

Activity-Based Costing: Demonstration Problems and Practice Quiz

Demonstration Problem 1

ABC Manufacturing, Inc. produces three gadgets (Ace, Best, and Champ) in two departments, Machining and Assembly. Each product requires one hour of direct labor for completion. The following table provides production and cost data for the year.

	Ace	Best	Champ	Total
Number of units	25,000	15,000	5,000	45,000
Machine hours	2,500	1,500	2,000	6,000
<i>MH per unit</i>	<i>0.1 MH</i>	<i>0.1 MH</i>	<i>0.4 MH</i>	
Direct materials	\$1,000,000	\$450,000	\$275,000	\$1,725,000
Direct labor	375,000	225,000	75,000	675,000
Overhead				
Machining	(MH) 562,500	337,500	450,000	900,000
Assembly	(DL\$) 750,000	450,000	150,000	450,000
Total overhead				1,350,000
Tot costs				\$3,750,000

*Plantwide*  
 $\div 6,000 \text{ MH} = \$225/\text{MH}$   
 $\div \$675,000 = 200\%$   
*of DL\$*

Required:

Use the plantwide allocation method to determine the unit cost for each product. The allocation bases to choose from are

1. Machine hours.
2. Direct labor costs.

Solution:

1. The overhead allocation rate when **machine hours** were used as the allocation base was \$225 per machine hour (= \$1,350,000 ÷ 6,000 machine hours). The unit cost report would show the following:

	Ace	Best	Champ
Units produced	25,000	15,000	5,000
Machine hours per unit	0.1	0.1	0.4
Direct materials	\$40.0	\$30.0	\$55.0
Direct labor	15.0	15.0	15.0
Applied overhead ( <b>\$225 per machine hour</b> )	22.5	22.5	90.0
Unit cost	\$77.5	\$67.5	\$160.0

2. The overhead allocation rate when **direct hour costs** were used as the allocation base was 200% (= \$1,350,000 ÷ \$675,000). The unit cost report would show the following:

	Ace	Best	Champ
Units produced	25,000	15,000	5,000
Direct materials	\$40.0	\$30.0	\$55.0
Direct labor	15.0	15.0	15.0
Applied overhead ( <b>200% direct labor costs</b> )	30.0	30.0	30.0
Unit cost	\$85.0	\$75.0	\$100.0

Please note that the same results can be obtained using the number of units produced as the allocation base because each product requires one hour of direct labor for completion and the direct labor costs are in direct proportion to the number of units produced. The overhead allocation rate would be \$30 per unit (= \$1,350,000 ÷ 45,000 units) as shown above.

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- The department allocation method uses a separate cost pool for each department. Each department has its own overhead allocation rate or set of rates. This is a variation of the two-stage allocation approach in which the cost pools happen to be departments.
- If the company manufactures products that are quite similar and all use the same set of resources, the plantwide rate is probably sufficient.
- If there are multiple products that require manufacturing facilities in many different ways, departmental rates provide a better picture of the use of manufacturing resources by the different products.
- The choice between a plantwide rate and departmental rates is based on the costs and benefits of the information inherent in each system. Any incremental costs of additional information must be justified by an increase in benefits from improved decisions.

Demonstration Problem 2  
 (Continued from Demonstration Problem 1)

Considering the nature of the production processes, the cost accountant of ABC Manufacturing decided to experiment with the department-specific allocation approach and determined that the Machining Department can use machine hours as the allocation base for overhead assignment while the Assembly Department can use direct labor costs instead.

Required:

Use the department allocation method to determine the unit cost for each product.

	MH = 2500	1500	2000
	Ace	Best	Champ
Units produced	25,000	15,000	5,000
Machine hours per unit	0.1	0.1	0.4
Direct materials	40	30	55
Direct labor	15	15	15
Applied overhead			
Machining ( $\frac{\$150}{}$ per machine hour)	15	15	60
Assembly ( $\frac{66.7\%}{}$ of direct labor costs)	10	10	10
Unit cost	<u>\$ 80</u>	<u>\$ 70</u>	<u>\$ 140</u>

$$\$450,000 \div \$675,000 = 66.7\% \text{ of DL\$}$$

$$\$900,000 \div 6000 \text{ MHS} = \$150/\text{MH}$$

**Solution:**

For the Machining Department, the overhead allocation rate would be \$150 per machine hour (= \$900,000 ÷ 6,000 machine hours).

For the Assembly Department, the overhead allocation rate would be 66.67% (= \$450,000 ÷ \$675,000).

	Ace	Best	Champ
Units produced	25,000	15,000	5,000
Machine hours per unit	0.1	0.1	0.4
Direct materials	\$40.0	\$30.0	\$55.0
Direct labor	15.0	15.0	15.0
Applied overhead			
Machining (\$150 per machine hour)	15.0	15.0	60.0
Assembly (66.67% of direct labor costs)	10.0	10.0	10.0
Unit cost	<u>\$80.0</u>	<u>\$70.0</u>	<u>\$140.0</u>

### Demonstration Problem 3 (Continued from Demonstration Problems 2 and 3)

The cost accountant of ABC Manufacturing attended a workshop on activity-based costing and was impressed by the results. After consulting with the production personnel, he prepared the following information on cost drivers and the estimated volume for each driver.

Activity	Cost driver	Cost driver volume			Total
		Ace	Best	Champ	
Machining					
Setup	Number of setups	125	75	50	250
Machining	Machine hours	2,500	1,500	2,000	6,000
Assembly					
Assembly	Direct labor hours	25,000	15,000	5,000	45,000
Inspection	Number of inspections	50	25	25	100
	<i>Units Produced</i>	<i>25,000</i>	<i>15,000</i>	<i>5,000</i>	

The cost accountant also determined how much overhead costs were incurred in each of the four activities as follows:

Activity	Overhead costs	Rates
Machining		
Setup	\$150,000	$\div 250 \text{ setups} = \$600/\text{setup}$
Machining	750,000	$\div 6,000 \text{ Mths} = \$125/\text{Mth}$
Total Machining department overhead	\$900,000	
Assembly		
Assembly	\$360,000	$\div 45,000 \text{ DLHs} = \$8/\text{DLH}$
Inspection	90,000	$\div 100 \text{ Inspections} = \$900/\text{Inspect}$
Total Assembly department overhead	\$450,000	
Total overhead costs	\$1,350,000	

Required:

1. Determine the cost driver rate for each activity cost pool.
2. Use the activity-based costing method to determine the unit cost for each product.
3. Summarize and comment the results.

Solution:

1.

Activity	Cost drive rate
Machining Setup	\$600 per setup (= \$150,000 ÷ 250 setups)
Machining	\$125 per machine hour (= \$750,000 ÷ 6,000 machine hours)
Assembly	
Assembly	\$8 per direct labor hour (= \$360,000 ÷ 45,000 direct labor hours)
Inspection	\$900 per inspection (= \$90,000 ÷ 100 inspections)

2. In the following table, the total costs are divided by the number of units to arrive at the unit cost for each product.

	Ace	Best	Champ
Direct materials	\$1,000,000	\$450,000	\$275,000
Direct labor	375,000	225,000	75,000
Applied overhead			
Setup (\$600 per setup)	\$75,000	\$45,000	\$30,000
Machining (\$125 per machine hour)	312,500	187,500	250,000
Assembly (\$8 per direct labor hour)	200,000	120,000	40,000
Inspection (\$900 per inspection)	45,000	22,500	22,500
Total overhead costs	\$632,500	\$375,000	\$342,500
Total costs	\$2,007,500	\$1,050,000	\$692,500
Number of units	25,000	15,000	5,000
Unit cost	\$80.3	\$70.0	\$138.5
	80	70	140

Alternatively, the following table shows direct calculation of unit cost for each product based on consumption of the activities for each unit of the products.

	Ace	Best	Champ
Units produced	25,000	15,000	5,000
Number of setups per unit	0.005	0.005	0.01
Machine hours per unit	0.1	0.1	0.4
Direct labor hours per unit	1	1	1
Number of inspections per unit	0.002	0.00167	0.005
Direct materials	\$40.0	\$30.0	\$55.0
Direct labor	15.0	15.0	15.0
Applied overhead			
Setup (\$600 per setup)	3.0	3.0	6.0
Machining (\$125 per machine hour)	12.5	12.5	50.0
Assembly (\$8 per direct labor hour)	8.0	8.0	8.0
Inspection (\$900 per inspection)	1.8	1.5	4.5
Unit cost	\$80.3	\$70.0	\$138.5

3. In summary, a comparison of the methods used to calculate unit cost for each product is presented below.

	Ace	Best	Champ
Plantwide rate based on machine hours	\$77.5	\$67.5	\$160.0
Plantwide rate based on direct labor costs →	85.0	75.0	100.0
Department rates	80.0	70.0	140.0
Activity-based costing	80.3	70.0	138.5

In this series of demonstration problems, both of the plantwide allocation methods distort product costs. Since Champ uses four times as much machine hours as the other two products, it inevitably receives more cost assignment from the plantwide method based on machine hours; the opposite is the case when direct labor costs are used as the allocation base.

The department allocation method and activity-based costing produce comparable numbers that portray consumption of resources closer to reality. Since it is less costly to implement the department allocation method than the activity-based costing method, the managers of ABC Manufacturing should probably use the department allocation method to handle overhead costs in the future.

## Multiple Choice

1. Death spiral

- a. Happens when managers try to set higher prices to recover increasing reported costs.
- b. Occurs when capacity is reduced.
- c. May happen when the market share is gaining.
- d. Has to do with costs ~~other than~~ overhead.

caused by overallocated overhead costs

2. In a two-stage cost allocation system,

- a. The first stage involves assigning overhead costs to cost pools.
- b. The cost pools may be departments.
- c. Each cost pool requires an allocation rate.
- d. All of the above.

3. One of the cost pools at Toylands Store is Personnel department that provides recruiting and training for Sales and Administrative departments and has an estimated overhead of \$45,000. Sales department has 12 employees and Administrative department has 3. How much of the overhead cost of the Personnel department should be allocated to the Sales department?

- a. \$9,000.
- b. \$22,000.
- c. \$36,000.
- d. \$38,000.

$$\frac{45,000}{12+3} = \$3,000 \text{ per employee}$$

x 12 employees = \$36,000 allocated to Sales Dept.

The following information is for questions 4 – 7.

The accountant of Toylands Manufacturing collected the following information:

Activity	Overhead costs	Cost driver	Product X1	Product X2
Machining Dept.				
Setup	\$200,000	Number of setups	200	50
Machining	700,000	Machine hours	20,000	15,000
Packaging Dept.				
Assembly	300,000	Direct labor hours	40,000	60,000
Inspection	180,000	Number of inspections	120	60
Total	1,380,000			

4. If Toylands Manufacturing uses a plantwide rate based on direct labor hours to allocate overhead costs, how much is product X1's share of overhead?

- a. \$324,000.
- b. \$416,000.
- c. \$638,000.
- d. \$552,000.

$$\frac{\text{(Total OH)} \quad \$1,380,000}{\text{(Total DLHs)} \quad (40,000 + 60,000)} = \$13.80 \text{ per DLH}$$

x 40,000 DLHs = \$552,000 for Product X1

5. If the department allocation method is used, what is the overhead rate for the Machining department with machine hours as the allocation base?

- a. \$39.43 per machine hour.
- b. \$13.71 per machine hour.
- c. \$20 per machine hour.
- d. \$25.71 per machine hour.

$$\frac{\text{Total Mach Dept OH} \quad (700,000 + 200,000)}{\text{Total MHs} \quad (20,000 + 15,000)} = \$25.71 \text{ per MH}$$



6. When activity-based costing is used, what is product X2's share of the Packaging department overhead costs?

- a. \$270,000.
- b. \$240,000.
- c. \$580,000.
- d. \$380,000.

$$\frac{\$300,000}{(40,000 + 60,000 \text{ DLHs})} \Rightarrow \$3 \text{ per DLH} \times 60,000 \text{ DLHs} = \$180,000$$

$$\frac{\$180,000}{120 + 60} \Rightarrow \$1,000 \text{ per I} \times 60 \text{ Insp.} = 60,000$$

Total \$240,000

7. When activity-based costing is used, how much of the overhead cost is allocated to product X1?

- a. \$580,000.
- b. \$800,000.
- c. \$950,000.
- d. \$670,000.

Packaging and machining

$$\frac{\$200,000}{200 + 50 \text{ setups}} \Rightarrow \$800/\text{setup} \times 200 \text{ setups} = \$160,000$$

$$\frac{\$700,000}{20,000 + 15,000 \text{ MHS}} \Rightarrow \$20/\text{MH} \times 20,000 \text{ MHS} = \$400,000$$

$$\$3/\text{DLH} \times 40,000 \text{ DLHs} = \$120,000$$

$$\$1,000/\text{I} \times 120 \text{ Insp.} = \$120,000$$

Total \$800,000

8. Which of the following is true of activity-based costing relative to traditional costing?

- a. It requires ~~less~~ detailed cost measures.
- b. Accounting department ~~alone~~ can handle ~~all~~ the work.
- c. It needs more cost pools.
- d. It is ~~less~~ costly to implement.

9. Activity-based costing can be beneficial to

- a. Banks.
- b. Nonprofit organizations.
- c. Law firms
- d. All of the above.

10. Low-volume products, relative to high-volume ones,

- a. Entail ~~less~~ complexity during production.
- b. Often require more machine setups.
- c. Will ~~not~~ disrupt the production flow of high-volume items.
- d. Are usually ~~over~~costed.

11. What are the steps required for activity-based costing in administration?

- a. Identify activities that consume resources. *Stage 1*
- b. Identify cost drivers associated with activities.
- c. Compute activity rate per cost driver. *Stage 2*
- d. All of the above.

12. Which of the following statements is incorrect?

- a. Nowadays, labor is still a major product cost in many companies, especially service organizations. *T*
- b. When the labor component drops, it is prudent to allocate overhead based on direct labor.
- c. When the labor component drops, the overhead rate based on direct labor tends to increase substantially. *T*
- d. When all resources are used proportionally, allocation of overhead based on machine hours is acceptable. *T*

## Answers

1. a LO1

2. d LO2

3. c LO2

$$\frac{\$45,000}{12+3} = \$3,000 \text{ per employees.}$$

$\$3,000 \times 12$  employees at Sales department =  
 $\$36,000$ .

4. d LO2

$$\$200,000 + \$700,000 + \$300,000 + \$180,000 =$$
  
 $\$1,380,000.$

$$\frac{\$1,380,000}{40,000 + 60,000} = \$13.8 \text{ per direct labor hour.}$$

$$\$13.8 \times 40,000 \text{ direct labor hours} = \$552,000.$$

5. d LO2

$$\$700,000 + \$200,000 = \$900,000.$$

$$\frac{\$900,000}{20,000 + 15,000} = \$25.71 \text{ per machine hour.}$$

6. b LO4, LO5

$$\frac{\$300,000}{40,000 + 60,000} = \$3 \text{ per direct labor hour.}$$

$$\frac{\$180,000}{120 + 60} = \$1,000 \text{ per inspection.}$$

$\$3$  per direct labor  $\times 60,000$  direct labor hours +  
 $\$1,000$  per inspection  $\times 60$  inspections =  
 $\$240,000$ .

7. b LO4, LO5

$$\frac{\$200,000}{200 + 50} = \$800 \text{ per setup.}$$

$$\frac{\$700,000}{20,000 + 15,000} = \$20 \text{ per machine hour.}$$

$\$800$  per setup  $\times 200$  setups +  $\$20$  per machine  
hour  $\times 20,000$  machine hours +  $\$3$  per direct labor  
hour  $\times 40,000$  direct labor hours +  $\$1,000$  per  
inspection  $\times 120$  inspections =  $\$800,000$ .

8. c LO6

9. d LO8

10. b LO7

11. d LO8

12. b LO7