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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 Job-order and processing costing are similar in the following ways:

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 individual 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 processing department.

4-5 The journal entry to record the transfer of work in process from the Mixing Department to the Firing Department is:

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.

Exercise 4-1 (20 minutes)

a. To record issuing raw materials for use in production:		
Work in Process—Molding Department.....	23,000	
Work in Process—Firing Department.....	8,000	
Raw Materials.....		31,000
b. To record direct labor costs incurred:		
Work in Process—Molding Department.....	12,000	
Work in Process—Firing Department.....	7,000	
Wages Payable.....		19,000
c. To record applying manufacturing overhead:		
Work in Process—Molding Department.....	25,000	
Work in Process—Firing Department.....	37,000	
Manufacturing Overhead.....		62,000
d. To record transfer of unfired, molded bricks from the Molding Department to the Firing Department:		
Work in Process—Firing Department.....	57,000	
Work in Process—Molding Department. .		57,000
e. To record transfer of finished bricks from the Firing Department to the finished bricks warehouse:		
Finished Goods.....	103,000	
Work in Process—Firing Department.....		103,000
f. To record cost of goods sold:		
Cost of Goods Sold.....	101,000	
Finished Goods.....		101,000

Exercise 4-2 (10 minutes)

Weighted-Average Method

	<u>Equivalent Units (EU)</u>	
	<u>Materials</u>	<u>Conversion</u>
Units transferred out.....	190,000	190,000
Work in process, ending:		
15,000 units × 80%.....	12,000	
15,000 units × 40%.....		<u>6,000</u>
Equivalent units of production.....	<u>202,000</u>	<u>196,000</u>

Exercise 4-3 (10 minutes)

Weighted-Average Method

1.

	<i>Materials</i>	<i>Labor</i>	<i>Overhead</i>
Cost of beginning work in process inventory.....	\$ 18,000	\$ 5,500	\$ 27,500
Cost added during the period.....	<u>238,900</u>	<u>80,300</u>	<u>401,500</u>
Total cost (a).....	<u>\$256,900</u>	<u>\$85,800</u>	<u>\$429,000</u>
Equivalent units of production (b)...	35,000	33,000	33,000
Cost per equivalent unit (a) ÷ (b)....	\$7.34	\$2.60	\$13.00

2.

Cost per equivalent unit for materials.....	\$ 7.34
Cost per equivalent unit for labor.....	2.60
Cost per equivalent unit for overhead.....	<u>13.00</u>
Total cost per equivalent unit.....	<u>\$22.94</u>

Exercise 4-4 (10 minutes)

	<i>Material s</i>	<i>Conversio n</i>	<i>Total</i>
<i>Ending work in process inventory:</i>			
Equivalent units of production.....	2,000	800	
Cost per equivalent unit.....	\$13.86	\$4.43	
Cost of ending work in process inventory.....	\$27,720	\$3,544	\$31,264
<i>Units completed and transferred out:</i>			
Units transferred to the next department.....	20,100	20,100	
Cost per equivalent unit.....	\$13.86	\$4.43	
Cost of units transferred out.....	\$278,586	\$89,043	\$367,629

Exercise 4-5 (10 minutes)

Baking Department
Cost Reconciliation

Costs to be accounted for:

Cost of beginning work in process inventory. .	\$ 3,570
Costs added to production during the period..	<u>43,120</u>
Total cost to be accounted for.....	<u>\$46,690</u>

Costs accounted for as follows:

Cost of ending work in process inventory.....	\$ 2,860	
Cost of units completed and transferred out...	<u>43,830</u>	*
Total cost accounted for.....	<u>\$46,690</u>	

*The cost of units completed and transferred out can be deduced as follows:

Cost of beginning work in process + inventory	Costs added to production during the period	=	Cost of ending work in process + inventory	Cost of units completed and transferred out
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$$\begin{array}{rcl} \$3,570 + \$43,120 & = & \$2,860 + \text{Cost of units} \\ & & \text{completed and} \\ & & \text{transferred out} \end{array}$$

$$\begin{array}{rcl} \text{Cost of units} \\ \text{completed and} & = & \$3,570 + \$43,120 - \$2,860 \\ \text{transferred out} \end{array}$$

$$\begin{array}{rcl} \text{Cost of units} \\ \text{completed and} & = & \$43,830 \\ \text{transferred out} \end{array}$$

Exercise 4-6 (10 minutes)

Work in Process—Cooking.....	42,000	
Raw Materials Inventory.....		42,000
Work in Process—Cooking.....	50,000	
Work in Process—Molding.....	36,000	
Wages Payable.....		86,000
Work in Process—Cooking.....	75,000	
Work in Process—Molding.....	45,000	
Manufacturing Overhead.....		120,000
Work in Process—Molding.....	160,000	
Work in Process—Cooking.....		160,000
Finished Goods.....	240,000	
Work in Process—Molding.....		240,000

Exercise 4-7 (10 minutes)

Weighted-Average Method

1.		<i>Tons of Pulp</i>	
	Work in process, June 1.....		20,000
	Started into production during the month.....		<u>190,000</u>
	Total tons in process.....		210,000
	Deduct work in process, June 30.....		<u>30,000</u>
	Completed and transferred out during the month.....		<u>180,000</u>
2.		<i>Equivalent Units (EU)</i>	
		<i>Materials</i>	<i>Labor and Overhead</i>
	Units transferred out.....	180,000	180,000
	Work in process, ending:		
	Materials: 30,000 tons × 60% complete...	18,000	
	Labor and overhead:		
	30,000 tons × 40% complete.....		<u>12,000</u>
	Equivalent units of production.....	<u>198,000</u>	<u>192,000</u>

Exercise 4-8 (15 minutes)

Weighted-Average Method

1.	<i>Materials</i>	<i>Labor</i>	<i>Overhead</i>
Units transferred to the next department.....	42,000	42,000	42,000
Work in process, ending:			
Materials:			
8,000 units × 75% complete.....	6,000		
Labor and overhead:			
8,000 units × 50% complete.....		<u>4,000</u>	<u>4,000</u>
Equivalent units of production.....	<u>48,000</u>	<u>46,000</u>	<u>46,000</u>
2.	<i>Materials</i>	<i>Labor</i>	<i>Overhead</i>
Cost of beginning work in process....	\$ 4,320	\$ 1,040	\$ 1,790
Cost added during the period.....	<u>52,800</u>	<u>21,500</u>	<u>32,250</u>
Total cost (a).....	<u>\$57,120</u>	<u>\$22,540</u>	<u>\$34,040</u>
Equivalent units of production (b).....	48,000	46,000	46,000
Cost per equivalent unit (a) ÷ (b).....	\$1.19	\$0.49	\$0.74

Exercise 4-9 (30 minutes)

Weighted-Average Method

	<i>Material s</i>	<i>Conversio n</i>	
1.			
Units transferred to the next production department.....	175,000	175,000	
Ending work in process:			
Materials: 10,000 units × 100% complete.....	10,000		
Conversion: 10,000 units × 30% complete....		<u>3,000</u>	
Equivalent units of production.....	<u>185,000</u>	<u>178,000</u>	
2.	<i>Material s</i>	<i>Conversio n</i>	
Cost of beginning work in process.....	\$ 1,500	\$ 4,000	
Cost added during the period.....	<u>54,000</u>	<u>352,000</u>	
Total cost (a).....	<u>\$55,500</u>	<u>\$356,000</u>	
Equivalent units of production (b).....	185,000	178,000	
Cost per equivalent unit (a) ÷ (b).....	\$0.30	\$2.00	
3.	<i>Materials</i>	<i>Conversio n</i>	<i>Total</i>
<i>Ending work in process inventory:</i>			
Equivalent units of production (see above).....	10,000	3,000	
Cost per equivalent unit (see above).....	\$0.30	\$2.00	
Cost of ending work in process inventory.....	\$3,000	\$6,000	\$9,000
<i>Units completed and transferred out:</i>			
Units transferred to the next department.....	175,000	175,000	
Cost per equivalent unit (see above).....	\$0.30	\$2.00	
Cost of units completed and transferred out.....	\$52,500	\$350,000	\$402,500

Exercise 4-10 (30 minutes)

Weighted-Average Method

1. Equivalent units of production

	<i>Pulping</i>	<i>Conversion</i>
		<i>n</i>
Transferred to next department.....	157,000	157,000
Ending work in process:		
Pulping: 8,000 units x 100% complete.....	<u>8,000</u>	
Conversion: 8,000 units x 25% complete.....		<u>2,000</u>
Equivalent units of production.....	<u>165,000</u>	<u>159,000</u>

2. Cost per equivalent unit

	<i>Pulping</i>	<i>Conversion</i>
		<i>n</i>
Cost of beginning work in process.....	\$ 4,800	\$ 500
Cost added during the period.....	<u>102,450</u>	<u>31,300</u>
Total cost (a).....	\$107,250	\$31,800
Equivalent units of production (b).....	165,000	159,000
Cost per equivalent unit, (a) ÷ (b).....	\$0.65	\$0.20

3. Cost of ending work in process inventory and units transferred out

	<i>Pulping</i>	<i>Conversion</i>	<i>Total</i>
		<i>n</i>	
Ending work in process inventory:			
Equivalent units of production...	8,000	2,000	
Cost per equivalent unit.....	\$0.65	\$0.20	
Cost of ending work in process inventory.....	\$5,200	\$400	\$5,600
Units completed and transferred out:			
Units transferred to the next department.....	157,000	157,000	
Cost per equivalent unit.....	\$0.65	\$0.20	
Cost of units completed and transferred out.....	\$102,050	\$31,400	\$133,450

Exercise 4-10 (continued)

4. Cost reconciliation

Costs to be accounted for:

Cost of beginning work in process inventory (\$4,800 + \$500).....	\$ 5,300
Costs added to production during the period (\$102,450 + \$31,300).....	<u>133,750</u>
Total cost to be accounted for.....	<u>\$139,050</u>

Costs accounted for as follows:

Cost of ending work in process inventory.....	\$ 5,600
Cost of units completed and transferred out...	<u>133,450</u>
Total cost accounted for.....	<u>\$139,050</u>

Exercise 4-11 (20 minutes)

Weighted-Average Method

1. Computation of equivalent units in ending inventory:

	<i>Materials</i>	<i>Labor</i>	<i>Overhead</i>
Units in ending inventory.....	3,000	3,000	3,000
Percent completed.....	80%	60%	60%
Equivalent units of production...	2,400	1,800	1,800

2. Cost of ending work in process inventory and units transferred out:

	<i>Materials</i>	<i>Labor</i>	<i>Overhead</i>	<i>Total</i>
Ending work in process inventory:				
Equivalent units of production.....	2,400	1,800	1,800	
Cost per equivalent unit.	\$12.50	\$3.20	\$6.40	
Cost of ending work in process inventory.....	\$30,000	\$5,760	\$11,520	\$47,280
Units completed and transferred out:				
Units transferred to the next department.....	25,000	25,000	25,000	
Cost per equivalent unit.	\$12.50	\$3.20	\$6.40	
Cost of units completed and transferred out.....	\$312,500	\$80,000	\$160,000	\$552,500

3. Cost reconciliation:

Total cost to be accounted for.....	<u>\$599,780</u>
Costs accounted for as follows:	
Cost of ending work in process inventory.....	\$ 47,280
Cost of units completed and transferred out...	<u>552,500</u>
Total cost accounted for.....	<u>\$599,780</u>

Exercise 4-12 (10 minutes)

Weighted-Average Method

	<i>Material s</i>	<i>Labor & Overhead</i>
Pounds transferred to the Packing Department during July*	375,000	375,000
Work in process, July 31:		
Materials: 25,000 pounds × 100% complete	<u>25,000</u>	
Labor and overhead:		
25,000 pounds × 60% complete		<u>15,000</u>
Equivalent units of production	<u>400,000</u>	<u>390,000</u>

* $20,000 + 380,000 - 25,000 = 375,000$

Problem 4-13 (45 minutes)

Weighted-Average Method

1. Equivalent units of production:

	<i>Material s</i>	<i>Conversio n</i>
Transferred to next department.....	160,000	160,000
Ending work in process:		
Materials: 40,000 units x 100% complete.....	<u>40,000</u>	
Conversion: 40,000 units x 25% complete.....		<u>10,000</u>
Equivalent units of production.....	<u>200,000</u>	<u>170,000</u>

2. Cost per Equivalent Unit

	<i>Materials</i>	<i>Conversio n</i>
Cost of beginning work in process.....	\$ 25,200	\$ 24,800
Cost added during the period.....	<u>334,800</u>	<u>238,700</u>
Total cost (a).....	<u>\$360,000</u>	<u>\$263,500</u>
Equivalent units of production (b).....	200,000	170,000
Cost per equivalent unit, (a) ÷ (b).....	\$1.80	\$1.55

3. Applying costs to units:

	<i>Materials</i>	<i>Conversio n</i>	<i>Total</i>
Ending work in process inventory:			
Equivalent units of production	40,000	10,000	
Cost per equivalent unit.....	\$1.80	\$1.55	
Cost of ending work in process inventory.....	\$72,000	\$15,500	\$87,500
Units completed and transferred out:			
Units transferred to the next department.....	160,000	160,000	
Cost per equivalent unit.....	\$1.80	\$1.55	
Cost of units completed and transferred out.....	\$288,000	\$248,000	\$536,000

Problem 4-13 (continued)

4. Cost reconciliation:

Costs to be accounted for:

Cost of beginning work in process inventory (\$25,200 + \$24,800).....	\$ 50,000
Costs added to production during the period (\$334,800 + \$238,700).....	<u>573,500</u>
Total cost to be accounted for.....	<u>\$623,500</u>

Costs accounted for as follows:

Cost of ending work in process inventory.....	\$ 87,500
Cost of units completed and transferred out...	<u>536,000</u>
Total cost accounted for.....	<u>\$623,500</u>

Problem 4-14 (45 minutes)

Weighted-Average Method

1. Equivalent units of production

	<i>Material</i> <i>s</i>	<i>Conversio</i> <i>n</i>
Transferred to next department*.....	95,000	95,000
Ending work in process:		
Materials: 15,000 units x 60% complete.....	<u>9,000</u>	
Conversion: 15,000 units x 20% complete.....		<u>3,000</u>
Equivalent units of production.....	<u>104,000</u>	<u>98,000</u>

*Units transferred to the next department = Units in beginning work in process + Units started into production – Units in ending work in process
= 10,000 + 100,000 – 15,000 = 95,000

2. Cost per equivalent unit

	<i>Materials</i>	<i>Conversio</i> <i>n</i>
Cost of beginning work in process.....	\$ 1,500	\$ 7,200
Cost added during the period.....	<u>154,500</u>	<u>90,800</u>
Total cost (a).....	\$156,000	\$98,000
Equivalent units of production (b).....	104,000	98,000
Cost per equivalent unit, (a) ÷ (b).....	\$1.50	\$1.00

3. Cost of ending work in process inventory and units transferred out

	<i>Materials</i>	<i>Conversio</i> <i>n</i>	<i>Total</i>
Ending work in process inventory:			
Equivalent units of production...	9,000	3,000	
Cost per equivalent unit.....	\$1.50	\$1.00	
Cost of ending work in process inventory.....	\$13,500	\$3,000	\$16,500
Units completed and transferred out:			
Units transferred to the next department.....	95,000	95,000	
Cost per equivalent unit.....	\$1.50	\$1.00	
Cost of units completed and transferred out.....	\$142,500	\$95,000	\$237,500

Problem 4-14 (continued)

4. Cost Reconciliation

Costs to be accounted for:

Cost of beginning work in process inventory (\$1,500 + \$7,200).....	\$ 8,700
Costs added to production during the period (\$154,500 + \$90,800).....	<u>245,300</u>
Total cost to be accounted for.....	<u>\$254,000</u>

Costs accounted for as follows:

Cost of ending work in process inventory.....	\$ 16,500
Cost of units completed and transferred out...	<u>237,500</u>
Total cost accounted for.....	<u>\$254,000</u>

Problem 4-15 (60 minutes)

Weighted-Average Method

1. Computation of equivalent units in ending inventory:

	<i>Mixing</i>	<i>Materials</i>	<i>Conversion</i>
			<i>n</i>
Units transferred to the next department.....	50.0	50.0	50.0
Ending work in process:			
Mixing: 1 unit × 100% complete.....	<u>1.0</u>		
Materials: 1 unit × 80% complete.....		<u>0.8</u>	
Conversion: 1 unit × 70% complete.....			<u>0.7</u>
Equivalent units of production.....	<u>51.0</u>	<u>50.8</u>	<u>50.7</u>

2. Costs per equivalent unit:

	<i>Mixing</i>	<i>Materials</i>	<i>Conversion</i>
			<i>n</i>
Cost of beginning work in process inventory....	\$ 1,670	\$ 90	\$ 605
Cost added during the period.....	<u>81,460</u>	<u>6,006</u>	<u>42,490</u>
Total cost.....	\$83,130	\$6,096	\$43,095
Equivalent units of production.....	51.0	50.8	50.7
Cost per equivalent unit.....	\$1,630	\$120	\$850

Problem 4-15 (continued)

3. Costs of ending work in process inventory and units transferred out:

	<i>Mixing</i>	<i>Materials</i>	<i>Conversion</i>	<i>Total</i>
Ending work in process inventory:				
Equivalent units of production.....	1.0	0.8	0.7	
Cost per equivalent unit.....	\$1,630	\$120	\$850	
Cost of ending work in process inventory....	\$1,630	\$96	\$595	\$2,321
Units completed and transferred out:				
Units transferred to the next department.....	50.0	50.0	50.0	
Cost per equivalent unit.....	\$1,630	\$120	\$850	
Cost of units transferred out.....	\$81,500	\$6,000	\$42,500	\$130,000

4. Cost reconciliation:

Cost to be accounted for:

Cost of beginning work in process inventory (\$1,670 + \$90 + \$605).....	\$ 2,365
Cost added to production during the period (\$81,460 + \$6,006 + \$42,490).....	<u>129,956</u>
Total cost to be accounted for.....	<u>\$132,321</u>

Costs accounted for as follows:

Cost of ending work in process inventory.....	\$ 2,321
Cost of units transferred out.....	<u>130,000</u>
Total cost accounted for.....	<u>\$132,321</u>

Problem 4-17 (45 minutes)

Weighted-Average Method

1. Equivalent units of production

	<i>Material s</i>	<i>Conversio n</i>
Transferred to next department*.....	170,000	170,000
Ending work in process:		
Materials: 15,000 units x 100% complete.....	<u>15,000</u>	
Conversion: 15,000 units x 60% complete.....		<u>9,000</u>
Equivalent units of production.....	<u>185,000</u>	<u>179,000</u>

*Units transferred to the next department = Units in beginning work in process + Units started into production – Units in ending work in process
= 18,000 + 167,000 – 15,000 = 170,000

2. Cost per equivalent unit

	<i>Materials</i>	<i>Conversio n</i>
Cost of beginning work in process.....	\$ 14,600	\$ 7,200
Cost added during the period.....	<u>133,400</u>	<u>225,500</u>
Total cost (a).....	\$148,000	\$232,700
Equivalent units of production (b).....	185,000	179,000
Cost per equivalent unit, (a) ÷ (b).....	\$0.80	\$1.30

3. Cost of ending work in process inventory and units transferred out

	<i>Materials</i>	<i>Conversio n</i>	<i>Total</i>
Ending work in process inventory:			
Equivalent units of production...	15,000	9,000	
Cost per equivalent unit.....	\$0.80	\$1.30	
Cost of ending work in process inventory.....	\$12,000	\$11,700	\$23,700
Units completed and transferred out:			
Units transferred to the next department.....	170,000	170,000	
Cost per equivalent unit.....	\$0.80	\$1.30	
Cost of units completed and transferred out.....	\$136,000	\$221,000	\$357,000

Problem 4-18 (45 minutes)

Weighted-Average Method

1. a.	Work in Process—Refining Department.....	495,000	
	Work in Process—Blending Department.....	115,000	
	Raw Materials.....		610,000
b.	Work in Process—Refining Department.....	72,000	
	Work in Process—Blending Department.....	18,000	
	Salaries and Wages Payable.....		90,000
c.	Manufacturing Overhead.....	225,000	
	Accounts Payable.....		225,000
d.	Work in Process—Refining Department.....	181,000	
	Manufacturing Overhead.....		181,000
d.	Work in Process—Blending Department.....	42,000	
	Manufacturing Overhead.....		42,000
e.	Work in Process—Blending Department.....	740,000	
	Work in Process—Refining Department..		740,000
f.	Finished Goods.....	950,000	
	Work in Process—Blending Department.		950,000
g.	Accounts Receivable.....	1,500,000	
	Sales.....		1,500,000
	Cost of Goods Sold.....	900,000	
	Finished Goods.....		900,000

Problem 4-18 (continued)

2.

Accounts Receivable		Raw Materials		
(g)	1,500,000	Bal.	618,000	
		(a)	610,000	
		Bal.	8,000	
Work in Process Refining Department		Work in Process Blending Department		
Bal.	38,000	(e)	740,000	
(a)	495,000	Bal.	65,000	
(b)	72,000	(f)	950,000	
(d)	181,000	(a)	115,000	
Bal.	46,000	(b)	18,000	
		(d)	42,000	
		(e)	740,000	
		Bal.	30,000	
Finished Goods		Manufacturing Overhead		
Bal.	20,000	(c)	225,000	
(f)	950,000	(d)	223,000	
Bal.	70,000	Bal.	2,000	
Accounts Payable		Salaries and Wages Payable		
	(c)	225,000	(b)	90,000
Sales		Cost of Goods Sold		
	(g)	1,500,000	(g)	900,000

Case 4-19 (45 minutes)

Weighted-Average Method

1. The revised computations follow:

Equivalent Units of Production:

	<i>Transferred In Costs</i>	<i>Materials</i>	<i>Conversion</i>
Transferred to finished goods.....	1,800	1,800	1,800
Ending work in process:			
Transferred in costs: 600 units x 100% complete.....	<u>600</u>		
Materials: 600 units x 0% complete.....		<u>0</u>	
Conversion: 600 units x 35% complete.....			<u>210</u>
Equivalent units of production.....	<u>2,400</u>	<u>1,800</u>	<u>2,010</u>

Cost per Equivalent Unit:

	<i>Transferred In Costs</i>	<i>Materials</i>	<i>Conversion</i>
Cost of beginning work in process.....	\$ 4,068	\$1,980	\$ 2,160
Cost added during the period.....	<u>17,940</u>	<u>6,210</u>	<u>13,920</u>
Total cost (a).....	\$22,008	\$8,190	\$16,080
Equivalent units of production (b).....	2,400	1,800	2,010
Cost per equivalent unit, (a) ÷ (b).....	\$9.17	\$4.55	\$8.00

Case 4-19 (continued)

	<i>Transferred In Costs</i>	<i>Materials</i>	<i>Conversion</i>	<i>Total</i>
Ending work in process inventory:				
Equivalent units of production (see above). .	600	0	210	
Cost per equivalent unit.....	\$9.17	\$4.55	\$8.00	
Cost of ending work in process inventory.....	\$5,502	\$0	\$1,680	<u>\$7,182</u>
Units completed and transferred out:				
Units transferred to finished goods.....	1,800	1,800	1,800	
Cost per equivalent unit.....	\$9.17	\$4.55	\$8.00	
Cost of units completed and transferred out.	\$16,506	\$8,190	\$14,400	<u>\$39,096</u>

2. The unit cost computed above is \$21.72 (= \$9.17 + \$4.55 + \$8.00) versus \$25.71 on the original report for the units completed and transferred to finished goods. The unit cost on the original report is high because none of the cost incurred during the month was assigned to the units in the ending work in process inventory.

Case 4-20 (90 minutes)

- This case is difficult—particularly part 3, which requires analytical skills.
- Because there are no beginning inventories, it makes no difference whether the weighted-average or FIFO method is used by the company. You may choose to specify that the FIFO method be used rather than the weighted-average method.

1. Computation of the Cost of Goods Sold:

	<i>Transferred In</i>	<i>Conversion</i>
Units completed and sold.....	200,000	200,000
Ending work in process:		
Transferred in:		
10,000 units × 100% complete.....	<u>10,000</u>	
Conversion:		
10,000 units × 30% complete.....		<u>3,000</u>
Equivalent units of production.....	<u>210,000</u>	<u>203,000</u>
	<i>Transferred In</i>	<i>Conversion</i>
Cost of beginning work in process.....	\$ 0	\$ 0
Cost added during the period.....	<u>39,375,000</u>	<u>20,807,500</u>
Total cost (a).....	\$39,375,000	\$20,807,500
Equivalent units of production (b).....	210,000	203,000
Cost per equivalent unit, (a) ÷ (b).....	\$187.50	\$102.50

Cost of goods sold = 200,000 units × (\$187.50 per unit + \$102.50 per unit) = \$58,000,000

2. The estimate of the percentage completion of ending work in process inventories affects the unit costs of finished goods and therefore the cost of goods sold. Gary Stevens would like the estimated percentage completion of the ending work in process to be increased. The higher the percentage of completion of ending work in process, the higher the equivalent units for the period and the lower the unit costs.
3. Increasing the percentage of completion can increase net operating income by reducing the cost of goods sold. To increase net operating income by \$200,000, the cost of goods sold would have to be decreased

by \$200,000 from \$58,000,000 down to \$57,800,000. See the next page for the necessary calculations.

Case 4-20 (continued)

The percentage of completion, X, affects the cost of goods sold by its effect on the unit cost, which can be determined as follows:

$$\text{Unit cost} = \$187.50 + \frac{\$20,807,500}{200,000 + 10,000X}$$

And the cost of goods sold can be computed as follows:

$$\text{Cost of goods sold} = 200,000 \times \text{Unit cost}$$

Because the cost of goods sold must be reduced down to \$57,800,000, the unit cost must be \$289.00 (\$57,800,000 ÷ 200,000 units). Thus, the required percentage completion, X, to obtain the \$200,000 reduction in cost of goods sold can be found by solving the following equation:

$$\$187.50 + \frac{\$20,807,500}{200,000 + 10,000X} = \$289.00$$

$$\frac{\$20,807,500}{200,000 + 10,000X} = \$289.00 - \$187.50$$

$$\frac{\$20,807,500}{200,000 + 10,000X} = \$101.50$$

$$\frac{200,000 + 10,000X}{\$20,807,500} = \frac{1}{\$101.50}$$

$$200,000 + 10,000X = \frac{\$20,807,500}{\$101.50}$$

$$200,000 + 10,000X = 205,000$$

$$10,000X = 205,000 - 200,000$$

$$10,000X = 5,000$$

$$X = \frac{5,000}{10,000} = 50\%$$

Thus, changing the percentage completion to 50% will decrease cost of goods sold and increase net operating income by \$200,000 as verified on the next page.

Case 4-20 (continued)

3. (continued)

Computation of the Cost of Goods Sold:

	<i>Transferred In</i>	<i>Conversion</i>
Units completed and sold.....	200,000	200,000
Ending work in process:		
Transferred in:		
10,000 units x 100% complete.....	<u>10,000</u>	
Conversion:		
10,000 units x 50% complete.....		<u>5,000</u>
Equivalent units of production.....	<u>210,000</u>	<u>205,000</u>
	<i>Transferred In</i>	<i>Conversion</i>
Cost of beginning work in process.....	\$ 0	\$ 0
Cost added during the period.....	<u>39,375,000</u>	<u>20,807,500</u>
Total cost (a).....	<u>\$39,375,000</u>	<u>\$20,807,500</u>
Equivalent units of production (b).....	210,000	205,000
Cost per equivalent unit, (a) ÷ (b).....	\$187.50	\$101.50

Cost of goods sold = 200,000 units × (\$187.50 per unit + \$101.50 per unit) = \$57,800,000

4. Mary is in a very difficult position. Collaborating with Gary Stevens in subverting the integrity of the accounting system is unethical by almost any standard. To put the situation in its starkest light, Stevens is suggesting that the production managers lie in order to get their bonus. Having said that, the peer pressure to go along in this situation may be intense. It is difficult on a personal level to ignore such peer pressure. Moreover, Mary probably prefers not to risk alienating people she might need to rely on in the future. On the other hand, Mary should be careful not to accept at face value Gary's assertion that all of the other managers are "doing as much as they can to pull this bonus out of the hat." Those who engage in unethical or illegal acts often rationalize their own behavior by exaggerating the extent to which others engage in the same kind of behavior. Other managers may actually be very uncomfortable "pulling strings" to make the target profit for the year.

5.

Appendix 4A

FIFO Method

Exercise 4A-1 (10 minutes)

FIFO Method

	<i>Materials</i>	<i>Conversion</i>
To complete beginning work in process:		
Materials: 30,000 units × (100% – 65%).	10,500	
Conversion: 30,000 units × (100% – 30%).....		21,000
Units started and completed during October*.....	160,000	160,000
Ending work in process:		
Materials: 15,000 units × 80% complete.....	12,000	
Conversion: 15,000 units × 40% complete.....		<u>6,000</u>
Equivalent units of production.....	<u>182,500</u>	<u>187,000</u>

* 175,000 units started – 15,000 units in ending work in process
= 160,000 units started and completed

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Exercise 4A-2 (10 minutes)

FIFO method

	<i>Materials</i>	<i>Labor</i>	<i>Overhead</i>
Cost added during May (a).....	\$193,320	\$62,000	\$310,000
Equivalent units of production (b).....	27,000	25,000	25,000
Cost per equivalent unit (a) ÷ (b).....	\$7.16	\$2.48	\$12.40
Cost per equivalent unit for materials.	\$ 7.16		
Cost per equivalent unit for labor.....	2.48		
Cost per equivalent unit for overhead	<u>12.40</u>		
Total cost per equivalent unit.....	<u>\$22.04</u>		

Exercise 4A-3 (15 minutes)

	<i>Material s</i>	<i>Conversio n</i>	<i>Total</i>
<i>Ending work in process inventory:</i>			
Equivalent units of production.....	400	200	
Cost per equivalent unit.....	\$2.32	\$0.75	
Cost of ending work in process inventory	\$928	\$150	<u>\$1,078</u>
<i>Units transferred out:</i>			
Cost in beginning inventory.....	\$3,200	\$650	\$3,850
<i>Cost to complete the units in beginning inventory:</i>			
Equivalent units of production required to complete the beginning inventory.	600	1,200	
Cost per equivalent unit.....	\$2.32	\$0.75	
Cost to complete the units in beginning inventory.....	\$1,392	\$900	\$2,292
<i>Cost of units started and completed this period:</i>			
Units started and completed this period (26,000 units completed and transferred to the next department – 2,000 units in beginning work in process inventory).....	24,000	24,000	
Cost per equivalent unit.....	\$2.32	\$0.75	
Cost of units started and completed this period.....	\$55,680	\$18,000	<u>\$73,680</u>
Total cost of units transferred out.....			<u>\$79,822</u>

Exercise 4A-4 (10 minutes)

Mixing Department Cost Reconciliation

Costs to be accounted for:

Cost of beginning work in process inventory. .	\$ 1,460
Costs added to production during the period..	<u>36,540</u>
Total cost to be accounted for.....	<u>\$38,000</u>

Costs accounted for as follows:

Cost of ending work in process inventory.....	\$ 3,120	
Cost of units completed and transferred out...	<u>34,880</u>	*
Total cost accounted for.....	<u>\$38,000</u>	

*The cost of units completed and transferred out can be deduced as follows:

Cost of beginning work in process + inventory	Costs added to production during the period	=	Cost of ending work in process + inventory	Cost of units completed and transferred out
---	---	---	--	---

$$\begin{array}{rcll} \$1,460 + \$36,540 & = & \$3,120 + & \text{Cost of units} \\ & & & \text{completed and} \\ & & & \text{transferred out} \end{array}$$

$$\begin{array}{rcll} \text{Cost of units} & & & \\ \text{completed and} & = & \$1,460 + \$36,540 - \$3,120 & \\ \text{transferred out} & & & \end{array}$$

$$\begin{array}{rcll} \text{Cost of units} & & & \\ \text{completed and} & = & \$34,880 & \\ \text{transferred out} & & & \end{array}$$

Exercise 4A-5 (10 minutes)

	<i>Material s</i>	<i>Conversio n</i>
To complete beginning work in process:		
Materials: 500 units x (100% – 80%).....	100	
Conversion: 500 units x (100% – 40%).....		300
Units started and completed during the period (153,600 units started – 400 units in ending inventory).....	153,200	153,200
Ending work in process		
Materials: 400 units x 75% complete.....	<u>300</u>	
Conversion: 400 units x 20% complete.....		<u>80</u>
Equivalent units of production.....	<u>153,600</u>	<u>153,580</u>

Exercise 4A-6 (20 minutes)

FIFO Method

	<i>Material s</i>	<i>Labor</i>	<i>Overhea d</i>
1.			
To complete beginning work in process:			
Materials: 5,000 units × (100% – 80%).....	1,000		
Labor: 5,000 units × (100% – 60%).....		2,000	
Overhead: 5,000 units × (100% – 60%).....			2,000
Units started and completed during the period*.....	37,000	37,000	37,000
Ending work in process:			
Materials: 8,000 units × 75%.....	<u>6,000</u>		
Labor: 8,000 units × 50%.....		<u>4,000</u>	
Overhead: 8,000 units × 50%.....			<u>4,000</u>
Equivalent units of production.....	<u>44,000</u>	<u>43,000</u>	<u>43,000</u>

* 45,000 units started into production – 8,000 units in ending work in process = 37,000 started and completed

	<i>Material s</i>	<i>Labor</i>	<i>Overhea d</i>
2.			
Cost added during the period (a).....	\$52,800	\$21,500	\$32,250
Equivalent units of production (b).....	44,000	43,000	43,000
Cost per equivalent unit (a) ÷ (b).....	\$1.20	\$0.50	\$0.75

Exercise 4A-7 (15 minutes)**FIFO Method**

1.	<i>Tons of Pulp</i>
Work in process, June 1.....	20,000
Started into production during the month.....	<u>190,000</u>
Total tons in process.....	210,000
Deduct work in process, June 30.....	<u>30,000</u>
Completed and transferred out during the month.....	<u>180,000</u>

2.	<u><i>Equivalent Units</i></u>	
	<i>Materials</i>	<i>Labor and Overhead</i>
To complete beginning work in process:		
Materials: 20,000 tons × (100% – 90%)...	2,000	
Labor and overhead: 20,000 tons × (100% – 80%).....		4,000
Units started and completed during the month*.....	160,000	160,000
Ending work in process:		
Materials: 30,000 tons × 60% complete...	<u>18,000</u>	
Labor and overhead:		
30,000 tons × 40% complete.....		<u>12,000</u>
Equivalent units of production.....	<u>180,000</u>	<u>176,000</u>

* 190,000 tons started into production – 30,000 tons in ending work in process = 160,000 tons started and completed

Exercise 4A-8 (45 minutes)

FIFO Method

1. Computation of the total cost per equivalent unit of production:

Cost per equivalent unit of production for material.....	\$25.40
Cost per equivalent unit of production for conversion.....	<u>18.20</u>
Total cost per equivalent unit of production.....	<u>\$43.60</u>

2. Computation of equivalent units in ending inventory:

	<i>Materials</i>	<i>Conversion</i>
Units in ending inventory (a).....	300	300
Percentage completed (b).....	70%	60%
Equivalent units of production (a) × (b)...	210	180

3. Computation of equivalent units required to complete the beginning inventory:

	<i>Materials</i>	<i>Conversion</i>
Units in ending inventory (a).....	400	400
Percentage completed (b).....	20%	60%
Equivalent units of production (a) × (b)...	80	240

4. Units transferred to the next department..... 3,100
Units from the beginning inventory..... 400
Units started and completed during the period.... 2,700

Exercise 4A-8 (continued)

5.	<i>Material s</i>	<i>Conversio n</i>	<i>Total</i>
Ending work in process inventory:			
Equivalent units of production.....	210	180	
Cost per equivalent unit.....	\$25.40	\$18.20	
Cost of ending work in process inventory.....	\$5,334	\$3,276	<u>\$8,610</u>
Units transferred out:			
Cost from the beginning work in process inventory.....	\$8,120	\$2,920	\$11,040
Cost to complete the units in beginning work in process inventory:			
Equivalent units of production required to complete the units in beginning inventory.....	80	240	
Cost per equivalent unit.....	\$25.40	\$18.20	
Cost to complete the units in beginning inventory.....	\$2,032	\$4,368	\$6,400
Cost of units started and completed this period:			
Units started and completed this period.....	2,700	2,700	
Cost per equivalent unit.....	\$25.40	\$18.20	
Cost of units started and completed this period.....	\$68,580	\$49,140	<u>\$117,720</u>
Total cost of units transferred out.....			<u>\$135,160</u>

Exercise 4A-9 (15 minutes)

FIFO Method

	<i>Material s</i>	<i>Labor & Overhead</i>
To complete the beginning work in process:		
Materials: 20,000 pounds × (100% – 100%).....	0	
Labor and overhead:		
20,000 pounds × (100% – 30%).....		14,000
Pounds started and completed during July*.....	355,000	355,000
Ending work in process:		
Materials: 25,000 pounds × 100% complete.....	<u>25,000</u>	
Labor and overhead:		
25,000 pounds × 60% complete.....		<u>15,000</u>
Equivalent units of production.....	<u>380,000</u>	<u>384,000</u>

* 380,000 pounds started – 25,000 pounds in ending work in process inventory = 355,000 pounds started and completed this month

Problem 4A-10 (45 minutes)

FIFO method

1. Equivalent Units of Production

	<i>Material s</i>	<i>Conversio n</i>
To complete beginning work in process:		
Materials: 20,000 units x (100% – 100%).....	0	
Conversion: 20,000 units x (100% – 75%).....		5,000
Units started and completed during the period (180,000 units started – 40,000 units in ending inventory).....	140,000	140,000
Ending work in process:		
Materials: 40,000 units x 100% complete.....	<u>40,000</u>	
Conversion: 40,000 units x 25% complete.....		<u>10,000</u>
Equivalent units of production.....	<u>180,000</u>	<u>155,000</u>

2. Cost per Equivalent Unit

	<i>Materials</i>	<i>Conversio n</i>
Cost added during the period (a).....	\$334,800	\$238,700
Equivalent units of production (b).....	180,000	155,000
Cost per equivalent unit (a) ÷ (b).....	\$1.86	\$1.54

3. See the next page.

4. Cost Reconciliation

Costs to be accounted for:

Cost of beginning work in process inventory (\$25,200 + \$24,800).....	\$ 50,000
Costs added to production during the period (\$334,800 + \$238,700).....	<u>573,500</u>
Total cost to be accounted for.....	<u>\$623,500</u>
Costs accounted for as follows:	
Cost of ending work in process inventory.....	\$ 89,800
Costs of units transferred out.....	<u>533,700</u>
Total cost accounted for.....	<u>\$623,500</u>

Problem 4A-10 (continued)

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

	<i>Material s</i>	<i>Conversio n</i>	<i>Total</i>
Ending work in process inventory:			
Equivalent units of production.....	40,000	10,000	
Cost per equivalent unit.....	\$1.86	\$1.54	
Cost of ending work in process inventory.....	\$74,400	\$15,400	<u>\$89,800</u>
Units transferred out:			
Cost in beginning work in process inventory.....	\$25,200	\$24,800	\$50,000
Cost to complete the units in beginning work in process inventory:			
Equivalent units of production required to complete the beginning inventory.....	0	5,000	
Cost per equivalent unit.....	\$1.86	\$1.54	
Cost to complete the units in beginning inventory.....	\$0	\$7,700	\$7,700
Cost of units started and completed this period:			
Units started and completed this period.....	140,000	140,000	
Cost per equivalent unit.....	\$1.86	\$1.54	
Cost of units started and completed this period.....	\$260,400		<u>\$476,000</u>
	0	\$215,600	<u>0</u>
Cost of units transferred out.....			<u>\$533,700</u>
			<u>0</u>

Problem 4A-11 (45 minutes)

FIFO method

1. Equivalent Units of Production

	<i>Material s</i>	<i>Conversio n</i>
To complete beginning work in process:		
Materials: 10,000 units x (100% – 100%).....	0	
Conversion: 10,000 units x (100% – 30%).....		7,000
Units started and completed during the period (170,000 units started – 20,000 units in ending inventory).....	150,000	150,000
Ending work in process:		
Materials: 20,000 units x 100% complete.....	<u>20,000</u>	
Conversion: 20,000 units x 40% complete.....		<u>8,000</u>
Equivalent units of production.....	<u>170,000</u>	<u>165,000</u>

2. Cost per Equivalent Unit

	<i>Materials</i>	<i>Conversio n</i>
Cost added during the period (a).....	\$139,400	\$244,200
Equivalent units of production (b).....	170,000	165,000
Cost per equivalent unit (a) ÷ (b).....	\$0.82	\$1.48

3. See the next page.

4. Cost Reconciliation

Costs to be accounted for:

Cost of beginning work in process inventory (\$8,500 + \$4,900).....	\$ 13,400
Costs added to production during the period (\$139,400 + \$244,200).....	<u>383,600</u>
Total cost to be accounted for.....	<u>\$397,000</u>
Costs accounted for as follows:	
Cost of ending work in process inventory.....	\$ 28,240
Costs of units transferred out.....	<u>368,760</u>
Total cost accounted for.....	<u>\$397,000</u>

Problem 4A-11 (continued)

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

	<i>Material s</i>	<i>Conversio n</i>	<i>Total</i>
Ending work in process inventory:			
Equivalent units of production.....	20,000	8,000	
Cost per equivalent unit.....	\$0.82	\$1.48	
Cost of ending work in process inventory.....	\$16,400	\$11,840	<u>\$28,240</u>
Units transferred out:			
Cost in beginning work in process inventory.....	\$8,500	\$4,900	\$13,400
Cost to complete the units in beginning work in process inventory:			
Equivalent units of production required to complete the beginning inventory.....	0	7,000	
Cost per equivalent unit.....	\$0.82	\$1.48	
Cost to complete the units in beginning inventory.....	\$0	\$10,360	\$10,360
Cost of units started and completed this period:			
Units started and completed this period.....	150,000	150,000	
Cost per equivalent unit.....	\$0.82	\$1.48	
Cost of units started and completed this period.....	\$123,00		<u>\$345,00</u>
	0	\$222,000	<u>0</u>
Cost of units transferred out.....			<u>\$368,76</u> <u>0</u>

Case 4A-12 (60 minutes)

1.

	<i>Transferred In</i>	<i>Materials</i>	<i>Conversion</i>
To complete beginning work in process:			
Transferred in: 450 units × (100% – 100%).....	0		
Materials: 450 units × (100% – 100%).....		0	
Conversion: 450 units × (100% – 60%).....			180
Units started and completed during the period (1,950 units started – 600 units in ending inventory).....	1,350	1,350	1,350
Ending work in process:			
Transferred in: 600 units x 100% complete	<u>600</u>		
Materials: 600 units x 0% complete.....		<u>0</u>	
Conversion: 600 units x 35% complete.....			<u>210</u>
Equivalent units of production.....	<u>1,950</u>	<u>1,350</u>	<u>1,740</u>
	<i>Transferred In</i>	<i>Materials</i>	<i>Conversion</i>
Cost added during the period (a).....	\$17,940	\$6,210	\$13,920
Equivalent units of production (b).....	1,950	1,350	1,740
Cost per equivalent unit (a) ÷ (b).....	\$9.20	\$4.60	\$8.00

Case 4A-12 (continued)

	<i>Transferred In</i>	<i>Material s</i>	<i>Conversio n</i>	<i>Total</i>
Ending work in process inventory:				
Equivalent units of production.....	600	0	210	
Cost per equivalent unit.....	\$9.20	\$4.60	\$8.00	
Cost of ending work in process inventory.....	\$5,520	\$0	\$1,680	<u>\$7,200</u>
Units transferred out:				
Cost in beginning work in process inventory.....	\$4,068	\$1,980	\$2,160	\$8,208
Cost to complete units in beginning work in process inventory:				
Equivalent units of production required to complete the beginning inventory (see above).....	0	0	180	
Cost per equivalent unit.....	\$9.20	\$4.60	\$8.00	
Cost to complete units in beginning inventory.....	\$0	\$0	\$1,440	\$1,440
Cost of units started and completed this period:				
Units started and completed this period.....	1,350	1,350	1,350	
Cost per equivalent unit.....	\$9.20	\$4.60	\$8.00	
Cost of units started and completed this period.....	\$12,420	\$6,210	\$10,800	<u>\$29,430</u>
Cost of units transferred out.....				<u>\$39,078</u>

2. The effects of the price increases will tend to show up more under the FIFO method. The reason is that the FIFO method keeps the costs of the current period separate from the costs of prior periods. Thus, under the FIFO method, management will be able to see the effect of price increases on unit costs without any distorting influence from what has happened in the past.

Case 4A-12 (continued)

Under the weighted-average method, however, costs carried over from the prior period are averaged in with costs of the current period, which will tend to reduce somewhat the impact of increased materials prices on current period unit costs.

Appendix 4B

Service Department Allocations

Exercise 4B-1 (15 minutes)

	<i>Service Departments</i>		<i>Operating Departments</i>		
	<i>Admini- stration</i>	<i>Facility Services</i>	<i>Undergraduat e Programs</i>	<i>Graduate Programs</i>	<i>Total</i>
Departmental costs before allocations.....	\$2,400,000	\$1,600,000	\$26,800,000	\$5,700,000	<u>\$36,500,00</u> <u>0</u>
Allocations:					
Administration costs (20/25, 5/25).....	(2,400,000)		1,920,000	480,000	
Facility Services costs (70/100, 30/100)*....	_____	(1,600,000)	<u>1,120,000</u>	<u>480,000</u>	
Total costs after allocation.....	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$29,840,000</u>	<u>\$6,660,000</u>	<u>\$36,500,00</u> <u>0</u>

*Based on the space occupied by the two operating departments, which is 100,000 square feet.

Exercise 4B-2 (15 minutes)

	Service Departments		Operating Departments		
	Admini- stration	Janitoria l	Groceries	Gifts	Total
Departmental costs before allocations.....			\$2,320,00	\$950,00	<u>\$3,460,00</u>
	\$150,000	\$40,000	0	0	<u>0</u>
Allocations:					
Administration costs					
(160/4,000, 3,100/4,000, 740/4,000)*	(150,000)	6,000	116,250	27,750	
Janitorial costs					
(4,000/5,000, 1,000/5,000)†.....	_____	<u>(46,000)</u>	<u>36,800</u>	<u>9,200</u>	
Total costs after allocation.....			<u>\$2,473,05</u>	<u>\$986,95</u>	<u>\$3,460,00</u>
	<u>\$ 0</u>	<u>\$ 0</u>	<u>0</u>	<u>0</u>	<u>0</u>

*Based on employee hours in the other three departments: $160 + 3,100 + 740 = 4,000$.

†Based on space occupied by the two operating departments: $4,000 + 1,000 = 5,000$.

Both the Janitorial Department costs of \$40,000 and the Administration costs of \$6,000 that have been allocated to the Janitorial Department are allocated to the two operating departments.

Exercise 4B-3 (20 minutes)

	Service Departments			Operating Departments		
	<i>Admini- stration</i>	<i>Janitorial</i>	<i>Mainte- nance</i>	<i>Binding</i>	<i>Printing</i>	<i>Total</i>
Costs.....	\$140,000	\$105,000	\$ 48,000	\$275,000	\$430,000	<u>\$998,000</u>
Allocations:						
Administration costs ¹ :						
(35/700, 140/700, 315/700, 210/700).....	(140,000)	7,000	28,000	63,000	42,000	
Janitorial costs ² :						
(20/160, 40/160, 100/160).....		(112,000)	14,000	28,000	70,000	
Maintenance costs ³ : (30/90, 60/90).			(90,000)	30,000	60,000	
Total cost after allocations.....	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$396,000</u>	<u>\$602,000</u>	<u>\$998,000</u>

¹Allocation base: 35 employees + 140 employees + 315 employees + 210 employees = 700 employees

²Allocation base: 20,000 square feet + 40,000 square feet + 100,000 square feet = 160,000 square feet

³Allocation base: 30,000 hours + 60,000 hours = 90,000 hours

Exercise 4B-4 (20 minutes)

	<i>Service Departments</i>			<i>Operating Departments</i>		
	<i>Admini- stration</i>	<i>Janitorial</i>	<i>Mainte- nance</i>	<i>Binding</i>	<i>Printing</i>	<i>Total</i>
Overhead costs.....	\$140,000	\$105,000	\$ 48,000	\$275,000	\$430,000	<u>\$998,000</u>
Allocation:						
Administration costs ¹ :						
(315/525, 210/525).....	(140,000)			84,000	56,000	
Janitorial costs ² :						
(40/140, 100/140).....		(105,000)		30,000	75,000	
Maintenance costs ³ :						
(30/90, 60/90).....			(48,000)	<u>16,000</u>	<u>32,000</u>	
Total overhead costs after allocations.....	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$405,000</u>	<u>\$593,000</u>	<u>\$998,000</u>

¹Allocation base: 315 employees + 210 employees = 525 employees

²Allocation base: 40,000 square feet + 100,000 square feet = 140,000 square feet

³Allocation base: 30,000 hours + 60,000 hours = 90,000 hours

Problem 4B-5 (90 minutes)

1.

	(Thousands of ¥)					
	Factory Admini- stration	Custodial Services	Personnel	Mainte- nance	Machinin g	Assembly
<i>Step-down method</i>						
Operating department costs.....					¥376,300	¥175,900
Costs to be allocated.....	¥270,000	¥ 68,760	¥ 28,840	¥ 45,200		
Allocations:						
Factory Administration						
@ ¥1,800 per labor-hour.....	(270,000)	5,400	9,000	39,600	54,000	162,000
Custodial Services						
@ ¥720 per square foot.....		(74,160)	2,160	7,200	50,400	14,400
Personnel						
@ ¥320,000 per employee.			(40,000)	8,000	12,800	19,200
Maintenance						
@ ¥1,250 per machine- hour.....	_____	_____	_____	(100,000)	<u>87,500</u>	<u>12,500</u>
Total overhead after allocations.....	<u>¥ 0</u>	<u>¥ 0</u>	<u>¥ 0</u>	<u>¥ 0</u>	<u>¥581,000</u>	<u>¥384,000</u>
Divide by machine-hours (thousands).....					÷ 70	
Divide by direct labor-hours (thousands).....						÷ 80
Overhead rate.....					¥8,300	¥4,800

Problem 4B-5 (continued)

2.

(Thousands of ¥)

	<i>Factory Admini- stration</i>	<i>Custodial Services</i>	<i>Personnel</i>	<i>Mainte- nance</i>	<i>Machinin g</i>	<i>Assembly</i>
<i>Direct method</i>						
Operating department costs.....					¥376,300	¥175,900
Costs to be allocated.....	¥270,000	¥68,760	¥28,840	¥45,200		
Allocations:						
Factory Administration (30/120, 90/120).....	(270,000)				67,500	202,500
Custodial Services (70/90, 20/90).....		(68,760)			53,480	15,280
Personnel (40/100, 60/100).....			(28,840)		11,536	17,304
Maintenance (70/80, 10/80).....				(45,200)	39,550	5,650
Total overhead after allocations	<u>¥ 0</u>	<u>¥ 0</u>	<u>¥ 0</u>	<u>¥ 0</u>	<u>¥548,366</u>	<u>¥416,634</u>
Divide by machine-hours (thousands).....					÷ 70	
Divide by direct labor-hours (thousands).....						÷ 80
Overhead rate.....					¥7,834	¥5,208

Problem 4B-5 (continued)

3. Plantwide rate

$$\begin{aligned}\text{Overhead rate} &= \frac{\text{Total overhead cost}}{\text{Total direct labor-hours}} \\ &= \frac{\text{¥965,000,000}}{100,000 \text{ DLHs}} = \text{¥9,650 per DLH}\end{aligned}$$

4. The amount of overhead cost assigned to the job would be:

Step-down method:

Machining Department: ¥8,300 per machine-hour × 190 machine-hours.....	¥1,577,000
Assembly Department: ¥4,800 per direct labor-hour × 75 direct labor-hours.....	<u>360,000</u>
Total overhead cost.....	<u>¥1,937,000</u>

Direct method:

Machining Department: ¥7,834 per machine-hour × 190 machine-hours.....	¥1,488,460
Assembly department: ¥5,208 per direct labor-hour × 75 direct labor-hours.....	<u>390,600</u>
Total overhead cost.....	<u>¥1,879,060</u>

Plantwide method:

¥9,650 per direct labor-hour × 100 direct labor-hours..	<u>¥ 965,000</u>
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The plantwide method, which is based on direct labor-hours, assigns very little overhead cost to the job because it requires little labor time. Assuming that Factory Administrative costs really do vary in proportion to labor-hours, Custodial Services with square feet occupied, and so on, the company will tend to undercost such jobs if a plantwide overhead rate is used (and it will tend to overcost jobs requiring large amounts of labor time). The direct method is better than the plantwide method, but the step-down method will generally provide the most accurate overhead rates of the three methods.

Problem 4B-6 (60 minutes)

	<i>House- keeping Services</i>	<i>Food Services</i>	<i>Admini- strative Services</i>	<i>Laboratory</i>	<i>Radiology</i>	<i>General Hospital</i>
Variable costs.....	\$ 0	\$193,860	\$158,840	\$243,600	\$304,800	\$ 74,500
Food Services allocation: (800/71,800; 2,000/71,800, 1,000/71,800; 68,000/71,800)...		(193,860)	2,160	5,400	2,700	183,600
Admin. Services allocation: (14/46; 7/46; 25/46).....			(161,000)	<u>49,000</u>	<u>24,500</u>	<u>87,500</u>
Total variable costs.....	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$298,000</u>	<u>\$332,000</u>	<u>\$345,600</u>
Fixed costs.....	\$87,000	\$107,200	\$90,180	\$162,300	\$215,700	\$401,300
Housekeeping Services allocation (13/145; 6.5/145; 10/145; 7.5/145; 108/145).....	(87,000)	7,800	3,900	6,000	4,500	64,800
Food Services allocation: (0.8%; 2.4%; 1.6%; 95.2%)....		(115,000)	920	2,760	1,840	109,480
Admin. Services allocation: (30%; 20%; 50%).....			(95,000)	<u>28,500</u>	<u>19,000</u>	<u>47,500</u>
Total fixed costs.....	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$199,560</u>	<u>\$241,040</u>	<u>\$623,080</u>
Total overhead costs.....	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$497,560</u>	<u>\$573,040</u>	<u>\$968,680</u>

Case 4B-7 (90 minutes)

1. Step-down method:

	<i>Personnel</i>	<i>Custodial Services</i>	<i>Mainte- nance</i>	<i>Printing</i>	<i>Binding</i>
Total cost before allocations.....	\$360,000	\$141,000	\$201,000	\$525,000	\$373,500
Allocations:					
Personnel (15/200, 25/200, 40/200, 120/200) ¹	(360,000)	27,000	45,000	72,000	216,000
Custodial services (20/140, 80/140, 40/140) ²		(168,000)	24,000	96,000	48,000
Maintenance (150/180, 30/180) ³			(270,000)	225,000	45,000
Total overhead cost after allocations.....	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$918,000</u>	<u>\$682,500</u>
Divide by machine-hours.....				÷ 150,000	
Divide by direct labor-hours.....					÷ 175,000
Predetermined overhead rate.....				\$6.12	\$3.90

¹ Based on 15 + 25 + 40 + 120 = 200 employees

² Based on 20,000 + 80,000 + 40,000 = 140,000 square feet

³ Based on 150,000 + 30,000 = 180,000 machine-hours

Case 4B-7 (continued)

2. Direct method:

	<i>Personnel</i>	<i>Custodial Services</i>	<i>Mainte- nance</i>	<i>Printing</i>	<i>Binding</i>
Total costs before allocations.....	\$360,000	\$141,000	\$201,000	\$525,000	\$373,500
Allocations:					
Personnel (40/160, 120/160) ¹	(360,000)			90,000	270,000
Custodial Services (80/120, 40/120) ²		(141,000)		94,000	47,000
Maintenance (150/180, 30/180) ³			(201,000)	167,500	33,500
Total overhead cost after allocations.....	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$876,500</u>	<u>\$724,000</u>
Divide by machine-hours.....				÷ 150,000	
Divide by direct labor-hours.....					÷ 175,000
Predetermined overhead rate.....				\$5.84	\$4.14

¹ Based on 40 + 120 = 160 employees² Based on 80,000 + 40,000 = 120,000 square feet³ Based on 150,000 + 30,000 = 180,000 machine-hours

Case 4B-7 (continued)

3. a. The amount of overhead cost assigned to the job would be:

Step-down method:

Printing department:

\$6.12 per machine-hour × 15,400 machine-hours..... \$ 94,248

Binding department:

\$3.90 per direct labor-hour × 2,000 direct labor-hours.. 7,800

Total overhead cost..... \$102,048

Direct method:

Printing department:

\$5.84 per machine-hour × 15,400 machine-hours..... \$ 89,936

Binding department:

\$4.14 per direct labor-hour × 2,000 direct labor-hours.. 8,280

Total overhead cost..... \$ 98,216

- b. The step-down method provides a better basis for computing predetermined overhead rates than the direct method because it gives recognition to services provided between service departments. If this interdepartmental service is not recognized, then either too much or too little of a service department's costs may be allocated to a producing department. The result will be an inaccuracy in the producing department's predetermined overhead rate.

Inaccuracies in the predetermined overhead rate can cause corresponding inaccuracies in bids for jobs. Because the direct method in this case understates the overhead rate in the Printing Department and overstates the overhead rate in the Binding Department, it is not surprising that the company tends to bid low on jobs requiring a lot of printing work and tends to bid too high on jobs that require a lot of binding work.

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