Chapter 11 Performance Measurement in Decentralized Organizations Answer Key

True / False Questions

1. Residual income is superior to return on investment as a means of measuring performance because it encourages managers to make investment decisions that are more consistent with the interests of the company as a whole.
   **TRUE**

   AACSB: Reflective Thinking
   AICPA BB: Critical Thinking
   AICPA FN: Measurement
   Bloom’s: Knowledge
   Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI
   Learning Objective: 11-02 Compute residual income and understand its strengths and weaknesses
   Level: Easy

2. Residual income equals average operating assets multiplied by the difference between the return on investment and the minimum required rate of return.
   **TRUE**

   AACSB: Reflective Thinking
   AICPA BB: Critical Thinking
   AICPA FN: Measurement
   Bloom’s: Comprehension
   Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI
   Learning Objective: 11-02 Compute residual income and understand its strengths and weaknesses
   Level: Hard

3. Consider a company that has only variable costs. All other things the same, an increase in unit sales will result in no change in the return on investment.
   **FALSE**

   AACSB: Reflective Thinking
   AICPA BB: Critical Thinking
   AICPA FN: Measurement
   Bloom’s: Comprehension
   Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI
   Level: Medium
4. The use of return on investment as a performance measure may lead managers to make decisions that are not in the best interests of the company as a whole.  
**TRUE**

AACSB: Reflective Thinking  
AICPA BB: Critical Thinking  
AICPA FN: Measurement  
Bloom’s: Comprehension  
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI  
Level: Medium

5. Residual income is the net operating income that an investment center earns above the minimum required return on the investment in operating assets.  
**TRUE**

AACSB: Reflective Thinking  
AICPA BB: Critical Thinking  
AICPA FN: Measurement  
Bloom’s: Knowledge  
Learning Objective: 11-02 Compute residual income and understand its strengths and weaknesses  
Level: Easy

6. Residual income should not be used to evaluate a cost center.  
**TRUE**

AACSB: Reflective Thinking  
AICPA BB: Critical Thinking  
AICPA FN: Measurement  
Bloom’s: Comprehension  
Learning Objective: 11-02 Compute residual income and understand its strengths and weaknesses  
Level: Medium

7. The performance measures on a balanced scorecard tend to fall into four groups: financial measures, customer measures, internal business process measures, and external business process measures.  
**FALSE**

AACSB: Reflective Thinking  
AICPA BB: Critical Thinking  
AICPA FN: Measurement  
Bloom’s: Comprehension  
Learning Objective: 11-04 Understand how to construct and use a balanced scorecard  
Level: Medium
8. A balanced scorecard should contain every performance measure that can be expected to influence a company's profits.

**FALSE**

AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Comprehension
Learning Objective: 11-04 Understand how to construct and use a balanced scorecard
Level: Medium

9. The performance measures on an individual's scorecard should not be overly influenced by actions taken by others in the company or by events that are outside of the individual's control.

**TRUE**

AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Knowledge
Learning Objective: 11-04 Understand how to construct and use a balanced scorecard
Level: Easy

10. Managers of cost centers are evaluated according to the profits which their departments are able to generate.

**FALSE**

AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Knowledge
Learning Objective: Other topics
Level: Easy

11. If expenses exceed revenues in a department, then it would be considered a cost center.

**FALSE**
Multiple Choice Questions

12. Residual income is a better measure for performance evaluation of an investment center manager than return on investment because:
   A. the problems associated with measuring the asset base are eliminated.
   B. desirable investment decisions will not be rejected by divisions that already have a high ROI.
   C. only the gross book value of assets needs to be calculated.
   D. returns do not increase as assets are depreciated.

AACSB: Reflective Thinking
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom’s: Comprehension
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI
Learning Objective: 11-02 Compute residual income and understand its strengths and weaknesses
Level: Medium
Source: CMA, adapted

13. Turnover is computed by dividing average operating assets into:
   A. invested capital.
   B. total assets.
   C. net operating income.
   D. sales.

AACSB: Reflective Thinking
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom’s: Knowledge
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI
Level: Easy
Chapter 11 - Performance Measurement in Decentralized Organizations

14. Which of the following statements provide(s) an argument in favor of including only a plant's net book value rather than gross book value as part of operating assets in the ROI computation?
I. Net book value is consistent with how plant and equipment items are reported on a balance sheet.
II. Net book value is consistent with the computation of net operating income, which includes depreciation as an operating expense.
III. Net book value allows ROI to decrease over time as assets get older.
A. Only I.
B. Only III.
C. Only I and II.
D. Only I and III.

AACSB: Reflective Thinking
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Comprehension
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI
Level: Medium

15. In computing the margin in a ROI analysis, which of the following is used?
A. Sales in the denominator
B. Net operating income in the denominator
C. Average operating assets in the denominator
D. Residual income in the denominator

AACSB: Reflective Thinking
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Comprehension
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI
Level: Medium
16. Which of the following is not an operating asset?
A. Cash
B. Inventory
C. Plant equipment
D. Common stock

AACSB: Reflective Thinking
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom’s: Knowledge
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales, expenses, and assets affect ROI
Level: Easy

17. In determining the dollar amount to use for operating assets in the return on investment (ROI) calculation, companies will generally use either net book value or gross cost of the assets. Which of the following is an argument for the use of net book value rather than gross cost?
A. It is consistent with how assets are reported on the balance sheet.
B. It eliminates the depreciation method as a factor in ROI calculations.
C. It encourages the replacement of old, worn-out equipment.
D. All of the above.

AACSB: Reflective Thinking
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom’s: Comprehension
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales, expenses, and assets affect ROI
Level: Medium

18. Which of the following will not result in an increase in the residual income, assuming other factors remain constant?
A. An increase in sales.
B. An increase in the minimum required rate of return.
C. A decrease in expenses.
D. A decrease in operating assets.

AACSB: Reflective Thinking
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom’s: Comprehension
Learning Objective: 11-02 Compute residual income and understand its strengths and weaknesses
Level: Medium
19. All other things the same, which of the following would increase residual income?
A. Increase in average operating assets.
B. Decrease in average operating assets.
C. Increase in minimum required return.
D. Decrease in net operating income.

AACSB: Reflective Thinking
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Comprehension
Learning Objective: 11-02 Compute residual income and understand its strengths and weaknesses
Level: Medium

20. Which of the following three statements are correct?
I. A profit center has control over both cost and revenue.
II. An investment center has control over invested funds, but not over costs and revenue.
III. A cost center has no control over sales.
A. Only I
B. Only II
C. Only I and III
D. Only I and II

AACSB: Reflective Thinking
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Comprehension
Learning Objective: Other topics
Level: Medium

21. The purpose of the Data Processing Department of Falena Corporation is to assist the various departments of the corporation with their information needs free of charge. The Data Processing Department would best be evaluated as a:
A. cost center.
B. revenue center.
C. profit center.
D. investment center.

AACSB: Reflective Thinking
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Knowledge
Learning Objective: Other topics
Level: Easy
22. Average operating assets are $110,000 and net operating income is $23,100. The company invests $25,000 in new assets for a project that will increase net operating income by $4,750. What is the return on investment (ROI) of the new project?

A. 21%  
B. 19%  
C. 18.5%  
D. 20%  

ROI = \frac{\text{Net operating income}}{\text{Average operating assets}}  
= \frac{4,750}{25,000} = 19\%  

23. Last year a company had stockholder's equity of $160,000, net operating income of $16,000 and sales of $100,000. The turnover was 0.5. The return on investment (ROI) was:

A. 10%  
B. 9%  
C. 8%  
D. 7%  

Margin = \frac{\text{Net operating income}}{\text{Sales}} = \frac{16,000}{100,000} = 16\%  
ROI = \text{Margin} \times \text{Turnover} = 16\% \times 0.5 = 8\%
24. Sales and average operating assets for Company P and Company Q are given below:

<table>
<thead>
<tr>
<th></th>
<th>Sales</th>
<th>Average Operating Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company P</td>
<td>$20,000</td>
<td>$8,000</td>
</tr>
<tr>
<td>Company Q</td>
<td>$50,000</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

What is the margin that each company will have to earn in order to generate a return on investment of 20%?

A. 12% and 16%
B. 50% and 100%
C. 8% and 4%
D. 2.5% and 5%

Company P:
Turnover = Sales ÷ Average operating assets = $20,000 ÷ $8,000 = 2.5
ROI ÷ Turnover = Margin = 20% ÷ 2.5 = 8%

Company Q:
Turnover = Sales ÷ Average operating assets = $50,000 ÷ $10,000 = 5
ROI ÷ Turnover = Margin = 20% ÷ 5 = 4%
25. Reed Company's sales last year totaled $150,000 and its return on investment (ROI) was 12%. If the company's turnover was 3, then its net operating income for the year must have been:

A. $6,000
B. $2,000
C. $18,000
D. it is impossible to determine from the data given.

ROI = Margin × Turnover
Margin = ROI ÷ Turnover = 12% ÷ 3 = 4%
Margin = Net operating income ÷ Sales
Net operating income = Margin × Sales = 4% × $150,000 = $6,000

26. A company's current net operating income is $16,800 and its average operating assets are $80,000. The company's required rate of return is 18%. A new project being considered would require an investment of $15,000 and would generate annual net operating income of $3,000. What is the residual income of the new project?

A. 20.8%
B. 20%
C. ($150)
D. $300

<table>
<thead>
<tr>
<th>Net operating income</th>
<th>$3,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum required return (15,000 × 18%)</td>
<td>2,700</td>
</tr>
<tr>
<td>Residual income</td>
<td>$300</td>
</tr>
</tbody>
</table>

AACSB: Analytic
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Application
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI
Level: Hard

Learning Objective: 11-02 Compute residual income and understand its strengths and weaknesses
Level: Easy
27. Soderquist Corporation uses residual income to evaluate the performance of its divisions. The company's minimum required rate of return is 11%. In April, the Commercial Products Division had average operating assets of $100,000 and net operating income of $9,400. What was the Commercial Products Division's residual income in April?

A. $1,600  
B. $1,600  
C. $1,034  
D. -$1,034

<table>
<thead>
<tr>
<th>Net operating income</th>
<th>$9,400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum required return ($100,000 \times 11%)</td>
<td>11,000</td>
</tr>
<tr>
<td>Residual income</td>
<td>$(1,600)</td>
</tr>
</tbody>
</table>

28. In August, the Universal Solutions Division of Jugan Corporation had average operating assets of $670,000 and net operating income of $77,500. The company uses residual income, with a minimum required rate of return of 12%, to evaluate the performance of its divisions. What was the Universal Solutions Division's residual income in August?

A. $2,900  
B. -$2,900  
C. -$9,300  
D. $9,300

<table>
<thead>
<tr>
<th>Net operating income</th>
<th>$77,500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum required return ($670,000 \times 12%)</td>
<td>80,400</td>
</tr>
<tr>
<td>Residual income</td>
<td>$(2,900)</td>
</tr>
</tbody>
</table>
29. Division B had an ROI last year of 15%. The division's minimum required rate of return is 10%. If the division's average operating assets last year were $450,000, then the division's residual income for last year was:

A. $67,500  
B. $22,500  
C. $37,500  
D. $45,000

\[
\text{ROI} = \text{Net operating income} \div \text{Average operating assets} \\
\text{Net operating income} = \text{ROI} \times \text{Average operating assets} = 15\% \times 450,000 = 67,500
\]

<table>
<thead>
<tr>
<th>Net operating income</th>
<th>$67,500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum required return ($450,000 \times 10%)</td>
<td>45,000</td>
</tr>
<tr>
<td>Residual income</td>
<td>$22,500</td>
</tr>
</tbody>
</table>

AACSB: Analytic  
AICPA BB: Critical Thinking  
AICPA FN: Measurement  
Bloom's: Application  
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI  
Learning Objective: 11-02 Compute residual income and understand its strengths and weaknesses  
Level: Hard
30. Garnick Corporation keeps careful track of the time required to fill orders. The times recorded for a particular order appear below:

<table>
<thead>
<tr>
<th></th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move time</td>
<td>3.5</td>
</tr>
<tr>
<td>Wait time</td>
<td>26.2</td>
</tr>
<tr>
<td>Queue time</td>
<td>5.2</td>
</tr>
<tr>
<td>Process time</td>
<td>0.9</td>
</tr>
<tr>
<td>Inspection time</td>
<td>0.3</td>
</tr>
</tbody>
</table>

The delivery cycle time was:
A. 3.5 hours
B. 8.7 hours
C. 34.9 hours
D. 36.1 hours

Throughput time = Process time + Inspection time + Move time + Queue time
= 0.9 hours + 0.3 hours + 3.5 hours + 5.2 hours = 9.9 hours
Delivery cycle time = Wait time + Throughput time
= 26.2 hours + 9.9 hours = 36.1 hours
31. Galanis Corporation keeps careful track of the time required to fill orders. Data concerning a particular order appear below:

<table>
<thead>
<tr>
<th></th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wait time</td>
<td>24.7</td>
</tr>
<tr>
<td>Process time</td>
<td>1.4</td>
</tr>
<tr>
<td>Inspection time</td>
<td>0.4</td>
</tr>
<tr>
<td>Move time</td>
<td>3.6</td>
</tr>
<tr>
<td>Queue time</td>
<td>8.7</td>
</tr>
</tbody>
</table>

The throughput time was:

A. 38.8 hours
B. 33.4 hours
C. 14.1 hours
D. 5.4 hours

Throughput time = Process time + Inspection time + Move time + Queue time
= 1.4 hours + 0.4 hours + 3.6 hours + 8.7 hours = 14.1 hours

AACSB: Analytic
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Application

Learning Objective: 11-03 Compute delivery cycle time; throughput time; and manufacturing cycle efficiency (MCE)
Level: Easy
32. Hoster Corporation keeps careful track of the time required to fill orders. The times recorded for a particular order appear below:

<table>
<thead>
<tr>
<th>Time Type</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move time</td>
<td>2.9</td>
</tr>
<tr>
<td>Wait time</td>
<td>13.6</td>
</tr>
<tr>
<td>Queue time</td>
<td>4.4</td>
</tr>
<tr>
<td>Process time</td>
<td>1.2</td>
</tr>
<tr>
<td>Inspection time</td>
<td>0.4</td>
</tr>
</tbody>
</table>

The throughput time was:

**A. 8.9 hours**  
**B. 18 hours**  
**C. 4.5 hours**  
**D. 22.5 hours**

Throughput time = Process time + Inspection time + Move time + Queue time  
= 1.2 hours + 0.4 hours + 2.9 hours + 4.4 hours = 8.9 hours

AACSB: Analytic  
AICPA BB: Critical Thinking  
AICPA FN: Measurement  
Bloom’s: Application  
Learning Objective: 11-03 Compute delivery cycle time; throughput time; and manufacturing cycle efficiency (MCE)  
Level: Easy
33. Botelho Corporation keeps careful track of the time required to fill orders. Data concerning a particular order appear below:

<table>
<thead>
<tr>
<th></th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wait time</td>
<td>18.3</td>
</tr>
<tr>
<td>Process time</td>
<td>1.9</td>
</tr>
<tr>
<td>Inspection time</td>
<td>0.3</td>
</tr>
<tr>
<td>Move time</td>
<td>3.7</td>
</tr>
<tr>
<td>Queue time</td>
<td>8.9</td>
</tr>
</tbody>
</table>

The delivery cycle time was:

A. 33.1 hours
B. 3.7 hours
C. 12.6 hours
D. 30.9 hours

Throughput time = Process time + Inspection time + Move time + Queue time
= 1.9 hours + 0.3 hours + 3.7 hours + 8.9 hours = 14.8 hours

Delivery cycle time = Wait time + Throughput time
= 18.3 hours + 14.8 hours = 33.1 hours
34. Niemiec Corporation keeps careful track of the time required to fill orders. The times recorded for a particular order appear below:

<table>
<thead>
<tr>
<th></th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move time</td>
<td>2.6</td>
</tr>
<tr>
<td>Wait time</td>
<td>13.3</td>
</tr>
<tr>
<td>Queue time</td>
<td>8.5</td>
</tr>
<tr>
<td>Process time</td>
<td>1.5</td>
</tr>
<tr>
<td>Inspection time</td>
<td>0.2</td>
</tr>
</tbody>
</table>

The manufacturing cycle efficiency (MCE) was closest to:
A. 0.20
B. 0.06
C. 0.12
D. 0.96

Throughput time = Process time + Inspection time + Move time + Queue time
= 1.5 hours + 0.2 hours + 2.6 hours + 8.5 hours = 12.8 hours
MCE = Value-added time (Process time) ÷ Throughput (manufacturing cycle) time
= 1.5 hours ÷ 12.8 hours = 0.12
35. Mordue Corporation keeps careful track of the time required to fill orders. Data concerning a particular order appear below:

<table>
<thead>
<tr>
<th></th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wait time</td>
<td>2.7</td>
</tr>
<tr>
<td>Process time</td>
<td>1.7</td>
</tr>
<tr>
<td>Inspection time</td>
<td>0.1</td>
</tr>
<tr>
<td>Move time</td>
<td>2.4</td>
</tr>
<tr>
<td>Queue time</td>
<td>6.7</td>
</tr>
</tbody>
</table>

The manufacturing cycle efficiency (MCE) was closest to:

A. 0.15  
B. 0.53  
C. 0.05  
D. 0.16

Throughput time = Process time + Inspection time + Move time + Queue time  
= 1.7 hours + 0.1 hours + 2.4 hours + 6.7 hours = 10.9 hours  
MCE = Value-added time (Process time) ÷ Throughput (manufacturing cycle) time  
= 1.7 hours ÷ 10.9 hours = 0.16

AICPA BB: Critical Thinking  
AICPA FN: Measurement  
Bloom’s: Application  
Learning Objective: 11-03 Compute delivery cycle time; throughput time; and manufacturing cycle efficiency (MCE)  
Level: Easy

Aide Industries is a division of a major corporation. Data concerning the most recent year appears below:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$17,400,000</td>
</tr>
<tr>
<td>Net operating income</td>
<td>$870,000</td>
</tr>
<tr>
<td>Average operating assets</td>
<td>$4,000,000</td>
</tr>
</tbody>
</table>
Chapter 11 - Performance Measurement in Decentralized Organizations

36. The division's margin is closest to:
   A. 21.8%
   B. 5.0%
   C. 23.0%
   D. 28.0%

Margin = Net operating income ÷ Sales = $870,000 ÷ $17,400,000 = 5.0%

37. The division's turnover is closest to:
   A. 20.00
   B. 4.35
   C. 0.22
   D. 3.57

Turnover = Sales ÷ Average operating assets = $17,400,000 ÷ $4,000,000 = 4.35
38. The division's return on investment (ROI) is closest to:
   A. 4.1%
   B. 21.75%
   C. 17.9%
   D. 1.1%

ROI = Net operating income ÷ Average operating assets = $870,000 ÷ $4,000,000 = 21.75%

AACSB: Analytic
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom’s: Application
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI
Level: Easy

The Reed Division reports the following operating data for the past two years:

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margin</td>
<td>16%</td>
<td>?</td>
</tr>
<tr>
<td>Turnover</td>
<td>2.5</td>
<td>2</td>
</tr>
<tr>
<td>Average operating assets</td>
<td>?</td>
<td>$150,000</td>
</tr>
<tr>
<td>Net operating income</td>
<td>$40,000</td>
<td>?</td>
</tr>
<tr>
<td>Stockholders’ equity</td>
<td>$80,000</td>
<td>$125,000</td>
</tr>
<tr>
<td>Sales</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

The return on investment at Reed was exactly the same in Year 1 and Year 2.
39. The margin in Year 2 was:
   A. 48%
   B. 32%
   C. 20%
   D. 10%

ROI in Year 1:
ROI = Margin × Turnover = 16% × 2.5 = 40%
By assumption, the ROI is the same in Year 2 as in Year 1. Therefore, in Year 2:
ROI = Margin × Turnover
40% = Margin × 2
Margin = 40% ÷ 2 = 20%

40. Sales in Year 2 amounted to:
   A. $250,000
   B. $300,000
   C. $325,000
   D. $350,000

ROI in Year 1:
ROI = Margin × Turnover = 16% × 2.5 = 40%
By assumption, the ROI is the same in Year 2 as in Year 1. Therefore, in Year 2:
Net operating income = ROI × Average operating assets = 40% × $150,000 = $60,000
Margin = Net operating income ÷ Sales
Sales = Net operating income ÷ Margin = $60,000 ÷ 20% = $300,000
41. Average operating assets in Year 1 were:
A. $160,000  
B. $150,000  
C. $125,000  
D. $100,000

Margin = Net operating income ÷ Sales  
Sales = Net operating income ÷ Margin  
$40,000 ÷ 16% = $250,000  
Turnover = Sales ÷ Average operating assets  
Average operating assets = Sales ÷ Turnover  
$250,000 ÷ 2.5 = $100,000

42. Net operating income in Year 2 amounted to:
A. $60,000  
B. $50,000  
C. $40,000  
D. $35,000

ROI in Year 1:
ROI = Margin × Turnover = 16% × 2.5 = 40%
By assumption, the ROI is the same in Year 2 as in Year 1. Therefore, in Year 2:
Net operating income = ROI × Average operating assets = 40% × $150,000 = $60,000

Beall Industries is a division of a major corporation. Last year the division had total sales of $20,160,000, net operating income of $1,592,640, and average operating assets of $8,000,000.
43. The division's margin is closest to:
A. 39.7%
B. 47.6%
C. 7.9%
D. 19.9%

Margin = Net operating income ÷ Sales
= $1,592,640 ÷ $20,160,000 = 7.9%

44. The division's turnover is closest to:
A. 2.52
B. 2.10
C. 0.20
D. 12.66

Turnover = Sales ÷ Average operating assets
= $20,160,000 ÷ $8,000,000 = 2.52
45. The division's return on investment (ROI) is closest to:

A. 19.9%
B. 16.6%
C. 1.6%
D. 5.7%

ROI = Net operating income ÷ Average operating assets
= $1,592,640 ÷ $8,000,000 = 19.9%

The West Division of Shekarchi Corporation had average operating assets of $620,000 and net operating income of $80,100 in March. The minimum required rate of return for performance evaluation purposes is 14%.

46. What was the West Division's minimum required return in March?

A. $80,100
B. $86,800
C. $11,214
D. $98,014

Minimum required return = Average operating assets × Minimum required rate of return
= $620,000 × 14% = $86,800
47. What was the West Division's residual income in March?
A. $-6,700  
B. $6,700  
C. $-11,214  
D. $11,214

<table>
<thead>
<tr>
<th>Net operating income</th>
<th>$80,100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum required return ($620,000 × 14%)</td>
<td>$86,800</td>
</tr>
<tr>
<td>Residual income</td>
<td>$ (6,700)</td>
</tr>
</tbody>
</table>

The Consumer Products Division of Weiter Corporation had average operating assets of $570,000 and net operating income of $65,100 in March. The minimum required rate of return for performance evaluation purposes is 12%.

48. What was the Consumer Products Division's minimum required return in March?
A. $7,812  
B. $76,212  
C. $68,400  
D. $65,100

Minimum required return = Average operating assets × Minimum required rate of return
= $570,000 × 12% = $68,400
49. What was the Consumer Products Division's residual income in March?

A. $-3,300
B. $3,300
C. $-7,812
D. $7,812

| Net operating income | $65,100 |
| Minimum required return ($570,000 \times 12\%) | 68,400 |
| Residual income | $(3,300) |

Estes Company has assembled the following data for its divisions for the past year:

<table>
<thead>
<tr>
<th></th>
<th>Division A</th>
<th>Division B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average operating assets</td>
<td>$500,000</td>
<td>?</td>
</tr>
<tr>
<td>Sales</td>
<td>?</td>
<td>$520,000</td>
</tr>
<tr>
<td>Net operating income</td>
<td>$100,000</td>
<td>$20,300</td>
</tr>
<tr>
<td>Turnover</td>
<td>1.25</td>
<td>4</td>
</tr>
<tr>
<td>Margin</td>
<td>?</td>
<td>3.9%</td>
</tr>
<tr>
<td>Minimum required rate of return</td>
<td>14%</td>
<td>?</td>
</tr>
<tr>
<td>Residual income</td>
<td>?</td>
<td>$6,000</td>
</tr>
</tbody>
</table>
50. Division A's sales are:
A. $400,000  
B. $625,000  
C. $125,000  
D. $200,000

Turnover = Sales ÷ Average operating assets
Sales = Average operating assets × Turnover
= $500,000 × 1.25 = $625,000

51. Division A's residual income is:
A. $20,000
B. $30,000
C. $35,000
D. $45,000

<table>
<thead>
<tr>
<th>Net operating income</th>
<th>$100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum required return ($500,000 × 14%)</td>
<td>70,000</td>
</tr>
<tr>
<td>Residual income</td>
<td>$30,000</td>
</tr>
</tbody>
</table>
52. Division B’s average operating assets is:
A. $81,200  
B. $2,080,000  
C. $1,333,333  
D. $130,000

Turnover = Sales ÷ Average operating assets
Average operating assets = Sales ÷ Turnover
= $520,000 ÷ 4 = $130,000

AACSB: Analytic
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom’s: Application
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI
Learning Objective: 11-02 Compute residual income and understand its strengths and weaknesses
Level: Medium

Operating data from Tindall Company for last year follows:

<table>
<thead>
<tr>
<th>Sales</th>
<th>$900,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stockholders’ equity</td>
<td>$500,000</td>
</tr>
<tr>
<td>Return on investment</td>
<td>12%</td>
</tr>
<tr>
<td>Average operating assets</td>
<td>?</td>
</tr>
<tr>
<td>Turnover</td>
<td>1.5</td>
</tr>
<tr>
<td>Residual income</td>
<td>?</td>
</tr>
<tr>
<td>Minimum required rate of return</td>
<td>10%</td>
</tr>
<tr>
<td>Total assets</td>
<td>$800,000</td>
</tr>
</tbody>
</table>
53. The average operating assets amounted to:
A. $600,000
B. $400,000
C. $500,000
D. $800,000

Turnover = Sales ÷ Average operating assets 
Average operating assets = Sales ÷ Turnover 
= $900,000 ÷ 1.5 = $600,000

54. The residual income was:
A. $18,000
B. $10,000
C. $12,000
D. $16,000

Turnover = Sales ÷ Average operating assets 
Average operating assets = Sales ÷ Turnover 
= $900,000 ÷ 1.5 = $600,000 
ROI = Net operating income + Average operating assets 
Net operating income = ROI × Average operating assets 
= 12% × $600,000 = $72,000

<table>
<thead>
<tr>
<th>Net operating income</th>
<th>$72,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum required return ($600,000 × 10%)</td>
<td>60,000</td>
</tr>
<tr>
<td>Residual income</td>
<td>$12,000</td>
</tr>
</tbody>
</table>
55. The margin used in ROI calculations was closest to:
A. 18.00%
B. 8.00%
C. 6.67%
D. 15.00%

ROI = Margin × Turnover
Margin = ROI ÷ Turnover
= 12% ÷ 1.5 = 8%

The Baily Division recorded operating data as follows for the past two years:

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>?</td>
<td>$1,200,000</td>
</tr>
<tr>
<td>Stockholders’ equity</td>
<td>$540,000</td>
<td>720,000</td>
</tr>
<tr>
<td>Average operating assets</td>
<td>$600,000</td>
<td>?</td>
</tr>
<tr>
<td>Margin</td>
<td>15%</td>
<td>?</td>
</tr>
<tr>
<td>Return on investment</td>
<td>22.5%</td>
<td>18%</td>
</tr>
</tbody>
</table>

Baily Division’s turnover was exactly the same in both Year 1 and Year 2.
56. Sales in Year 1 amounted to:
   A. $400,000  
   B. $900,000  
   C. $750,000  
   D. $1,200,000

Turnover = ROI ÷ Margin = 22.5% ÷ 15% = 1.5
Turnover = Sales ÷ Average operating assets
Sales = Average operating assets × Turnover = $600,000 × 1.5 = $900,000

57. The net operating income in Year 1 was:
   A. $90,000  
   B. $135,000  
   C. $140,000  
   D. $150,000

Turnover = ROI ÷ Margin = 22.5% ÷ 15% = 1.5
Turnover = Sales ÷ Average operating assets
Sales = Average operating assets × Turnover = $600,000 × 1.5 = $900,000
Margin = Net operating income ÷ Sales
Net operating income = Sales × Margin = $900,000 × 15% = $135,000
58. The margin in Year 2 was:
A. 18.75%
B. 27.00%
C. 22.50%
D. 12.00%

Turnover in Year 1 = ROI in Year 1 ÷ Margin in Year 1 = 22.5% ÷ 15% = 1.5
ROI = Margin × Turnover
Margin in Year 2 = ROI in Year 2 ÷ Turnover in Year 2
= ROI in Year 2 ÷ Turnover in Year 1
= 18% ÷ 1.5 = 12%

59. The average operating assets in Year 2 were:
A. $720,000
B. $750,000
C. $800,000
D. $900,000

Turnover in Year 1 = ROI in Year 1 ÷ Margin in Year 1 = 22.5% ÷ 15% = 1.5
Turnover in Year 2 = Sales in Year 2 ÷ Average operating assets in Year 2
Average operating assets in Year 2 = Sales in Year 2 ÷ Turnover in Year 2
= Sales in Year 2 ÷ Turnover in Year 1
= $1,200,000 ÷ 1.5 = $800,000
The following data are available for the South Division of Redride Products, Inc. and the single product it makes:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit selling price</strong></td>
<td>$20</td>
</tr>
<tr>
<td><strong>Variable cost per unit</strong></td>
<td>$12</td>
</tr>
<tr>
<td><strong>Annual fixed costs</strong></td>
<td>$280,000</td>
</tr>
<tr>
<td><strong>Average operating assets</strong></td>
<td>$1,500,000</td>
</tr>
</tbody>
</table>

60. How many units must South sell each year to have an ROI of 16%?

A. 240,000  
B. 1,300,000  
C. 52,000  
D. **65,000**

ROI = \( \frac{\text{Net operating income}}{\text{Average operating assets}} \)

Net operating income = ROI × Average operating assets

= 16% × $1,500,000 = $240,000

Unit sales to attain a target profit = \( \frac{\text{(Target profit + Fixed expenses)}}{\text{Unit CM}} \)

= \( \frac{($240,000 + $280,000)}{($20 \text{ per unit} - $12 \text{ per unit})} \)

= \( \frac{$520,000}{$8 \text{ per unit}} \)

= 65,000 units
61. If South wants a residual income of $50,000 and the minimum required rate of return is 10%, the annual turnover will have to be:

A. 0.32  
B. 0.80  
C. 1.25  
D. 1.50

Turnover = Sales ÷ Average operating assets  
We need to determine the Sales that would generate a residual income of $50,000.  
Residual income = Net operating income - Average operating assets × Minimum required rate of return  
$50,000 = Net operating income - ($1,500,000 × 10%)  
Net operating income = $50,000 + ($1,500,000 × 10%) = $200,000  
Dollar sales to attain a target profit = (Target profit + Fixed expenses) ÷ CM ratio  
= ($200,000 + $280,000) ÷ [(20 per unit - $12 per unit)/$20 per unit]  
= $480,000 ÷ ($8 per unit/$20 per unit)  
= $480,000 ÷ 0.40  
= $1,200,000  
Turnover = Sales ÷ Average operating assets  
= $1,200,000 ÷ $1,500,000 = 0.8

The following data pertain to the Whalen Division of Northern Industries.

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$300,000</td>
<td>$600,000</td>
</tr>
<tr>
<td>Stockholders' equity</td>
<td>$38,000</td>
<td>$400,000</td>
</tr>
<tr>
<td>Average operating assets</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Turnover</td>
<td>6</td>
<td>1.2</td>
</tr>
<tr>
<td>Return on investment</td>
<td>?</td>
<td>9.6%</td>
</tr>
<tr>
<td>Minimum required rate of return</td>
<td>?</td>
<td>7%</td>
</tr>
<tr>
<td>Residual income</td>
<td>$16,000</td>
<td>?</td>
</tr>
</tbody>
</table>

The margin at Whalen was exactly the same in Year 2 as it was in Year 1.
62. The average operating assets for Year 2 amounted to:
A. $400,000
B. $800,000
C. $600,000
D. $500,000

Turnover = Sales ÷ Average operating assets
Average operating assets = Sales ÷ Turnover
= $600,000 ÷ 1.2 = $500,000

63. The return on investment in Year 1 was:
A. 48.00%
B. 32.50%
C. 7.58%
D. 1.92%

ROI = Margin × Turnover
Margin in Year 2 = ROI in Year 2 ÷ Turnover in Year 2
= 9.6% ÷ 1.2 = 8%
ROI in Year 1 = Margin in Year 1 × Turnover in Year 1
ROI in Year 1 = Margin in Year 2 × Turnover in Year 1
= 8% × 6 = 48%
64. The minimum required rate of return in Year 1 was:
   A. 18%
   B. 17%
   C. 16%
   D. 15%

Margin = Net operating income ÷ Sales
Net operating income = Sales × Margin
= $300,000 × 8% = $24,000
ROI = Margin × Turnover
Margin in Year 2 = ROI in Year 2 ÷ Turnover in Year 2
= 9.6% ÷ 1.2 = 8%
ROI in Year 1 = Margin in Year 1 × Turnover in Year 1
ROI in Year 1 = Margin in Year 2 × Turnover in Year 1
= 8% × 6 = 48%
ROI = Net operating income ÷ Average operating assets
48% = $24,000 ÷ Average operating assets
Average operating assets = $24,000 ÷ 48% = $50,000
Residual income = Net operating income - Average operating assets × Minimum required rate of return
$16,000 = $24,000 - $50,000 × Minimum required rate of return
$50,000 × Minimum required rate of return = $24,000 - $16,000
Minimum required rate of return = $8,000 ÷ $50,000 = 16%

Dickinson Products is a division of a major corporation. The following data are for the last year of operations:

<table>
<thead>
<tr>
<th>Sales</th>
<th>$16,640,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net operating income</td>
<td>$399,360</td>
</tr>
<tr>
<td>Average operating assets</td>
<td>$4,000,000</td>
</tr>
<tr>
<td>The company’s minimum required rate of return</td>
<td>18%</td>
</tr>
</tbody>
</table>
65. The division's margin is closest to:
A. 26.4%
B. 10.0%
C. 2.4%
D. 24.0%

Margin = Net operating income ÷ Sales
= $399,360 ÷ $16,640,000 = 2.4%

66. The division's turnover is closest to:
A. 3.78
B. 41.67
C. 4.16
D. 0.10

Turnover = Sales ÷ Average operating assets
= $16,640,000 ÷ $4,000,000 = 4.16
67. The division's return on investment (ROI) is closest to:
A. 0.2%
B. 41.6%
C. 10.0%
D. 1.9%

ROI = Net operating income ÷ Average operating assets
= $399,360 ÷ $4,000,000 = 9.984%

68. The division's residual income is closest to:
A. $(320,640)
B. $1,119,360
C. $399,360
D. $(2,595,840)

<table>
<thead>
<tr>
<th>Net operating income</th>
<th>$399,360</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum required return ($4,000,000 × 18%)</td>
<td>720,000</td>
</tr>
<tr>
<td>Residual income</td>
<td>$(320,640)</td>
</tr>
</tbody>
</table>

Chace Products is a division of a major corporation. Last year the division had total sales of $21,300,000, net operating income of $575,100, and average operating assets of $5,000,000. The company’s minimum required rate of return is 12%.
69. The division's margin is closest to:
A. 26.2%
B. 23.5%
C. 2.7%
D. 11.5%

Margin = Net operating income ÷ Sales = $575,100 ÷ $21,300,000 = 2.7%

AACSB: Analytic  
AICPA BB: Critical Thinking  
AICPA FN: Measurement  
Bloom's: Application  
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI  
Level: Easy

70. The division's turnover is closest to:
A. 3.82
B. 4.26
C. 0.12
D. 37.04

Turnover = Sales ÷ Average operating assets = $21,300,000 ÷ $5,000,000 = 4.26

AACSB: Analytic  
AICPA BB: Critical Thinking  
AICPA FN: Measurement  
Bloom's: Application  
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI  
Level: Easy
71. The division's return on investment (ROI) is closest to:
A. 49.0%
B. 11.5%
C. 0.3%
D. 2.2%

\[
\text{ROI} = \frac{\text{Net operating income}}{\text{Average operating assets}}
\]
\[
= \frac{$575,100}{$5,000,000} = 11.502\%
\]

AACSB: Analytic
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Application
Learning Objective: 11-01 Compute return on investment (ROI) and show how changes in sales; expenses; and assets affect ROI
Level: Easy

72. The division's residual income is closest to:
A. $575,100
B. $1,175,100
C. $(1,980,900)
D. $(24,900)

<table>
<thead>
<tr>
<th>Net operating income</th>
<th>$575,100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum required return</td>
<td>$600,000</td>
</tr>
<tr>
<td>Residual income</td>
<td>$(24,900)</td>
</tr>
</tbody>
</table>

AACSB: Analytic
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Application
Learning Objective: 11-02 Compute residual income and understand its strengths and weaknesses
Level: Easy

Diorio Corporation keeps careful track of the time required to fill orders. The times recorded for a particular order appear below:

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move time</td>
</tr>
<tr>
<td>Wait time</td>
</tr>
<tr>
<td>Queue time</td>
</tr>
<tr>
<td>Process time</td>
</tr>
<tr>
<td>Inspection time</td>
</tr>
</tbody>
</table>
73. The delivery cycle time was:
A. 29.1 hours
B. 30.6 hours
C. 8 hours
D. 2.7 hours

Throughput time = Process time + Inspection time + Move time + Queue time
= 1.4 hours + 0.1 hours + 2.7 hours + 5.3 hours = 9.5 hours
Delivery cycle time = Wait time + Throughput time
= 21.1 hours + 9.5 hours = 30.6 hours

74. The throughput time was:
A. 4.2 hours
B. 9.5 hours
C. 30.6 hours
D. 26.4 hours

Throughput time = Process time + Inspection time + Move time + Queue time
= 1.4 hours + 0.1 hours + 2.7 hours + 5.3 hours = 9.5 hours
75. The manufacturing cycle efficiency (MCE) was closest to:
   A. 0.15
   B. 0.05
   C. 0.45
   D. 0.18

Throughput time = Process time + Inspection time + Move time + Queue time
= 1.4 hours + 0.1 hours + 2.7 hours + 5.3 hours = 9.5 hours
MCE = Value-added time (Process time) ÷ Throughput (manufacturing cycle) time
= 1.4 hours ÷ 9.5 hours = 0.15

Hart Manufacturing operates an automated steel fabrication process. For one operation, Hart has found that 45% of the total throughput (manufacturing cycle) time is spent on non-value-added activities. Delivery cycle time is 12 hours, waiting time during the production process is 3 hours, queue time prior to starting the production process is 2 hours, and inspection time is 1.2 hours.

76. The manufacturing cycle efficiency (MCE) for this operation is:
   A. 55%
   B. 45%
   C. 6.6 hours
   D. 5.4 hours

Percentage of time spent on non-value-added activities = 100% - MCE
45% = 100% - MCE
MCE = 100% - 45% = 55%
77. What is the move time recorded for the operation?
A. 1.5 hours  
B. 6.5 hours  
C. 5.8 hours  
D. 0.85 hours

Delivery cycle time = Wait time + Throughput time  
12 hours = 3 hours + Throughput time  
Throughput time = 12 hours - 3 hours = 9 hours  
Percentage of time spent on non-value-added activities = 100% - MCE  
45% = 100% - MCE  
MCE = 100% - 45% = 55%  
MCE = Value-added time (Process time) ÷ Throughput (manufacturing cycle) time  
55% = Process time ÷ 9 hours  
Process time = 9 hours × 55% = 4.95 hours  
Throughput time = Process time + Inspection time + Move time + Queue time  
9.00 hours = 4.95 hours + 1.20 hours + Move time + 2.00 hours  
Move time = 9.00 hours - (4.95 hours + 1.20 hours + 2.00 hours)  
= 9.00 hours - 8.15 hours = 0.85 hours

AACSB: Analytic  
AICPA BB: Critical Thinking  
AICPA FN: Measurement  
Bloom's: Application  
Learning Objective: 11-03 Compute delivery cycle time; throughput time; and manufacturing cycle efficiency (MCE)  
Level: Hard

78. What is the throughput (manufacturing cycle) time for the operation?
A. 12.0 hours  
B. 9.0 hours  
C. 10.0 hours  
D. 5.8 hours

Delivery cycle time = Wait time + Throughput time  
12 hours = 3 hours + Throughput time  
Throughput time = 12 hours - 3 hours = 9 hours

AACSB: Analytic  
AICPA BB: Critical Thinking  
AICPA FN: Measurement  
Bloom's: Application  
Learning Objective: 11-03 Compute delivery cycle time; throughput time; and manufacturing cycle efficiency (MCE)  
Level: Hard
Saffer Corporation keeps careful track of the time required to fill orders. Data concerning a particular order appear below:

<table>
<thead>
<tr>
<th>Time Type</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wait time</td>
<td>21.6</td>
</tr>
<tr>
<td>Process time</td>
<td>1.6</td>
</tr>
<tr>
<td>Inspection time</td>
<td>0.2</td>
</tr>
<tr>
<td>Move time</td>
<td>3.1</td>
</tr>
<tr>
<td>Queue time</td>
<td>4.4</td>
</tr>
</tbody>
</table>

79. The throughput time was:

A. 9.3 hours  
B. 4.9 hours  
C. 30.9 hours  
D. 26 hours

Throughput time = Process time + Inspection time + Move time + Queue time
= 1.6 hours + 0.2 hours + 3.1 hours + 4.4 hours = 9.3 hours

80. The manufacturing cycle efficiency (MCE) was closest to:

A. 0.17  
B. 0.05  
C. 0.43  
D. 0.19

MCE = Value-added time (Process time) ÷ Throughput (manufacturing cycle) time
= 1.6 hours ÷ 9.3 hours = 0.17
81. The delivery cycle time was:
   A. 7.5 hours  
   B. 29.1 hours  
   C. 30.9 hours  
   D. 3.1 hours

Delivery cycle time = Wait time + Throughput time
= 21.6 hours + 9.3 hours = 30.9 hours

Essay Questions

82. Heavey Fabrication is a division of a major corporation. Last year the division had total sales of $21,120,000, net operating income of $2,006,400, and average operating assets of $6,000,000. The company's minimum required rate of return is 12%.
Required:
What is the division's return on investment (ROI)?

ROI = Net operating income ÷ Average operating assets = $2,006,400 ÷ $6,000,000 = 33.4%
83. Gilde Industries is a division of a major corporation. Last year the division had total sales of $23,380,000, net operating income of $2,828,980, and average operating assets of $7,000,000. The company's minimum required rate of return is 12%.

Required:

a. What is the division's margin?
b. What is the division's turnover?
c. What is the division's return on investment (ROI)?

a. Margin = Net operating income ÷ Sales = $2,828,980 ÷ $23,380,000 = 12.1%
b. Turnover = Sales ÷ Average operating assets = $23,380,000 ÷ $7,000,000 = 3.3
c. ROI = Net operating income ÷ Average operating assets = $2,828,980 ÷ $7,000,000 = 40.4%

84. Ferris Wares is a division of a major corporation. The following data are for the latest year of operations:

<table>
<thead>
<tr>
<th>Sales</th>
<th>$12,700,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net operating income</td>
<td>$1,054,100</td>
</tr>
<tr>
<td>Average operating assets</td>
<td>$5,000,000</td>
</tr>
<tr>
<td>The company’s minimum required rate of return</td>
<td>16%</td>
</tr>
</tbody>
</table>

Required:

a. What is the division's return on investment (ROI)?
b. What is the division's residual income?

a. ROI = Net operating income ÷ Average operating assets = $1,054,100 ÷ $5,000,000 = 21.1%
b. Residual income = Net operating income - Average operating assets × Minimum required rate of return = $1,054,100 - $5,000,000 × 16% = $1,054,100 - $800,000 = $254,100
85. Financial data for Windsor, Inc. for last year appear below:

<table>
<thead>
<tr>
<th>Windsor, Inc. Statements of Financial Position</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Assets:</strong></td>
</tr>
<tr>
<td>Cash</td>
</tr>
<tr>
<td>$250,000</td>
</tr>
<tr>
<td>$260,000</td>
</tr>
<tr>
<td>Accounts receivable</td>
</tr>
<tr>
<td>120,000</td>
</tr>
<tr>
<td>135,000</td>
</tr>
<tr>
<td>Inventory</td>
</tr>
<tr>
<td>230,000</td>
</tr>
<tr>
<td>205,000</td>
</tr>
<tr>
<td>Plant and equipment (net)</td>
</tr>
<tr>
<td>420,000</td>
</tr>
<tr>
<td>380,000</td>
</tr>
<tr>
<td>Investment in Pine Company</td>
</tr>
<tr>
<td>220,000</td>
</tr>
<tr>
<td>250,000</td>
</tr>
<tr>
<td>Land (undeveloped)</td>
</tr>
<tr>
<td>430,000</td>
</tr>
<tr>
<td>430,000</td>
</tr>
<tr>
<td>Total assets</td>
</tr>
<tr>
<td>$1,670,000</td>
</tr>
<tr>
<td>$1,660,000</td>
</tr>
</tbody>
</table>

| Liabilities and owners’ equity:              |
| Accounts payable                            |
| $160,000                                     |
| $140,000                                     |
| Long-term debt                              |
| 800,000                                      |
| 800,000                                      |
| Owners’ equity                              |
| 710,000                                      |
| 720,000                                      |
| Total liabilities and owners’ equity         |
| $1,670,000                                   |
| $1,660,000                                   |

<table>
<thead>
<tr>
<th>Windsor, Inc. Income Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Sales</strong></td>
</tr>
<tr>
<td>$1,750,000</td>
</tr>
<tr>
<td><strong>Less operating expenses</strong></td>
</tr>
<tr>
<td>1,470,000</td>
</tr>
<tr>
<td><strong>Net operating income</strong></td>
</tr>
<tr>
<td>280,000</td>
</tr>
<tr>
<td><strong>Less interest and taxes:</strong></td>
</tr>
<tr>
<td>Interest expense</td>
</tr>
<tr>
<td>$96,000</td>
</tr>
<tr>
<td>Tax expense</td>
</tr>
<tr>
<td>70,000</td>
</tr>
<tr>
<td>$166,000</td>
</tr>
<tr>
<td><strong>Net income</strong></td>
</tr>
<tr>
<td>$114,000</td>
</tr>
</tbody>
</table>

The company paid dividends of $104,000 last year. The "Investment in Pine Company" on the statement of financial position represents an investment in the stock of another company. Required:

a. Compute the company's margin, turnover, and return on investment for last year.

b. The Board of Directors of Windsor, Inc. has set a minimum required return of 25%. What was the company's residual income last year?
a. Operating assets do not include investments in other companies or in undeveloped land.

<table>
<thead>
<tr>
<th></th>
<th>Beginning Balance</th>
<th>Ending Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>$ 250,000</td>
<td>$260,000</td>
</tr>
<tr>
<td>Accounts receivable</td>
<td>120,000</td>
<td>135,000</td>
</tr>
<tr>
<td>Inventory</td>
<td>230,000</td>
<td>205,000</td>
</tr>
<tr>
<td>Plant and equipment (net)</td>
<td>420,000</td>
<td>380,000</td>
</tr>
<tr>
<td>Total operating assets</td>
<td>$1,020,000</td>
<td>$980,000</td>
</tr>
</tbody>
</table>

Average operating assets = ($1,020,000 + $980,000) ÷ 2 = $1,000,000

Margin = Net operating income ÷ Sales = $280,000 ÷ $1,750,000 = 16%

Turnover = Sales ÷ Average operating assets = $1,750,000 ÷ $1,000,000 = 1.75

ROI = Margin × Turnover = 16% ÷ 1.75 = 28%

b. Residual income = Net operating income - Average operating assets × Minimum required rate of return = $280,000 - ($1,000,000 × 25%) = $280,000 - $250,000 = $30,000
86. Eckels Wares is a division of a major corporation. The following data are for the latest year of operations:

<table>
<thead>
<tr>
<th></th>
<th>$24,900,000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sales</strong></td>
<td>$24,900,000</td>
</tr>
<tr>
<td><strong>Net operating income</strong></td>
<td>$1,319,700</td>
</tr>
<tr>
<td><strong>Average operating assets</strong></td>
<td>$6,000,000</td>
</tr>
<tr>
<td><strong>The company’s minimum required rate of return</strong></td>
<td>12%</td>
</tr>
</tbody>
</table>

Required:

a. What is the division's margin?
b. What is the division's turnover?
c. What is the division's return on investment (ROI)?
d. What is the division's residual income?

a. Margin = Net operating income ÷ Sales = $1,319,700 ÷ $24,900,000 = 5.3%
b. Turnover = Sales ÷ Average operating assets = $24,900,000 ÷ $6,000,000 = 4.2
c. ROI = Net operating income ÷ Average operating assets = $1,319,700 ÷ $6,000,000 = 22.0%
d. Residual income = Net operating income - Average operating assets × Minimum required rate of return = $1,319,700 - $6,000,000 × 12% = $1,319,700 - $720,000 = $599,700
87. Iles Industries is a division of a major corporation. The following data are for the latest year of operations:

<table>
<thead>
<tr>
<th>Sales</th>
<th>$20,760,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net operating income</td>
<td>$2,553,480</td>
</tr>
<tr>
<td>Average operating assets</td>
<td>$6,000,000</td>
</tr>
<tr>
<td>The company’s minimum required rate of return</td>
<td>16%</td>
</tr>
</tbody>
</table>

Required:
What is the division's residual income?

Residual income = Net operating income - Average operating assets \times Minimum required rate of return

= $2,553,480 - $6,000,000 \times 16% = $2,553,480 - $960,000 = $1,593,480

88. The Casket Division of Rosencranz Corporation had average operating assets of $150,000 and net operating income of $27,800 in March. The company uses residual income to evaluate the performance of its divisions, with a minimum required rate of return of 17%.

Required:
What was the Casket Division's residual income in March?

<table>
<thead>
<tr>
<th>Net operating income</th>
<th>$27,800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum required return ($150,000 \times 17%)</td>
<td>25,500</td>
</tr>
<tr>
<td>Residual income</td>
<td>$2,300</td>
</tr>
</tbody>
</table>
89. Madrazo Corporation uses residual income to evaluate the performance of its divisions. The minimum required rate of return for performance evaluation purposes is 19%. The Games Division had average operating assets of $410,000 and net operating income of $86,000 in June.

Required:
What was the Games Division's residual income in June?

<table>
<thead>
<tr>
<th>Net operating income</th>
<th>$86,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum required return ($410,000 × 19%)</td>
<td>77,900</td>
</tr>
<tr>
<td>Residual income</td>
<td>$8,100</td>
</tr>
</tbody>
</table>

AACSB: Analytic
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Application
Learning Objective: 11-02 Compute residual income and understand its strengths and weaknesses
Level: Easy
Chapter 11 - Performance Measurement in Decentralized Organizations

90. Jaster Corporation’s management keeps track of the time it takes to process orders. During the most recent month, the following average times were recorded per order:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wait time</td>
<td>10.6</td>
</tr>
<tr>
<td>Inspection time</td>
<td>0.2</td>
</tr>
<tr>
<td>Process time</td>
<td>2.6</td>
</tr>
<tr>
<td>Move time</td>
<td>0.6</td>
</tr>
<tr>
<td>Queue time</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Required:
a. Compute the throughput time.
b. Compute the manufacturing cycle efficiency (MCE).
c. What percentage of the production time is spent in non-value-added activities?
d. Compute the delivery cycle time.

a. Throughput time
   = Process time + Inspection time + Move time + Queue time
   = 2.6 days + 0.2 days + 0.6 days + 3.2 days = 6.6 days
b. MCE = Value-added time (Process time) ÷ Throughput time
   = 2.6 days ÷ 6.6 days = 0.39
c. Percentage of time spent on non-value-added activities
   = 100% - MCE% = 100% - 39% = 61%
d. Delivery cycle time = Wait time + Throughput time
   = 10.6 days + 6.6 days = 17.2 days

AACSB: Analytic
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom’s: Application
Learning Objective: 11-03 Compute delivery cycle time; throughput time; and manufacturing cycle efficiency (MCE)
Level: Easy
91. During the most recent month at Coggan Corporation, queue time was 5.3 days, inspection time was 0.5 day, process time was 1.9 days, wait time was 4.5 days, and move time was 0.5 day.

Required:
a. Compute the throughput time.
b. Compute the manufacturing cycle efficiency (MCE).
c. What percentage of the production time is spent in non-value-added activities?
d. Compute the delivery cycle time.

a. Throughput time
   = Process time + Inspection time + Move time + Queue time
   = 1.9 days + 0.5 days + 0.5 days + 5.3 days = 8.2 days
b. MCE = Value-added time (Process time) ÷ Throughput time
   = 1.9 days ÷ 8.2 days = 0.23
c. Percentage of time spent on non-value-added activities
   = 100% - MCE% = 100% - 23% = 77%
d. Delivery cycle time = Wait time + Throughput time
   = 4.5 days + 8.2 days = 12.7 days
92. Durkee Corporation keeps careful track of the time required to fill orders. The times required for a particular order appear below:

<table>
<thead>
<tr>
<th>Time Type</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wait time</td>
<td>10.7</td>
</tr>
<tr>
<td>Process time</td>
<td>0.9</td>
</tr>
<tr>
<td>Inspection time</td>
<td>0.4</td>
</tr>
<tr>
<td>Move time</td>
<td>2.3</td>
</tr>
<tr>
<td>Queue time</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Required:

a. Determine the throughput time. Show your work!

b. Determine the manufacturing cycle efficiency (MCE). Show your work!

c. Determine the delivery cycle time. Show your work!

a. Throughput time
   = Process time + Inspection time + Move time + Queue time
   = 0.9 hours + 0.4 hours + 2.3 hours + 4.5 hours
   = 8.1 hours

b. MCE = Value-added time/Throughput time
   = 0.9 hours ÷ 8.1 hours = 0.11

c. Delivery cycle time = Wait time + Throughput time
   = 10.7 hours + 8.1 hours = 18.8 hours
93. Waltner Corporation's management reports that its average delivery cycle time is 20.0 days, its average throughput time is 7.5 days, its manufacturing cycle efficiency (MCE) is 0.32, its average move time is 0.2 day, and its average queue time is 4.0 days.

Required:

a. What is the wait time?
b. What is the process time?
c. What is the inspection time?

a. Delivery cycle time = Wait time + Throughput time
   20.0 days = Wait time + 7.5 days
   Wait time = 20.0 days - 7.5 days = 12.5 days

b. MCE = Process time ÷ Throughput time
   0.32 = Process time ÷ 7.5 days
   Process time = 0.32 × 7.5 days = 2.4 days

c. Throughput time = Process time + Inspection time + Move time + Queue time
   7.5 days = 2.4 days + Inspection time + 0.2 days + 4.0 days
   Inspection time = 7.5 days - 2.4 days - 0.2 days - 4.0 days = 0.9 days

AACSB: Analytic
AICPA BB: Critical Thinking
AICPA FN: Measurement
Bloom's: Application
Learning Objective: 11-03 Compute delivery cycle time; throughput time; and manufacturing cycle efficiency (MCE)
Level: Hard