has been received and a production order issued, the Production Department prepares a **materials requisition form** to specify the type, quantity, and total cost of materials (e.g., $116) to be drawn from the storeroom, and the job number (e.g., A-143) to which the cost of the materials is to be charged.
    a. For an existing product, the production department can refer to a **bill of materials** to determine the type and quantity of each item of materials needed to complete a unit of product.

8

2. The Accounting Department records the total direct material cost of **$116** on the appropriate job cost sheet. Notice, the **material requisition number** (e.g., X7-6890) is included on the job cost sheet to provide easy access to the source document.

iii. Measuring direct labor costs

9

1. Workers use **time tickets** to record the amount of time that they spent on each job and the total cost assigned to each job.

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2. The Accounting Department records the labor costs from the time tickets of **$120** on to the job cost sheet.

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iv. Computing predetermined overhead rates

11 *Learning Objective 1: Compute a predetermined overhead rate.*

12

1. An **allocation base,** such as direct labor hours, direct labor dollars, or machine hours**,** is used to assign manufacturing overhead to products. Allocation bases are used because:
   a. It is impossible or difficult to trace these costs to particular jobs (i.e., manufacturing overhead is an **indirect cost**).
   b. Manufacturing overhead consists of many different items ranging from the grease used in machines to the production manager's salary.
   c. Many types of manufacturing overhead costs are fixed even though output may fluctuate during the year.

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2. The **predetermined overhead rate** is calculated by dividing the estimated amount of manufacturing overhead for the coming period by the estimated quantity of the allocation base for the coming period. Ideally, the allocation base chosen should be the **cost driver** of overhead cost.

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a. **Predetermined overhead rates that rely upon estimated data are often used because:**
   (1) Actual overhead costs for the period are not known until the end of the period, thus inhibiting the ability to estimate job costs during the period.
   (2) Actual overhead costs can fluctuate seasonally, thus misleading decision makers.

15

3. Predetermined overhead rates are calculated using a four-step process.
   a. The first step is to estimate the total amount of the allocation base required for next period's estimated level of production.
   b. The second step is to estimate the total fixed manufacturing overhead cost for the coming period and the variable manufacturing overhead cost per unit of the allocation base.
   c. The third step is to use a cost formula to estimate the total manufacturing overhead cost for the coming period.
   d. The fourth step is to compute the predetermined overhead rate.

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v. Applying manufacturing overhead

16 *Learning Objective 2: Apply overhead cost to jobs using a predetermined overhead rate.*

1. Manufacturing overhead is applied to jobs using the predetermined overhead rate multiplied by the **actual** amount of the allocation base used completing the job (this is called a normal costing system). For example, assume PearCo:
   a. Applies overhead to jobs based on direct labor hours.
   b. Estimated that **160,000 direct labor hours**
   17 would be required to support the planned production for the year.
   c. Estimated **$200,000 of total fixed overhead cost** and **$2.75 of variable overhead per direct labor-hour**.
   d. Used a cost formula to estimate its total manufacturing overhead cost of **$640,000**.
   e. Calculated its predetermined overhead rate of **$4 per direct labor hour**.
      (1) The amount of overhead that would be applied to the job cost sheet that we have been working with related to Job A-143 is $32, calculated as follows:
         (a) Eight direct labor hours were
         18 worked on Job A-143.
         (b) The predetermined overhead rate is $4 per direct labor hour.
         (c) 8 direct labor hours × $4 per hour = **$32**.

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19 *Learning Objective 3: Compute the total cost and unit product cost of a job using a plantwide predetermined overhead rate.*

vi**. Completing the job cost sheet**

20 1. The total direct material, direct labor, and manufacturing overhead costs assigned to Job A-143 is **$268**.

21 a. Since this job included two units, the average cost per unit is **$134**. The average unit cost should **not** be interpreted as the costs that would actually be incurred if another unit was produced.

b. The fixed overhead would not change if another unit were produced, so the incremental cost of another unit is something **less than $134**.

22-23 *Quick Check – job cost accounting*

III. **Job-order costing—a managerial perspective**

C. **Inaccurately assigning** manufacturing costs to jobs adversely influences planning and decisions made by managers.

24 i. Job-order costing systems can accurately trace *direct* materials and *direct* labor costs to jobs.

ii. Job-order costing systems often fail to accurately allocate the manufacturing overhead costs used during the production process to their respective jobs.

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D. Choosing an allocation base

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i. Job-order costing systems often use allocation bases that do not reflect how jobs actually use overhead resources.

ii. The allocation base in the predetermined overhead rate must **drive** the overhead cost to improve job cost accuracy.

1. A **cost driver** is a factor that causes overhead costs.
2. Many companies use a single predetermined **plantwide overhead rate** to allocate all manufacturing overhead costs to jobs based on their usage of direct-labor hours.
    a. It is often **overly-simplistic** and incorrect to assume that direct-labor hours is a company's *only* manufacturing overhead cost driver.
    b. If more than one overhead cost driver can be identified, job cost accuracy is improved by using **multiple predetermined overhead rates**.

26 *Learning Objective 4: Compute the total cost and the unit product cost of a job using multiple predetermined overhead rates.*

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IV. Job-order costing using multiple predetermined overhead rates

27

A. A cost system with multiple predetermined **overhead rates** uses more than one overhead rate to apply overhead costs to jobs. For example, assume Dickson Company uses a job-order costing system and computes a predetermined overhead rate in each production department. The company uses cost-plus pricing to establish selling prices for all of its jobs.

i. Information relating to its two processing departments is provided on this slide.

ii. The company computes a selling price for Job 407 using a **5-step process**:

28

a. **Step 1:** Calculate the estimated total manufacturing overhead cost for each department:
   (1) Milling Department = $390,000 + ($2.00 per MH × 60,000 MHs) = **$510,000**.
   (2) Assembly Department = $500,000 + ($3.75 per DLH × 80,000 DLHs) = **$800,000**.

29

b. **Step 2:** Calculate the predetermined overhead rate in each department:
   (1) Milling Department = $510,000 ÷ 60,000 MHs = **$8.50 per MH**.
   (2) Assembly Department = $800,000 ÷ 80,000 DLHs = **$10.00 per DLH**.

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30 c. **Step 3:** Calculate the amount of overhead applied from both departments to a job:
   (1) Milling Department = $8.50 per MH × 90 MHs = **$765**.
   (2) **Assembly** Department = $10.00 per DLH × 20 DLHs = **$200**.

31 d. **Step 4:** Calculate the total job cost for Job 407:
   (1) Total job cost = Direct materials (= $800 + $370) + Direct labor (= $70 + $280) + Manufacturing overhead applied (= $765 + $200) = **$2,485**.

32 e. **Step 5:** Assuming a markup percentage of 75% of total manufacturing cost, calculate the selling price for the job:
   (1) Total job cost of $2,485.00 + Markup of $1,863.75 (= $2,485 x 75%) = **$4,348.75**.

33 iii. When a company instead creates overhead rates based on the activities that it performs, it is employing an approach called activity-based costing.

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V. Selected topics

A. An external reporting perspective

i. Job-order costing systems are often used to create financial statements for **external parties**.

ii. Impact on the income statement when a company uses predetermined overhead rates:

1. The amount of overhead applied to all jobs during a period **will differ** from the actual
34 amount of overhead costs incurred during the period.
   a. When a company applies less overhead to production than it actually incurs, it creates what is known as **underapplied overhead**.
   b. When it applies more overhead to production than it actually incurs, it results in **overapplied overhead**.
2. The cost of goods sold reported on a company's income statement must be **adjusted** to reflect underapplied or overapplied overhead.
35 a. The adjustment for **underapplied** overhead **increases cost of goods sold** and decreases net operating income.
   b. The adjustment for **overapplied** overhead **decreases cost of goods sold** and increases net operating income.

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iii. Job cost sheets: a **subsidiary ledger**

36 1. All of a company's job cost sheets collectively form a **subsidiary ledger**.
2. The job costs sheets provide an underlying set of financial records that explain what specific
37 jobs comprise the amounts reported in:
   a. **Work-in-Process** and **Finished Goods** on the balance sheet.
38 b. **Cost of Goods Sold** on the income statement.

B. **Job-order costing in service companies**

i. Although our attention has focused upon manufacturing applications, it bears re-emphasizing that **job-order costing is also used in service companies**.

39 1. For example, in a law firm, each client represents a "job." Legal forms and similar inputs represent direct materials. The time expended by attorneys represents direct labor. The costs of secretaries, clerks, rent, depreciation, and so forth, represent the overhead.

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I. Appendix 2A: Activity-Based Absorption Costing (Slide 1 is the title slide)

Commented [H1]: Note that the Appendix 2A PPT and LN files correspond.

2 *Learning Objective 5: Use activity-based absorption costing to compute unit product costs.*

A. Key definitions/concepts

3 i. Activity-based absorption costing assigns **all manufacturing overhead costs** to products using activity cost pools instead of plantwide or departmental cost pools.

4
1. An **activity** is an event that causes the consumption of overhead resources.
2. An **activity cost pool** is a "bucket" in which costs are accumulated that relate to a single activity.
3. An **activity measure** is an allocation that is used as the denominator for an activity cost pool.
4. An **activity rate** is used to assign costs from an activity cost pool to products.

5 ii. Activity-based absorption costing differs from traditional absorption costing in **two ways**:

1. The activity based approach uses **more cost pools** than a traditional approach.
2. The activity-based approach includes some **batch-level** and **product-level** activities and activity measures that **do not relate to the volume of units produced**, whereas the traditional approach relies exclusively on volume-related overhead allocation.

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B. Simmons Industries – **a traditional approach**

6 i. Assume the following information for the company as a whole and for its only two products—deluxe and standard hedge trimmers.

7 ii. If we assume that Simmons' traditional cost system relies on one predetermined **plantwide overhead rate** with **direct labor-hours** as the allocation base, then its plantwide overhead rate (**$4.50 per direct labor-hour**) would be computed as shown.

8 iii. Simmons' traditional cost system would report unit product costs as shown. Notice:

1. The deluxe product line is assigned **$9.00** of overhead cost per unit (= 2.0 DLH × $4.50 per hour).
2. The standard product line is assigned **$4.50** of overhead cost per unit (= 1.0 DLH × $4.50 per hour).

C. Simmons Industries – **activity-based absorption costing**

9 i. Assume that Simmons assigned its **$1,800,000** of manufacturing overhead costs to three activities with expected activity levels as shown.

10 ii. The **activity rates** for each of the three activities would be computed as shown.

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11 iii. The **overhead cost assignments** to the deluxe and standard product lines are computed as shown. Notice:

1. All manufacturing overhead has been assigned to products (**$1,130,000 + $670,000 = $1,800,000**).

12 iv. The **activity-based unit product costs** for both product lines are computed as shown. Notice:

13 1. The manufacturing overhead per unit for both products is computed by taking the total overhead assigned to that product and dividing it by the number of units produced.

14 D. Simmons Industries – **comparing the two approaches**

i. The difference in unit product costs between the two methods is as shown. Notice, the activity-based unit product cost for the deluxe (standard) product line is higher (lower) than what was computed using the traditional cost system. This is because:

15 1. The activity-based approach contains **two non-volume-related cost pools**—"setting up machines" which is a batch-level activity and "parts administration" which is a product-level activity.
2. The activity-based approach assigned these costs to products in a way that **shifted costs from the high volume product (standard) to the low volume product (deluxe)**.

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I. Appendix 2B: The Predetermined Overhead Rate and Capacity (Slide #1 is a title slide)

Learning Objective 6: Understand the implications of basing the predetermined overhead rate on activity at
2 *capacity rather than on estimated activity for the period.*

A. Calculating predetermined overhead rates using an estimated, or budgeted amount of the allocation base

i. There two methods of computing predetermined overhead rates:

3 1. The first method bases the **denominator volume** for overhead rates on the **estimated, or budgeted, amount of the allocation base** for the upcoming period.
2. The second method bases the **denominator volume** for overhead rates on the **estimated total amount of the allocation base at capacity**.

B. Traditional absorption costing

i. Two important limitations from a managerial accounting standpoint:

4 1. If predetermined overhead rates are based on budgeted activity and overhead includes significant fixed costs, then the unit product costs will fluctuate depending on the budgeted level of activity for the period.

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a. This in turn makes it appear as though the cost of producing the product has increased, which may tempt managers to raise prices at the worst possible time—just as demand is falling.

2. It charges products for resources that they don't use.

4 a. When the fixed costs of capacity are spread over estimated activity, the units that are produced must shoulder the costs of any unused capacity.

b. If the level of activity falls, a company's shrinking output of products must absorb a growing share of idle capacity cost that is above and beyond their actual production cost.

C. **Capacity-based overhead rates**

i. The limitations of traditional absorption costing can be overcome by using "estimated total amount of
5 the allocation base **at capacity**" in the denominator of the predetermined overhead rate calculation (rather than the "estimated total units in the allocation base" in the denominator).

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ii. The following example will help distinguish between these two approaches.

1. Assume that a company leases a piece of equipment for **$100,000** per year. If run at full capacity, the machine can produce **50,000** units per year.
2. The company estimates that **40,000** units will
6 be produced and sold next year.
3. The predetermined overhead rate, if based on the estimated number of units that will be produced and sold, is **$2.50 per unit**.
4. The predetermined overhead rate, if based on capacity, is **$2.00**.

D. Cost of unused capacity

i. Whenever a company operates at **less than full capacity** and allocates fixed overhead costs using a capacity-based denominator volume it will report some amount of unused capacity cost.

7 1. **Cost of unused capacity** = (Amount of the allocation base at capacity – Actual amount of the allocation base) x Predetermined overhead rate
2. Extending the example, since the company is operating below capacity, the company's cost of unused capacity is **$20,000**.

E. **Income statement preparation**

i. The **cost of unused capacity** should be **disclosed**
8 on the income statement prepared for internal purposes.

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9

1. Rather than treating it as a product cost (as is done in the absorption approach), the capacity-based approach would treat this cost as a **period expense** that is reported **below the gross margin**.
    a. The need to effectively manage capacity is then **highlighted** for the company's managers.
    b. Managers should respond by:
        (1). Seeking new business opportunities that consume the capacity
        (2). Cutting costs and shrinking the amount of available capacity.

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Chapter 2 – Job-Order Costing: Calculating Unit Product Costs

		Click on links
Exercise 2-2	Apply Overhead Cost to Jobs	Exercise 2-2
Exercise 2-3	Computing Total Job Costs and Unit Product Costs Using a Plantwide Predetermined Overhead Rate	Exercise 2-3
Exercise 2-5	Computing Total Job Costs and Unit Product Costs Using Multiple Predetermined Overhead Rates	Exercise 2-5
Exercise 2-6	Job-Order Costing for a Service Company	Exercise 2-6
Exercise 2-7	Job-Order Costing; Working Backwards	Exercise 2-7
Exercise 2-8	Applying Overhead Cost; Computing Unit Product Cost	Exercise 2-8
Exercise 2-9	Job-Order Costing and Decision Making	Exercise 2-9

Exercise 2-2

Garret Corporation uses a predetermined overhead rate of $42.45 per direct labor-hour. This plantwide predetermined rate was based on a cost formula that estimated $7,216,500 of total manufacturing overhead for an estimated activity level of 170,000 direct labor-hours. The company incurred actual total manufacturing overhead costs of $7,110,375 and 165,000 total direct labor-hours during the period.

Required:
Determine the amount of manufacturing overhead that would have been applied to all jobs during the period.

Actual direct labor-hours	165,000
× Predetermined overhead rate	$ 42.45
= Applied manufacturing overhead	$7,004,250

[LO2]

Exercise 2-3

Weaver Company's plantwide predetermined overhead rate is $21.00 per direct labor-hour and its direct labor wage rate is $14.00 per hour. The following information pertains to Job A-200:

Direct materials………………………..$290
Direct labor……………………………..$210

***Required**:*
1. What is the total manufacturing cost assigned to Job A-200?
2. If Job A-200 consists of 50 units, what is the average cost assigned to each unit in the job?

[LO3]

Total direct labor-hours required for Job A-200

Direct labor cost		$210
Direct labor wage rate per hour	÷	$14
Total direct labor-hours		15

Requirement 1: What is the total manufacturing cost assigned to Job A-200?

Direct materials		$290
Direct labor		210
Manufacturing overhead applied	$21 per DLH x 15 DLHs	315
Total manufacturing cost		$815

Manufacturing overhead applied=
Predetermined overhead rate per DLH x Jobs Actual Quantity of DLH

Requirement 2: If Job A-200 consists of 50 units, what is the average cost assigned to each unit in the job?

Direct materials		$290
Direct labor		210
Manufacturing overhead applied	$21 per DLH x15 DLHs	315
Total manufacturing cost		$815
Number of units in the job		÷ 50
Unit product cost		$16.30

Exercise 2-5

Lionheart Company has two manufacturing departments—Molding and Firing. The predetermined departmental overhead rates in Molding and Firing are $23.00 per direct labor-hour and 150% of direct materials cost, respectively. The company's direct labor wage rate is $18.00 per hour. The following information pertains to Job HC-916

	Molding	Firing
Direct materials	$290	$340
Direct labor	$198	$72

Required:
1. What is the total manufacturing cost assigned to Job HC-916?
2. If Job HC-916 consists of 20 units, what is the average cost assigned to each unit in the job?

[LO4]

Total direct labor-hours required for Job HC-916

	Molding
Direct labor cost	$198
Direct labor wage rate per hour	$18
Total direct labor hours	11

Requirement 1: What is the total manufacturing cost assigned to Job HC-916?

Direct materials		$630
Direct labor		270
Manufacturing Overhead Molding Department	$253	
Manufacturing Overhead Firing Department	510	763
Total manufacturing cost		$1,663

Manufacturing overhead applied Molding =
Predetermined overhead rate per DLH x Actual Quantity of DLH
= $23/DLH x 11

Manufacturing overhead applied Firing=
Predetermined overhead rate per DM$ x DM$
=150% x $340

Requirement 2: If Job HC-916 consists of 20 units, what is the average cost assigned to each unit in the job?

Total manufacturing cost	$1,663
Number of units in the job	20
Unit product cost	$83.15

Exercise 2-6

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Smart Strat is an advisory firm that uses a job-order costing system. Its direct materials consist of hardware and software that it purchases and installs on behalf of its clients. The firm's direct labor includes salaries of advisors that work at the client's job site, and its overhead consists of costs such as depreciation, utilities, and insurance related to the office headquarters as well as the office supplies that are consumed serving clients.

Smart Strat computes its predetermined overhead rate annually on the basis of direct labor-hours. At the beginning of the year, it estimated that 65,000 direct labor-hours would be required for the period's estimated level of client service. The company also estimated $445,250 of fixed overhead cost for the coming period and variable overhead of $1.50 per direct labor-hour. The firm's actual overhead cost for the year was $550,000 and its actual total direct labor was 67,000 hours.

***Required**:*

1. Compute the predetermined overhead rate.
2. During the year, Smart Strat started and completed the Valencia Company engagement. The following information was available with respect to this job:

Direct materials	$29,000
Direct labor cost	$28,500
Direct labor hours worked	300

Compute the total job cost for the Valencia Company engagement.

[LO1, LO2, LO3]

Requirement:

Compute the company's predetermined overhead rate for the year.

$$Y = a + bX$$

$$Y = \$445{,}250 + (\$1.50)\ (65{,}000 \text{ direct labor-hours})$$

Component	Amount
Estimated fixed overhead	$445,250
Estimated variable overhead:	
$1.50 per DLH × 65,000 DLHs	97,500
Estimated total overhead cost	$542,750

Estimated total overhead	$542,750	
÷ Estimated total direct labor-hours (DLHs)	65,000	DLHs
= Predetermined plantwide overhead rate	$8.35	per DLH

Requirement 2: Compute the total job cost for the Valencia Company engagement.

Direct materials		$29,000
Direct labor		28,500
Overhead applied	$8.35 per DLH x 300 DLHs	2,505
Total cost		$60,005

Overhead applied=
Predetermined manufacturing overhead rate per DLH x Actual Quantity of DLH

Exercise 2-7

Ahad Company uses a job-order costing system. Its plantwide predetermined overhead rate uses direct labor-hours as the allocation base. The company pays its direct laborers $16 per hour. During the year, the company started and completed only two jobs—Job Antelope, which used 42,500 direct labor-hours, and Job Zebra. The job cost sheets for the these two jobs are shown below:

Job Antelope		Job Zebra	
Direct materials	?	Direct materials	$150,000
Direct labor cost	?	Direct labor cost	288,000
Manufacturing overhead applied	?	Manufacturing overhead applied	183,960
Total job cost	$1,285,000	Total job cost	$621,960

Required:

1. Calculate the plantwide predetermined overhead rate.
2. Complete the job cost sheet for Job Antelope.

[LO1, LO2, LO3]

Requirement 1:

Calculate the plantwide predetermined overhead rate.

Direct labor cost	$288,000
Direct labor wage rate per hour	$16
Total direct labor hours worked	18,000

Manufacturing overhead applied to Job Zebra	$183,960	
Direct labor hours worked on Job Zebra	18,000	
Plantwide predetermined overhead rate	$10.22	per DLH

Requirement 2: Complete the job cost sheet for Job Antelope.

Direct materials (plug)		$170,650
Direct labor	$16.00 per DLH x 42,500 DLHs	680,000
Overhead applied	$10.22 per DLH x 42,500 DLHs	434,350
Total cost		$1,285,000

Exercise 2-8

Newhard Company assigns overhead cost to jobs on the basis of 140% of direct labor cost. The job cost sheet for Job XN99 includes $19,000 in direct materials cost and $15,000 in direct labor cost. A total of 500 units were produced in Job XN99.

***Required**:*
What is the total manufacturing cost assigned to Job XN99?
What is the unit product cost for Job XN99.

[LO2],[LO3]

Requirement : What is the total manufacturing cost assigned to Job XN99? What is the unit product cost for Job XN99.

Direct material	$19,000
Direct labor	15,000
Manufacturing overhead applied:	
$15,000 × 140%	21,000
Total manufacturing cost	$55,000

Total manufacturing cost	$55,000
Number of units in job	500
Unit product cost	$110

Exercise 2-9

Guided Example

Vence Corporation is currently operating at 40% of its available manufacturing capacity. It uses a job-order costing system with a plantwide predetermined overhead rate based on machine-hours. At the beginning of the year, the company made the following estimates:

Machine-hours required to support estimated production	40,000
Fixed manufacturing overhead cost	$792,000
Variable manufacturing overhead cost per machine-hour	$1.50

Required:

1. Compute the plantwide predetermined overhead rate.
2. During the year, Job 2K17 was started, completed, and sold to the customer for $4,000. The following information was available with respect to this job:

Direct materials	$2,100
Direct labor cost	$1,265
Machine hours used	90

Compute the total manufacturing cost assigned to Job 2K17.

3. Upon comparing Job 2K17's sales revenue to its total manufacturing cost, the company's chief financial officer said "If this exact same opportunity walked through our front door tomorrow, I'd turn it down rather than making it and selling it for $4,000." Do you agree?

[LO1, LO2, LO3, LO6]

Requirement:

Compute the company's predetermined overhead rate for the year.

$$Y = a + bX$$

$$Y = \$792{,}000 + (\$1.50 \times 40{,}000 \text{ machine hours})$$

Component	Amount
Estimated fixed overhead	$792,000
Estimated variable overhead:	
$1.50 per MH × 40,000 MHs	60,000
Estimated total manufacturing overhead cost	$852,000

Estimated total overhead	$852,000	
÷ Estimated total machine hours (MHs)	40,000	MHs
= Predetermined plantwide overhead rate	$21.30	per MH

Requirement 2: Compute the total manufacturing cost assigned to Job 2K17.

Direct materials		$2,100
Direct labor		1,265
Overhead applied	$21.30 per MH x 90 MHs	1,917
Total cost		$5,282

Overhead applied=
Predetermined plantwide manufacturing overhead rate per MH
x
Actual Quantity of MH

Requirement 3: Prepare some analysis to support or refute the CFO's position

Sales		$ 4,000
Direct materials	$2,100	
Direct labor	1,265	
Manufacturing overhead applied	1,917	5,282
Loss on Job		$(1,282)

Sales		$ 4,000
Direct materials	$2,100	
Direct labor	1,265	
Variable overhead applied	135	3,500
Contribution margin		$ 500

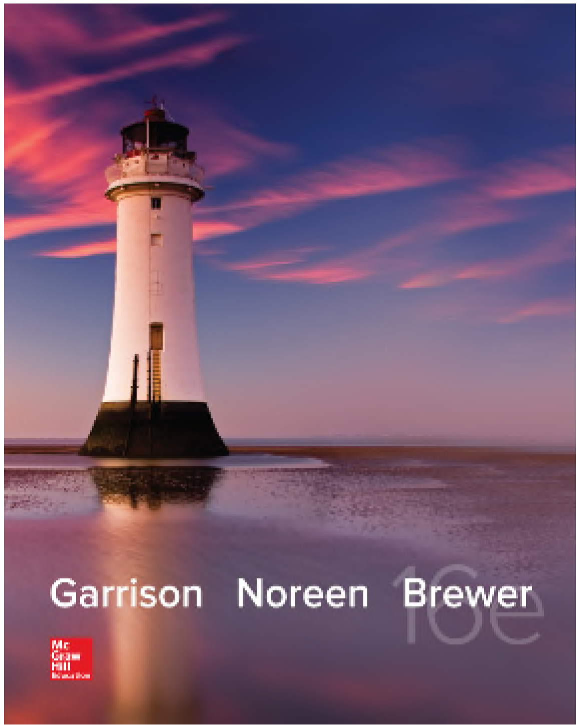
Current machine hours	40,000
Current capacity	40%
Machine hours at full capacity	100,000

Estimated fixed overhead	$792,000	
Estimated total machine-hours	100,000	MHs
Predetermined fixed overhead rate	$7.92	per MH
Add: variable overhead per MH	$1.50	per MH
Predetermined capacity overhead rate	$9.42	per MH

Sales		$ 4,000
Direct materials	$2,100	
Direct labor	1,265	
Overhead applied	848	4,213
Loss on job		$ (213)

Job-Order Costing: Calculating Unit Product Costs

CHAPTER 2



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Job-Order Costing: An Overview

Job-order costing systems are used when:

1. Many different products are produced each period.
2. Products are manufactured to order.
3. The unique nature of each order requires tracing or allocating costs to each job, and maintaining cost records for each job.

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Job-Order Costing: Examples

Examples of companies that would use job-order costing include:

1. Boeing (aircraft manufacturing)
2. Bechtel International (large scale construction)
3. Walt Disney Studios (movie production)

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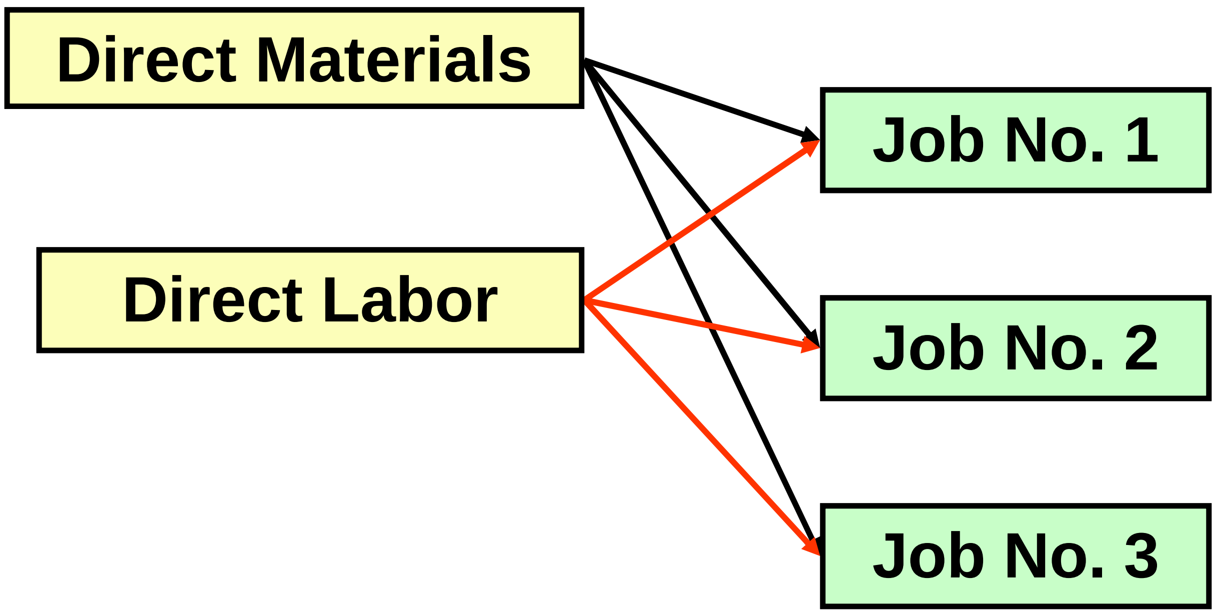
Job-Order Costing – Cost Flow 1

Direct Costs



Charge direct material and direct labor costs to each job as work is performed.

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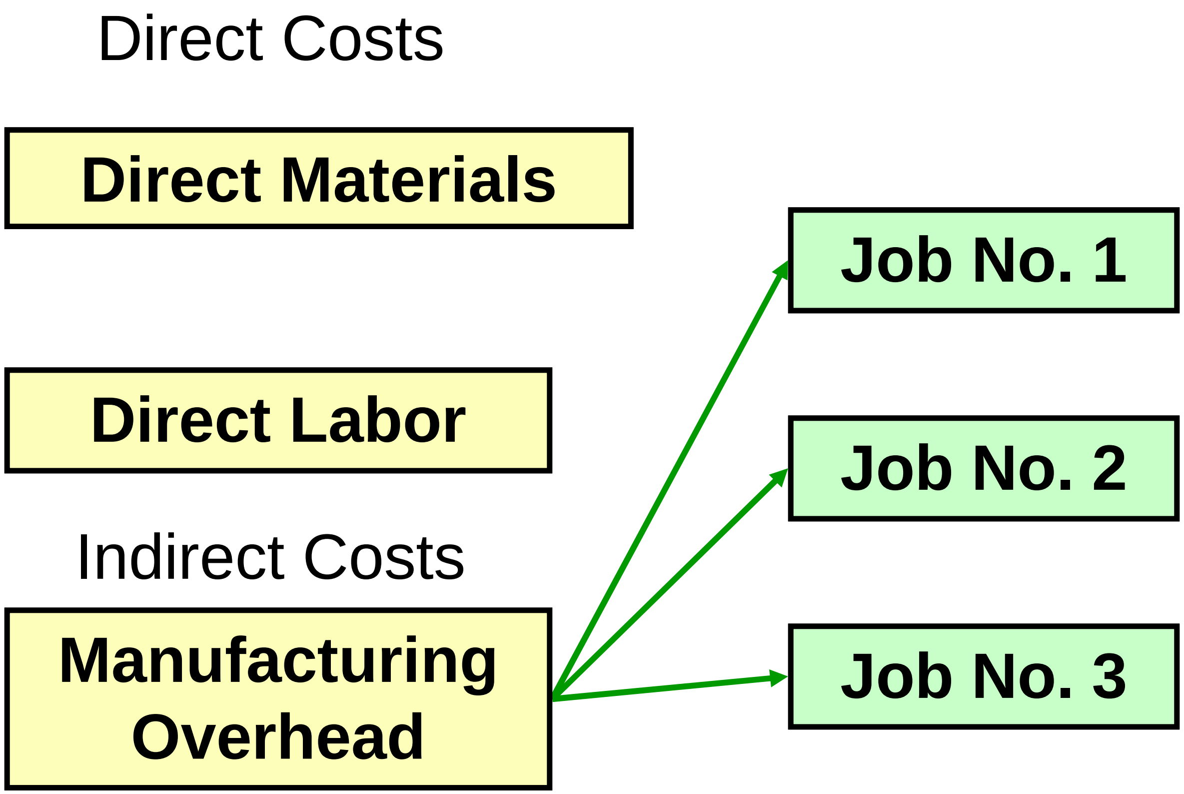
Job-Order Costing – Cost Flow 2



Manufacturing Overhead, including *indirect materials* and *indirect labor,* are allocated to all jobs rather than directly traced to each job.

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The Job Cost Sheet

PearCo Job Cost Sheet

Job Number A - 143

Date Initiated 3-4-17

Date Completed

Department B3

Units Completed

Item Wooden cargo crate

Direct Materials		Direct Labor			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount

Cost Summary	Units Shipped		
	Date	Number	Balance
Direct Materials			
Direct Labor			
Manufacturing Overhead			
Total Cost			
Unit Product Cost			

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Measuring Direct Materials Cost – Part 1

PearCo Materials Requisition Form

Requisition No. X7 - 6890
Date 3-4-17
Job No. A - 143
Department B3

Description	Quantity	Unit Cost	Total Cost
2 x 4, 12 feet	12	$ 3.00	$ 36.00
1 x 6, 12 feet	20	4.00	80.00
			$ 116.00

Authorized Signature *Will E. Delite*

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Measuring Direct Materials Cost – Part 2

PearCo Job Cost Sheet

Job Number A - 143

Date Initiated 3-4-17

Date Completed

Units Completed

Department B3

Item Wooden cargo crate

Direct Materials		Direct Labor			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount
X7-6890	$ 116						

Cost Summary		Units Shipped		
		Date	Number	Balance
Direct Materials	$ 116			
Direct Labor				
Manufacturing Overhead				
Total Cost				
Unit Product Cost				

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Measuring Direct Labor Costs

PearCo Employee Time Ticket

Time Ticket No. 36 | Date 3-5-17

Employee I. M. Skilled | Station 42

Starting Time	Ending Time	Hours Completed	Hourly Rate	Amount	Job No.
0800	1600	8.00	$ 15.00	$ 120.00	A-143
Totals		8.00	$ 15.00	$ 120.00	A-143

Supervisor *C. M. Workman*

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Job-Order Cost Accounting

PearCo Job Cost Sheet

Job Number A - 143

Date Initiated 3-4-17

Date Completed

Units Completed

Department B3

Item Wooden cargo crate

Direct Materials		Direct Labor			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount
X7-6890	$ 116	36	8	$ 120			

Cost Summary		Units Shipped		
		Date	Number	Balance
Direct Materials	$ 116			
Direct Labor	$ 120			
Manufacturing Overhead				
Total Cost				
Unit Product Cost				

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Learning Objective 1

Compute a predetermined overhead rate.

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Why Use an Allocation Base?

An allocation base, such as direct labor hours, direct labor dollars, or machine hours, is used to assign manufacturing overhead to individual jobs.

We use an allocation base because:

a. It is impossible or difficult to trace overhead costs to particular jobs.

b. Manufacturing overhead consists of many different items ranging from the grease used in machines to the production manager's salary.

c. Many types of manufacturing overhead costs are fixed even though output fluctuates during the period.

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Manufacturing Overhead Application

The predetermined overhead rate (*POHR*) used to apply overhead to jobs is determined before the period begins.

$$\text{POHR} = \frac{\text{Estimated total manufacturing overhead cost for the coming period}}{\text{Estimated total units in the allocation base for the coming period}}$$

Ideally, the allocation base is a cost driver that causes overhead.

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The Need for a POHR

Predetermined overhead rates that rely upon estimated data are often used because:

1. Actual overhead for the period is not known until the end of the period, thus inhibiting the ability to estimate job costs during the period.
2. Actual overhead costs can fluctuate seasonally, thus misleading decision makers.

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Computing Predetermined Overhead Rates

The predetermined overhead rate is computed before the period begins using a four-step process.

1.Estimate the total amount of the allocation base (the denominator) that will be required for next period's estimated level of production.

2.Estimate the total fixed manufacturing overhead cost for the coming period and the variable manufacturing overhead cost per unit of the allocation base.

3.Use the following equation to estimate the total amount of manufacturing overhead:

$$Y = a + bX$$

Where,

Y = The estimated total manufacturing overhead cost

a = The estimated total fixed manufacturing overhead cost

b = The estimated variable manufacturing overhead cost per unit of the allocation base

X = The estimated total amount of the allocation base

4. Compute the predetermined overhead rate.

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Learning Objective 2

Apply overhead cost to jobs using a predetermined overhead rate.

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Overhead Application Rate

PearCo estimates that it will require 160,000 direct labor-hours to meet the coming period's estimated production level. In addition, the company estimates total fixed manufacturing overhead at $200,000, and variable manufacturing overhead costs of $2.75 per direct labor hour.

Y = a + bX
Y = $200,000 + ($2.75 per direct labor-hour × 160,000 direct labor-hours)
Y = $200,000 + $440,000
Y = $640,000

POHR = $\dfrac{\text{\$640,000 estimated total manufacturing overhead}}{\text{160,000 estimated direct labor hours (DLH)}}$

POHR = $4.00 per direct labor-hour

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Recording Manufacturing Overhead

PearCo Job Cost Sheet

Job Number A - 143

Department B3

Item Wooden cargo crate

Date Initiated 3-4-17

Date Completed 3-5-17

Units Completed 2

Direct Materials		Direct Labor			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount
X7-6890	$ 116	36	8	$ 120	8	$ 4	$ 32

Cost Summary		Units Shipped		
		Date	Number	Balance
Direct Materials	$ 116			
Direct Labor	$ 120			
Manufacturing Overhead	$ 32			
Total Cost				
Unit Product Cost				

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Learning Objective 3

Compute the total cost and the unit product cost of a job using a plantwide predetermined overhead rate.

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Calculating Total Cost of Job

PearCo Job Cost Sheet

Job Number A - 143
Date Initiated 3-4-17
Date Completed 3-5-17
Department B3
Units Completed 2
Item Wooden cargo crate

Direct Materials		Direct Labor			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount
X7-6890	$ 116	36	8	$ 120	8	$ 4	$ 32

Cost Summary		Units Shipped		
		Date	Number	Balance
Direct Materials	$ 116			
Direct Labor	$ 120			
Manufacturing Overhead	$ 32			
Total Cost	$ 268			
Unit Product Cost				

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Calculating Unit Product Cost

PearCo Job Cost Sheet

Job Number A - 143

Date Initiated 3-4-17

Date Completed 3-5-17

Department B3

Units Completed 2

Item Wooden cargo crate

Direct Materials		Direct Labor			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount
X7-6890	$ 116	36	8	$ 120	8	$ 4	$ 32

Cost Summary		Units Shipped		
		Date	Number	Balance
Direct Materials	$ 116			
Direct Labor	$ 120			
Manufacturing Overhead	$ 32			
Total Cost	$ 268			
Unit Product Cost	$ 134			

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Quick Check 1

Job WR53 at NW Fab, Inc. required $200 of direct materials and 10 direct labor hours at $15 per hour. Estimated total overhead for the year was $760,000 and estimated direct labor hours were 20,000. What would be recorded as the cost of job WR53?

a. $200.

b. $350.

c. $380.

d. $730.

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Quick Check 1a

Job WR53 at NW Fab, Inc. required $200 of direct materials and 10 direct labor hours at $15 per hour. Estimated total overhead for the year was $760,000 and estimated direct labor hours were 20,000. What would be recorded as the cost of job WR53?

a. $200.

b. $350.

c. $380.

d. $730.

POHR = $760,000/20,000 hours $38

Direct materials			$200
Direct labor	$15	x 10 hours	$150
Manufacturing overhead	$38	x 10 hours	$380
Total cost			$730

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Job-Order Costing – A Managerial Perspective – Part 1

Inaccurately assigning manufacturing costs to jobs adversely influences planning and decisions made by managers.

1. Job-order costing systems can accurately trace *direct* materials and *direct* labor costs to jobs.
2. Job-order costing systems often fail to accurately allocate the manufacturing overhead costs used during the production process to their respective jobs.

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Job-Order Costing – A Managerial Perspective – Part 2

Choosing an Allocation Base

Job-order costing systems often use allocation bases that do not reflect how jobs actually use overhead resources. The allocation base in the predetermined overhead rate must **drive** the overhead cost to improve job cost accuracy. A **cost driver** is a factor that causes overhead costs.

Many companies use a single predetermined **plantwide overhead rate** to allocate all manufacturing overhead costs to jobs based on their usage of direct-labor hours.

1. It is often **overly-simplistic** and incorrect to assume that direct-labor hours is a company's *only* manufacturing overhead cost driver.
2. If more than one overhead cost driver can be identified, job cost accuracy is improved by using **multiple predetermined overhead rates**.

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Learning Objective 4

Compute the total cost and the unit product cost of a job using multiple predetermined overhead rates.

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Information to Calculate Multiple Predetermined Overhead Rates

Dickson Company has two production departments, Milling and Assembly. The company uses a job-order costing system and computes a predetermined overhead rate in each production department. The predetermined overhead rate in the Milling Department is based on machine-hours and in the Assembly Department it is based on direct labor-hours. The company uses cost-plus pricing (and a markup percentage of 75% of total manufacturing cost) to establish selling prices for all of its jobs. At the beginning of the year, the company made the following estimates:

	Department	
	Milling	Assembly
Machine-hours	60,000	3,000
Direct labor-hours	8,000	80,000
Total fixed manufacturing overhead cost	$390,000	$500,000
Variable manufacturing overhead per machine-hour	$2.00	—
Variable manufacturing overhead per direct labor-hour	—	$3.75

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Step 1 – Calculate the Predetermined Overhead Cost for Each Department

During the current month the company started and completed Job 407. It wants to use its predetermined departmental overhead cost and rate for the Milling and Assembly Departments.

Milling Department = $390,000 + ($2.00 per MH × 60,000 MHs) = $510,000
Assembly Department = $500,000 + ($3.75 per DLH × 80,000 DLHs) = $800,000

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Step 2 – Calculate the Predetermined Overhead Rate for Each Department

Use the amounts determined on the previous slide to calculate the predetermined overhead rate (POHR) of each department.

Milling Department = $510,000 ÷ 60,000 MHs = $ 8.50 per MH
Assembly Department = $800,000 ÷ 80,000 DLHs = $10.00 per DLH

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Step 3 – Calculate the Amount of Overhead Applied from Both Departments to a Job

Use the POR calculated on the previous slide to determine the overhead applied from both departments to Job 407:

	Department	
Job 407	Milling	Assembly
Machine-hours	90	4
Direct labor-hours	5	20
Direct materials	$800	$370
Direct labor cost	$70	$280

Milling Department = 90 MHs × $8.50 per MH = $765
Assembly Department = 20 DLHs × $10 per DLH = $200

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Step 4 – Calculate the Total Job Cost for Job 407

We can use the information given to calculate the amount of the total cost of Job 407. Here is the calculation:

	Milling	Assembly	Total
Direct materials	$800	$370	$1,170
Direct labor	$ 70	$280	350
Manufacturing overhead applied	$765	$200	965
Total cost of Job 407			$2,485

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Step 5 – Calculate the Selling Price for Job 407

The selling price of Job 407 assuming a 75% markup.

Total cost of Job 407	$2,485.00
Markup ($2,485 × 75%)	1,863.75
Selling price of Job 407	$4,348.75

It is important to emphasize that using a departmental approach to overhead application results in a different selling price for Job 407 than would have been derived using a Plantwide overhead rate based on either direct labor-hours or machine-hours. The appeal of using predetermined departmental overhead rates is that they presumably provide a more accurate accounting of the costs caused by jobs, which in turn, should enhance management planning and decision making.

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Multiple Predetermined Overhead Rates—An Activity-Based Approach

When a company creates overhead rates based on the activities that it performs, it is employing an approach called *activity-based costing*.

Activity-based costing is an alternative approach to developing multiple predetermined overhead rates. Managers use activity-based costing systems to more accurately measure the demands that jobs, products, customers, and other cost objects make on overhead resources.

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Job-Order Costing for Financial Statements to External Parties

The amount of overhead applied to all jobs during a period will differ from the actual amount of overhead costs incurred during the period.

1. When a company applies less overhead to production than it actually incurs, it creates what is known as underapplied overhead.
2. When it applies more overhead to production than it actually incurs, it results in overapplied overhead.

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Financial Adjust for Overhead Applied

The cost of goods sold reported on a company's income statement must be adjusted to reflect underapplied or overapplied overhead.

1. The adjustment for underapplied overhead **increases cost of goods sold** and decreases net operating income.
2. The adjustment for overapplied overhead **decreases cost of goods sold** and increases net operating income.

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Job Cost Sheets: A Subsidiary Ledger

All of a company's job cost sheets collectively form a **subsidiary ledger.**

PearCo Job Cost Sheet

Job Number A - 143
Date Initiated 3-4-17
Date Completed 3-5-17
Department B3
Units Completed 2
Item Wooden cargo crate

Direct Materials		Direct Labor			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount
X7-6890	$ 116	36	8	$ 120	8	$ 4	$ 32

Cost Summary		Units Shipped		
		Date	Number	Balance
Direct Materials	$ 116			
Direct Labor	$ 120			
Manufacturing Overhead	$ 32			
Total Cost	$ 268			
Unit Product Cost				

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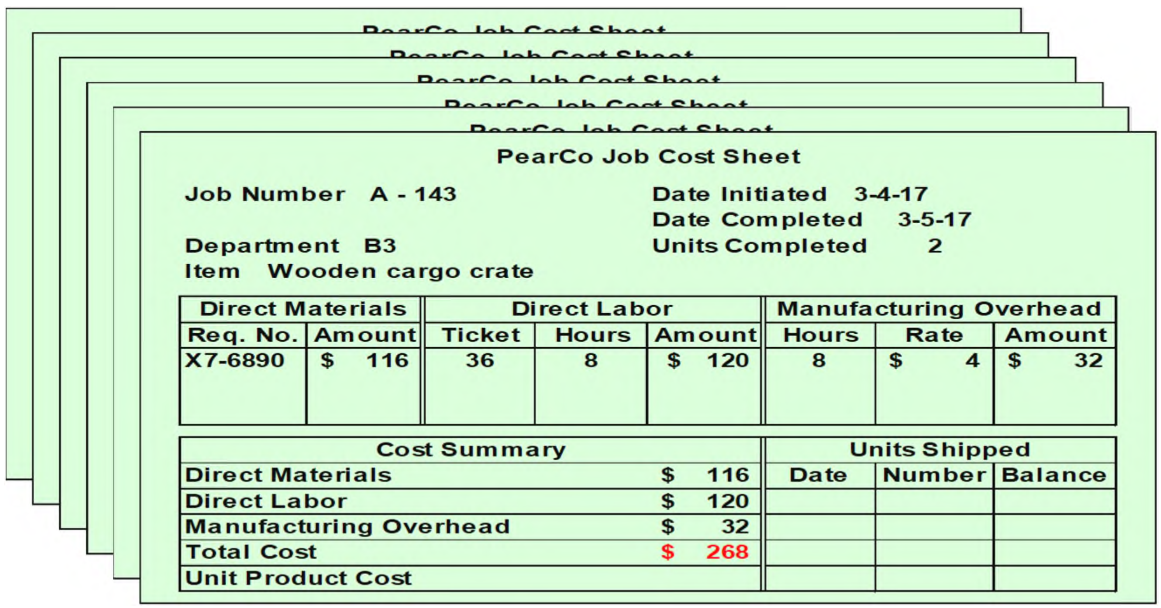
Job Cost Sheets: Balance Sheet Reporting

The job costs sheets provide an underlying set of financial records that explain what specific jobs comprise the amounts reported in **Work-in-Process** and **Finished Goods** on the balance sheet.



PearCo Job Cost Sheet

Job Number A - 143
Date Initiated 3-4-17
Date Completed 3-5-17
Department B3
Units Completed 2
Item Wooden cargo crate

Direct Materials		Direct Labor			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount
X7-6890	$ 116	36	8	$ 120	8	$ 4	$ 32

Cost Summary		Units Shipped		
		Date	Number	Balance
Direct Materials	$ 116			
Direct Labor	$ 120			
Manufacturing Overhead	$ 32			
Total Cost	$ 268			
Unit Product Cost				

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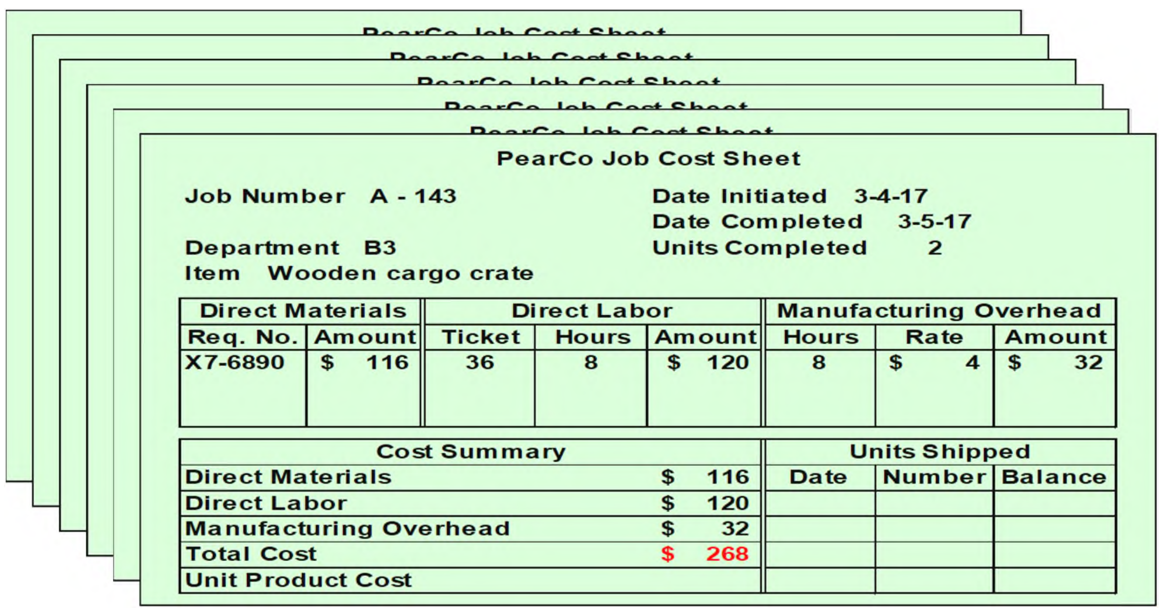
Job Cost Sheets: Income Statement Reporting

The job costs sheets provide an underlying set of financial records that explain what specific jobs comprise the amounts reported in **Cost of Goods Sold** on the income statement.



PearCo Job Cost Sheet

Job Number A - 143
Date Initiated 3-4-17
Date Completed 3-5-17
Department B3
Units Completed 2
Item Wooden cargo crate

Direct Materials		Direct Labor			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount
X7-6890	$ 116	36	8	$ 120	8	$ 4	$ 32

Cost Summary		Units Shipped		
		Date	Number	Balance
Direct Materials	$ 116			
Direct Labor	$ 120			
Manufacturing Overhead	$ 32			
Total Cost	$ 268			
Unit Product Cost				

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Job-Order Costing in Service Companies

Although our attention has focused upon manufacturing applications, it bears re-emphasizing that job-order costing is also used in service industries. Job-order costing is used in many different types of service companies. For example, law firms, accounting firms, and medical treatment.

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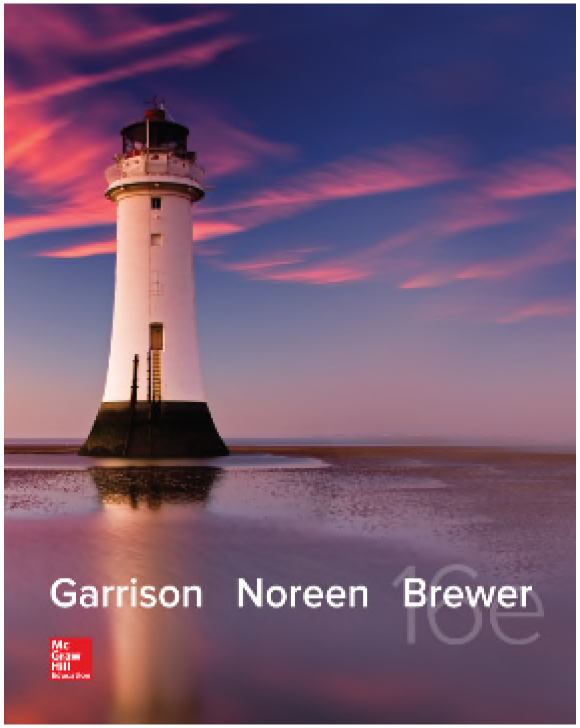
Activity-Based Absorption Costing

APPENDIX 2A



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Learning Objective 5

Use activity-based absorption costing to compute unit product costs.

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Activity-Based Absorption Costing: Overview

Activity-based absorption costing assigns all manufacturing overhead costs to products using activity cost pools instead of plantwide or department cost pools.

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Activity-Based Absorption Costing: Key Definitions

Key Definitions and Concepts

1. An activity is an event that causes the consumption of overhead resources.
2. An activity cost pool is a "bucket" in which costs are accumulated that relate to a single activity.
3. An activity measure is an allocation that is used as the denominator for an activity cost pool.
4. An activity rate is used to assign costs from an activity cost pool to products.

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Differences Between ABC Adsorption and Traditional Absorption Costing

Activity-based absorption costing differs from traditional absorption costing in two ways:

1. The activity based approach uses more cost pools than a traditional approach.
2. The activity-based approach includes some batch-level and product-level activities and activity measures that do not relate to the volume of units produced, whereas the traditional approach relies exclusively on volume-related overhead allocation.

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Simmons Industries – A Traditional Approach

Simmons Industries provides the following information for the company as a whole and for its only two products—deluxe and standard hedge trimmers.

Total estimated manufacturing overhead	$ 1,800,000
Total estimated direct labor hours	400,000

	Deluxe	Standard
Direct materials cost per unit	$ 38.00	$ 28.00
Direct labor cost per unit	$ 24.00	$ 12.00
Direct labor hours per unit	2.0	1.0
Units produced	100,000	200,000

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Simmons Industries – Calculating POHR

Assuming that Simmons' traditional cost system relies on one predetermined plantwide overhead rate with direct labor-hours (DLHs) as the allocation base, then its plantwide overhead rate is computed as follows:

$$\text{Predetermined overhead rate} = \frac{\$1{,}800{,}000}{400{,}000 \text{ DLHs}} = \$4.50 \text{ per DLH}$$

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Simmons Industries – Applying POH to Products

Simmons' traditional cost system would report unit product costs as follows:

	Deluxe		Standard	
Direct materials cost per unit	$	38.00	$	28.00
Direct labor cost per unit		24.00		12.00
Manufacturing overhead per unit		9.00		4.50
Unit product cost	$	71.00	$	44.50

2.0 DLH × $4.50 per DLH

1.0 DLH × $4.50 per DLH

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Simmons Industry – Activity-Based Absorption Costing

The ABC project team at Simmons has developed the following basic information.

Activity and Activity Measures	Estimated Overhead Cost	Expected Activity		
		Deluxe	Standard	Total
Direct labor support (DLHs)	$ 900,000	200,000	200,000	400,000
Machine setups (setups)	600,000	400	100	500
Parts administration (part types)	300,000	200	100	300
Total manufacturing overhead	$ 1,800,000			

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Simmons Industry – Calculating the Activity Rates

We can calculate the following activity rates:

Activity and Activity Measures	Estimated Overhead Cost		Total Expected Activity		Activity Rate
Direct labor support (DLHs)	$ 900,000	÷	400,000	=	$ 2.25 per DLH
Machine setups (setups)	600,000	÷	500	=	$ 1,200 per setup
Parts administration (part types)	300,000	÷	300	=	$ 1,000 per part type
Total manufacturing overhead	$ 1,800,000				

Using the new activity rates, let’s assign overhead to the two products based upon expected activity.

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Simmons Industry – Total Overhead Assigned to Products

Deluxe Product

Activity and Activity Measures	Expected Activity		Activity Rate		Amount
Direct labor support (DLHs)	200,000	×	$ 2.25	=	$ 450,000
Machine setups (setups)	400	×	$ 1,200	=	480,000
Parts administration (part types)	200	×	$ 1,000	=	200,000
Total overhead cost assigned					$ 1,130,000

Standard Product

Activity and Activity Measures	Expected Activity		Activity Rate		Amount
Direct labor support (DLHs)	200,000	×	$ 2.25	=	$ 450,000
Machine setups (setups)	100	×	$ 1,200	=	120,000
Parts administration (part types)	100	×	$ 1,000	=	100,000
Total overhead cost assigned					$ 670,000

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Simmons Industry – Calculating Unit Product Cost

Activity-based unit product costs for both product lines

	Deluxe	Standard
Direct materials cost per unit	$ 38.00	$ 28.00
Direct labor cost per unit	24.00	12.00
Manufacturing overhead per unit	11.30	3.35
Unit product cost	$ 73.30	$ 43.35

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Simmons Industry – Determining Overhead Per Unit

Activity-based unit product costs for both product lines

	Deluxe	Standard
Direct materials cost per unit	$ 38.00	$ 28.00
Direct labor cost per unit	24.00	12.00
Manufacturing overhead per unit	11.30	3.35
Unit product cost	$ 73.30	$ 43.35

$1,130,000 ÷ 100,000 units

$670,000 ÷ 200,000 units

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Comparing the Two Approaches

	Activity-Based Costing		Traditional Costing	
	Deluxe	Standard	Deluxe	Standard
Direct material	$ 38.00	$ 28.00	$ 38.00	$ 28.00
Direct labor	24.00	12.00	24.00	12.00
Manufacturing overhead	11.30	3.35	9.00	4.50
Unit product cost	$ 73.30	$ 43.35	$ 71.00	$ 44.50

Note that the unit product cost of a Standard unit decreased from $44.50 to $43.35 . . .

. . . while the unit cost of a Deluxe unit increased from $71.00 to $73.30.

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The Two Approaches – Difference in Unit Cost

Note that the unit product cost of a Standard unit decreased from $44.50 to $43.35, while the unit cost of the Deluxe unit increased from $71.00 to $73.30.

1. The activity-based approach contains two non-volume-related cost pools –"setting up machines" which is a batch-level activity and "parts administration" which is a product-level activity.
2. The activity–based approach assigned these to products in a way that shifted costs from high volume product (standard) to the low volume product

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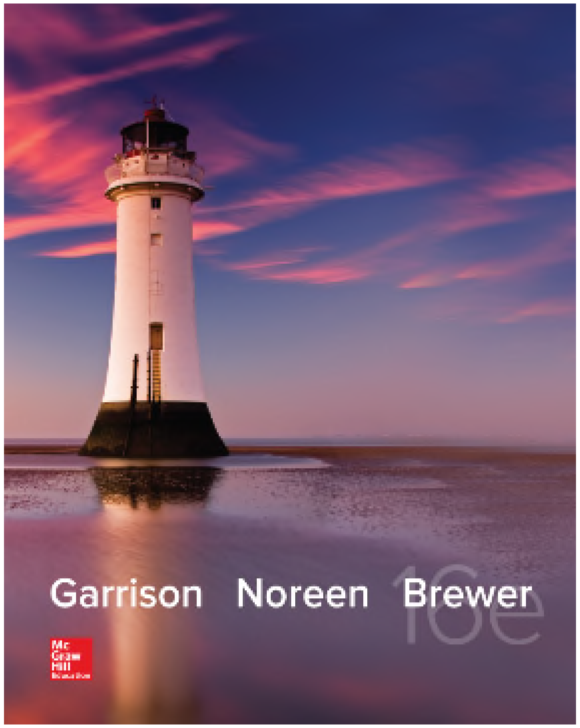
The Predetermined Overhead Rate and Capacity

APPENDIX 2B



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Learning Objective 6

Understand the implications of basing the predetermined overhead rate on activity at capacity rather than on estimated activity for the period.

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The Predetermined Overhead Rate and Capacity—Methods

One method, that we have used, bases the denominator on volume for overhead rates on the estimated, or budgeted, amount of the allocation base for the upcoming period.

A second method, often used for internal management purposes, bases the denominator volume for overhead rates on the estimated total amount of the allocation base at capacity.

For the remainder of this Appendix, we will make two assumptions:

(1) all manufacturing overhead costs are fixed; and
(2) the estimated, or budgeted, fixed manufacturing overhead at the beginning of the period equals the actual fixed manufacturing overhead at the end of the period.

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Traditional Absorption Costing

There are two significant problems with using the traditional absorption approach from a managerial accounting position.

First, if predetermined overhead rates are based on budgeted activity and overhead includes significant fixed costs, then the **unit product costs will fluctuate** depending on the budgeted level of activity for the period.

The second limitation of the absorption approach is that it charges products for resources that **they don’t use**. When the fixed costs of capacity are spread over estimated activity, the units that are produced must shoulder the costs of any unused capacity.

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Capacity-Based Overhead Rates

The limitations of traditional absorption costing can be overcome by using "estimated total amount of the allocation base at capacity" in the denominator of the predetermined overhead rate calculation (rather than the "estimated total units in the allocation base" in the denominator).

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Capacity-Based Overhead Rates – Calculations

Maximum, Inc. leases a piece of equipment for $100,000 per year. If run at full capacity, the machine can produce 50,000 units per year. However, the company estimates that 40,000 units will be produced and sold next year.

Predetermined Overhead Rate based on units produced and sold:

$$\frac{\$100{,}000}{40{,}000} = \$2.50 \text{ per unit}$$

Predetermined Overhead Rate, if based on capacity, is:

$$\frac{\$100{,}000}{50{,}000} = \$2.00 \text{ per unit}$$

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Cost of Unused Capacity Part 1

Maximum, Inc. leases a piece of equipment for $100,000 per year. If run at full capacity, the machine can produce 50,000 units per year. However, the company estimates that 40,000 units will be produced and sold next year.

Predetermined Overhead Rate based on unit capacity:

$$\frac{\$100{,}000}{50{,}000} = \$2.00 \text{ per unit}$$

Let's calculate the cost of unused capacity using the following equation:

$$\text{Cost of unused capacity} = \left(\text{Amount of the allocation base at capacity} - \text{Actual amount of the allocation base}\right) \times \text{Predetermined overhead rate}$$

Cost of unused capacity = (50,000 – 40,000) × $2.00 = $20,000

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Cost of Unused Capacity Part 2

$$\text{Cost of unused capacity} = \left(\begin{array}{c}\text{Amount of the allocation}\\ \text{base at capacity}\end{array} - \begin{array}{c}\text{Actual amount of the}\\ \text{allocation base}\end{array}\right) \times \begin{array}{c}\text{Predetermined}\\ \text{overhead rate}\end{array}$$

Cost of unused capacity = (50,000 - 40,000) × \$2.00 = \$20,000

Cost of unused capacity would be reported on the internal use income statement as an ***other expense***, just like selling and administrative expenses.

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Managing the Cost of Unused Capacity

Rather than treating it as a product cost (as is done in the absorption approach), the capacity-based approach would treat this cost as a period expense that is reported below the gross margin.

a. The need to effectively manage capacity is then highlighted for the company's managers.

b. Managers should respond by:

1) Seeking new business opportunities that consume the capacity.
2) Cutting costs and shrinking the amount of available capacity out to work in process, finished goods, and/or cost of goods sold.

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End of Chapter 2B

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