

Chapter 4

Systems Design: Process Costing

Solutions to Questions

4-1 A process costing system should be used in situations where a homogeneous product is produced on a continuous basis.

4-2

1. Job-order costing and process costing have the same basic purposes—to assign materials, labor, and overhead cost to products and to provide a mechanism for computing unit product costs.
2. Both systems use the same basic manufacturing accounts.
3. Costs flow through the accounts in basically the same way in both systems.

4-3 Cost accumulation is simpler under process costing because costs only need to be assigned to departments—not separate jobs. A company usually has a small number of processing departments, whereas a job-order costing system often must keep track of the costs of hundreds or even thousands of jobs.

4-4 In a process costing system, a Work in Process account is maintained for each separate processing department.

4-5 The journal entry would be:
Work in Process, Firing XXXX
 Work in Process, Mixing. XXXX

4-6 The costs that might be added in the Firing Department include: (1) costs transferred in from the Mixing Department; (2) materials costs added in the Firing Department; (3) labor costs added in the Firing Department; and (4) overhead costs added in the Firing Department.

4-7 Under the weighted-average method, equivalent units of production consist of units transferred to the next department (or to finished goods) during the period plus the equivalent units in the department's ending work in process inventory.

4-8 The company will want to distinguish between the costs of the metals used to make the medallions, but the medals are otherwise identical and go through the same production processes. Thus, operation costing is ideally suited for the company's needs.

4-9 Under the weighted-average method, each unit transferred out of the department is counted as one equivalent unit—regardless of in what period the work was done to complete the units. Under the FIFO method, only the work done in the current period is counted. Units transferred out are divided into two parts. One part consists of the units in the beginning inventory. Only the work needed *to complete* these units is shown as part of the equivalent units for the current period. The other part of the units transferred out consists of the units *started and completed* during the current period.

4-10 The weighted-average method mixes costs from the current period with costs from the prior period. Thus, under the weighted-average method, the department's apparent performance in the current period is influenced to some extent by what happened in a prior period. In contrast, the FIFO method cleanly separates the costs and work of the current period from those of the prior period. This makes the FIFO method superior to the weighted-average method for cost control because current performance should be measured in relation to costs of the current period only.

4-11 Operating departments are the units in an organization within which the central purposes of the organization are carried out; these

departments usually generate revenue. By contrast, service departments provide support or assistance to the operating departments. Examples of service departments include laundry services in a hotel or hospital, internal auditing, airport maintenance services (ground crews), cafeteria, personnel, cost accounting, and so on.

4-12 Service department costs are allocated to products and services in two stages. Service department costs are first allocated to the operating departments. These allocated costs are then included in the operating departments' overhead rates, which are used to cost products and services.

4-13 Interdepartmental services exist whenever two service departments provide services to each other.

4-14 Under the direct method, interdepartmental services are ignored; service department costs are allocated directly to operating departments.

4-15 Under the step-down method, the costs of the service department performing the greatest amount of service for the other service departments are allocated first, the costs of the service department performing the next greatest amount of service are allocated next, and so forth through all the service departments. Once a service department's costs have been allocated, costs are not reallocated back to it under the step-down method.

Exercise 4-2 (10 minutes)

Weighted-Average Method

	<i>Equivalent Units</i>	
	<i>Materials</i>	<i>Conversion</i>
Units transferred to the next department	410,000	410,000
Ending work in process:		
Materials: 30,000 units × 70% complete	21,000	
Conversion: 30,000 units × 50% complete ..		<u>15,000</u>
Equivalent units of production	<u>431,000</u>	<u>425,000</u>

Exercise 4-3 (10 minutes)

Weighted-Average Method

	<i>Materials</i>	<i>Labor</i>	<i>Overhead</i>	<i>Total</i>
Work in process, May 1.....	\$ 14,550	\$23,620	\$118,100	
Cost added during May	<u>88,350</u>	<u>14,330</u>	<u>71,650</u>	
Total cost (a)	<u>\$102,900</u>	<u>\$37,950</u>	<u>\$189,750</u>	
Equivalent units of production (b)	1,200	1,100	1,100	
Cost per equivalent unit (a) ÷ (b)	\$85.75	\$34.50	\$172.50	\$292.75

Exercise 4-4 (10 minutes)

Weighted-Average Method

	<i>Materials</i>	<i>Conversion</i>	<i>Total</i>
<i>Ending work in process inventory:</i>			
Equivalent units of production	300	100	
Cost per equivalent unit	\$31.56	\$9.32	
Cost of ending work in process inventory .	\$9,468	\$932	\$10,400
<i>Units completed and transferred out:</i>			
Units transferred to the next department..	1,300	1,300	
Cost per equivalent unit	\$31.56	\$9.32	
Cost of units completed and transferred out	\$41,028	\$12,116	\$53,144

Exercise 4-8 (15 minutes)

	<u>Service Departments</u>		<u>Operating Departments</u>		
	<i>Admini- stration</i>	<i>Physical Plant Services</i>	<i>Undergraduate Programs</i>	<i>Graduate Programs</i>	<i>Total</i>
Departmental costs before allocations	\$2,070,000	\$720,000	\$23,650,000	\$2,980,000	<u>\$29,420,000</u>
Allocations:					
Administration costs (40/45, 5/45).....	(2,070,000)		1,840,000	230,000	
Physical Plant costs (250/300, 50/300)*		<u>(720,000)</u>	<u>600,000</u>	<u>120,000</u>	
Total costs after allocation .	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$26,090,000</u>	<u>\$3,330,000</u>	<u>\$29,420,000</u>

*Based on the space occupied by the two operating departments, which is 300,000 square feet.

Exercise 4-9 (15 minutes)

	<i>Service Departments</i>		<i>Operating Departments</i>		
	<i>Admini- stration</i>	<i>Building Services</i>	<i>Groceries</i>	<i>Coffee Shop</i>	<i>Total</i>
Departmental costs before allocations ..	\$200,000	\$60,000	\$3,860,000	\$340,000	<u>\$4,460,000</u>
Allocations:					
Administration costs (320/3,200, 2,720/3,200, 160/3,200)*	(200,000)	20,000	170,000	10,000	
Building Services costs (9,500/10,000, 500/10,000)†		(80,000)	76,000	4,000	
Total costs after allocation	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$4,106,000</u>	<u>\$354,000</u>	<u>\$4,460,000</u>

*Based on employee hours in the other three departments, $320 + 2,720 + 160 = 3,200$.

†Based on space occupied by the two operating departments, $9,500 + 500 = 10,000$.

Both the Building Services Department costs of \$60,000 and the Administration costs of \$20,000 that have been allocated to the Building Services Department are allocated to the two operating departments.

Exercise 4-11 (20 minutes)

Weighted-Average Method

1.	<i>Materials</i>	<i>Labor</i>	<i>Overhead</i>
Units transferred to the next department.....	790,000	790,000	790,000
Ending work in process:			
Materials: 50,000 units × 60% complete	<u>30,000</u>		
Labor: 50,000 units × 20% complete		<u>10,000</u>	
Overhead: 50,000 units × 20% complete			<u>10,000</u>
Equivalent units of production	<u>820,000</u>	<u>800,000</u>	<u>800,000</u>
2.	<i>Materials</i>	<i>Labor</i>	<i>Overhead</i>
Cost of beginning work in process	\$ 68,600	\$ 30,000	\$ 48,000
Costs added during the period	<u>907,200</u>	<u>370,000</u>	<u>592,000</u>
Total cost (a).....	<u>\$975,800</u>	<u>\$400,000</u>	<u>\$640,000</u>
Equivalent units of production (b)	820,000	800,000	800,000
Cost per equivalent unit (a) ÷ (b).....	\$1.19	\$0.50	\$0.80

Exercise 4-14 (10 minutes)
 Weighted-Average Method

	<i>Materials</i>	<i>Labor & Overhead</i>
Pounds transferred to the Packing Department during May	490,000	490,000
Work in process, May 31:		
Materials: 20,000 pounds × 100% complete	<u>20,000</u>	
Labor and overhead: 20,000 pounds × 90% complete		<u>18,000</u>
Equivalent units of production	<u>510,000</u>	<u>508,000</u>

Problem 4-19 (45 minutes)

Weighted-Average Method

1. Equivalent Units of Production

	<i>Materials</i>	<i>Conversion</i>
Transferred to next department.....	450,000	450,000
Ending work in process:		
Materials: 80,000 units x 75% complete	<u>60,000</u>	
Conversion: 80,000 units x 25% complete		<u>20,000</u>
Equivalent units of production.....	<u>510,000</u>	<u>470,000</u>

2. Cost per Equivalent Unit

	<i>Materials</i>	<i>Conversion</i>
Cost of beginning work in process	\$ 36,550	\$ 13,500
Cost added during the period.....	<u>391,850</u>	<u>287,300</u>
Total cost (a)	<u>\$428,400</u>	<u>\$300,800</u>
Equivalent units of production (b)	510,000	470,000
Cost per equivalent unit, (a) ÷ (b)	\$0.84	\$0.64

3. Applying Costs to Units

	<i>Materials</i>	<i>Conversion</i>	<i>Total</i>
Ending work in process inventory:			
Equivalent units of production			
(materials: 80,000 units x 75%			
complete; conversion: 80,000			
units x 25% complete)	60,000	20,000	
Cost per equivalent unit	\$0.84	\$0.64	
Cost of ending work in process	\$50,400	\$12,800	\$63,200

inventory			
Units completed and transferred out:			
Units transferred to the next			
department	450,000	450,000	
Cost per equivalent unit	\$0.84	\$0.64	
Cost of units completed and			
transferred out	\$378,000	\$288,000	\$666,000

Problem 4-19 (continued)

4. Cost Reconciliation

Costs to be accounted for:

Cost of beginning work in process inventory (\$36,500 + \$13,500)	\$ 50,050
Costs added to production during the period (\$391,850 + \$287,300)	<u>679,150</u>
Total cost to be accounted for.....	<u><u>\$729,200</u></u>

Costs accounted for as follows:

Cost of ending work in process inventory.....	\$ 63,200
Cost of units completed and transferred out..	<u>666,000</u>
Total cost accounted for	<u><u>\$729,200</u></u>

Problem 4-21 (45 minutes)**Weighted-Average Method****1. Equivalent Units of Production**

	<i>Materials</i>	<i>Conversion</i>
Transferred to next department*	380,000	380,000
Ending work in process:		
Materials: 40,000 units x 75% complete	<u>30,000</u>	
Conversion: 40,000 units x 25% complete		<u>10,000</u>
Equivalent units of production	<u>410,000</u>	<u>390,000</u>

*Units transferred to the next department = Units in beginning work in process + Units started into production – Units in ending work in process = 70,000 + 350,000 – 40,000 = 380,000

2. Cost per Equivalent Unit

	<i>Materials</i>	<i>Conversion</i>
Cost of beginning work in process	\$ 86,000	\$ 36,000
Cost added during the period	<u>447,000</u>	<u>198,000</u>
Total cost (a)	\$533,000	\$234,000
Equivalent units of production (b)	410,000	390,000
Cost per equivalent unit, (a) ÷ (b)	\$1.30	\$0.60

3. Cost of Ending Work in Process Inventory and Units Transferred Out

	<i>Materials</i>	<i>Conversion</i>	<i>Total</i>
Ending work in process inventory:			
Equivalent units of production			
(materials: 40,000 units x 75%			
complete; conversion: 40,000			
units x 25% complete)	30,000	10,000	

Cost per equivalent unit	\$1.30	\$0.60	
Cost of ending work in process inventory	\$39,000	\$6,000	\$45,000
Units completed and transferred out:			
Units transferred to the next department	380,000	380,000	
Cost per equivalent unit	\$1.30	\$0.60	
Cost of units completed and transferred out	\$494,000	\$228,000	\$722,000

Problem 4-21 (continued)

4. Cost Reconciliation

Costs to be accounted for:

Cost of beginning work in process inventory (\$86,000 + \$36,000)	\$122,000
Costs added to production during the period (\$447,000 + \$198,000)	<u>645,000</u>
Total cost to be accounted for.....	<u><u>\$767,000</u></u>

Costs accounted for as follows:

Cost of ending work in process inventory.....	\$ 45,000
Cost of units completed and transferred out..	<u>722,000</u>
Total cost accounted for	<u><u>\$767,000</u></u>

Problem 4-23 (45 minutes)

	<i>Food Services</i>	<i>Admin. Services</i>	<i>X-Ray Services</i>	<i>Out- patient Clinic</i>	<i>OB Care</i>	<i>General Hospital</i>
Variable costs.....	\$73,150	\$ 6,800	\$38,100	\$11,700	\$ 14,850	\$ 53,400
Food Services allocation:						
\$1.90 per meal × 1,000 meals	(1,900)	1,900				
\$1.90 per meal × 500 meals	(950)		950			
\$1.90 per meal × 7,000 meals.....	(13,300)			0	13,300	
\$1.90 per meal × 30,000 meals.....	(57,000)					57,000
Admin. Services allocation:						
\$0.50 per file × 1,500 files.....		(750)	750			
\$0.50 per file × 3,000 files.....		(1,500)		1,500		
\$0.50 per file × 900 files.....		(450)			450	
\$0.50 per file × 12,000 files.....		(6,000)				6,000
X-Ray Services allocation:						
\$4 per X-ray × 1,200 X-rays			(4,800)	4,800		
\$4 per X-ray × 350 X-rays			(1,400)		1,400	
\$4 per X-ray × 8,400 X-rays			(33,600)			33,600
Total variable costs.....	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$18,000</u>	<u>\$ 30,000</u>	<u>\$150,000</u>

Problem 4-23 (continued)

	<i>Food Services</i>	<i>Admin. Services</i>	<i>X-Ray Services</i>	<i>Out- patient Clinic</i>	<i>OB Care</i>	<i>General Hospital</i>
Fixed costs.....	\$48,000	\$33,040	\$59,520	\$26,958	\$ 99,738	\$344,744
Food Services allocation:						
2% × \$48,000	(960)	960				
1% × \$48,000	(480)		480			
17% × \$48,000	(8,160)			0	8,160	
80% × \$48,000	(38,400)					38,400
Admin. Services allocation:						
10% × \$34,000		(3,400)	3,400			
20% × \$34,000		(6,800)		6,800		
30% × \$34,000		(10,200)			10,200	
40% × \$34,000		(13,600)				13,600
X-Ray Services allocation:						
13% × \$63,400			(8,242)	8,242		
3% × \$63,400			(1,902)		1,902	
84% × \$63,400			(53,256)			53,256
Total fixed costs	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$42,000</u>	<u>\$120,000</u>	<u>\$450,000</u>
Total overhead costs	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$60,000</u>	<u>\$150,000</u>	<u>\$600,000</u>

Problem 4-23 (continued)

Computation of allocation rates:

Variable Food Services:

$$\frac{\text{Variable food service cost}}{\text{Total meals served}} = \frac{\$73,150}{38,500 \text{ meals}} = \$1.90 \text{ per meal}$$

Variable Admin. Services:

$$\frac{\text{Variable administrative cost}}{\text{Files processed}} = \frac{\$6,800 + \$1,900}{17,400 \text{ files}} = \$0.50 \text{ per file}$$

Variable X-Ray Services:

$$\frac{\text{Variable X-ray cost}}{\text{X-rays taken}} = \frac{\$38,100 + \$950 + \$750}{9,950 \text{ X-rays}} = \$4.00 \text{ per X-ray}$$