SOLUTIONS TO SELECTED PROBLEMS

Student: You should work the problem completely before referring to the solution.

CHAPTER 8

Solutions included for problems 1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40, and 43

8.1  (a) The rate of return on the increment has to be larger than 18%.
     (b) The rate of return on the increment has to be smaller than 10%.

8.4 The rate of return on the increment of investment is less than 0.

8.7  (a) Incremental investment analysis is not required. Alternative X should be selected because the rate of return on the increment is known to be lower than 20%
     (b) Incremental investment analysis is not required because only Alt Y has ROR greater than the MARR
     (c) Incremental investment analysis is not required. Neither alternative should be selected because neither one has a ROR greater than the MARR.
     (d) The ROR on the increment is less than 26%, but an incremental investment analysis is required to determine if the rate of return on the increment equals or exceeds the MARR of 20%
     (e) Incremental investment analysis is not required because it is known that the ROR on the increment is greater than 22%.

8.10

<table>
<thead>
<tr>
<th>Year</th>
<th>Machine A</th>
<th>Machine B</th>
<th>B – A</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-15,000</td>
<td>-25,000</td>
<td>-10,000</td>
</tr>
<tr>
<td>1</td>
<td>-1,600</td>
<td>-400</td>
<td>+1200</td>
</tr>
<tr>
<td>2</td>
<td>-1,600</td>
<td>-400</td>
<td>+1200</td>
</tr>
<tr>
<td>3</td>
<td>-15,000 – 1600 + 3000</td>
<td>-400</td>
<td>+13,200</td>
</tr>
<tr>
<td>4</td>
<td>-1,600</td>
<td>-400</td>
<td>+1200</td>
</tr>
<tr>
<td>5</td>
<td>-1,600</td>
<td>-400</td>
<td>+1200</td>
</tr>
<tr>
<td>6</td>
<td>+3000 – 1600</td>
<td>+6000 – 400</td>
<td>+4200</td>
</tr>
</tbody>
</table>

8.13  (a) Find rate of return on incremental cash flow.
      
      \[ 0 = -3000 – 200(P/A,i,3) + 4700(P/F,i,3) \]
      
      \[ i = 10.4\% \]  (Excel)

      (b) Incremental ROR is less than MARR; select Ford.
8.16  \[ 0 = -10,000 + 1200(P/A,i,4) + 12,000(P/F,i,2) + 1000(P/F,i,4) \]

Solve for \( i \) by trial and error or Excel
\[ i = 30.3\% \quad (Excel) \]
Select machine B.

8.19  Find \( P \) to yield exactly 50% and the take difference.
\[ 0 = -P + 400,000(P/F,i,1) + 600,000(P/F,i,2) + 850,000(P/F,i,3) \]
\[ P = 400,000(0.6667) + 600,000(0.4444) + 850,000(0.2963) \]
\[ = 785,175 \]

Difference = 900,000 – 785,175
\[ = 114,825 \]

8.22  Find ROR for incremental cash flow over LCM of 4 years
\[ 0 = -50,000(A/P,i,4) + 5000 + (40,000 – 5000)(P/F, i,2)(A/P, i,4) + 2000(A/F,i,4) \]

Solve for \( i \) by trial and error or Excel
\[ i = 6.1\% \quad (Excel) \]
\( i < MARR \); select semiautomatic machine

8.25  Find ROR on increment of investment.
\[ 0 = -500,000(A/P,i,10) + 60,000 \]
\[ i = 3.5\% < MARR \]
Select design 1A

8.28  (a)  A vs DN:  \[ 0 = -30,000(A/P,i,8) + 4000 + 1000(A/F,i,8) \]
Solve for \( i \) by trial and error or Excel
\[ i = 2.1\% \quad (Excel) \]
Method A is not acceptable

B vs DN:  \[ 0 = - 36,000(A/P,i,8) + 5000 + 2000(A/F,i,8) \]
Solve for \( i \) by trial and error or Excel
\[ i = 3.4\% \quad (Excel) \]
Method B is not acceptable

C vs DN:  \[ 0 = - 41,000(A/P,i,8) + 8000 + 500(A/F,i,8) \]
Solve for \( i \) by trial and error or Excel
\[ i = 11.3\% \quad (Excel) \]
Method C is acceptable
8.28 (cont)

D vs DN: 0 = -53,000(A/P,i,8) + 10,500 - 2000(A/F,i,8)
Solve for i by trial and error or Excel
i = 11.1% (Excel)
Method D is acceptable

(b) A vs DN: 0 = -30,000(A/P,i,8) + 4000 + 1000(A/F,i,8)
Solve for i by trial and error or Excel
i = 2.1% (Excel)
Eliminate A

B vs DN: 0 = -36,000(A/P,i,8) + 5000 + 2000(A/F,i,8)
Solve for i by trial and error or Excel
i = 3.4% (Excel)
Eliminate B

C vs DN: 0 = -41,000(A/P,i,8) + 8000 + 500(A/F,i,8)
Solve for i by trial and error or Excel
i = 11.3% (Excel)
Eliminate DN

C vs D: 0 = -12,000(A/P,i,8) + 2,500 - 2500(A/F,i,8)
Solve for i by trial and error or Excel
i = 10.4% (Excel)
Eliminate D

Select method C

8.31 (a) Select all projects whose ROR > MARR of 15%. Select A, B, and C
(b) Eliminate alternatives with ROR < MARR; compare others incrementally:
   Eliminate D and E
   Rank survivors according to increasing first cost: B, C, A
   B vs C: i = 800/5000
           = 16% > MARR Eliminate B
   C vs A: i = 200/5000
           = 4% < MARR Eliminate A

Select project C
8.34 (a) Find ROR for each increment of investment:

\[ \text{E vs F: } 20,000(0.20) + 10,000(i) = 30,000(0.35) \]
\[ i = 65\% \]

\[ \text{E vs G: } 20,000(0.20) + 30,000(i) = 50,000(0.25) \]
\[ i = 28.3\% \]

\[ \text{E vs H: } 20,000(0.20) + 60,000(i) = 80,000(0.20) \]
\[ i = 20\% \]

\[ \text{F vs G: } 30,000(0.35) + 20,000(i) = 50,000(0.25) \]
\[ i = 10\% \]

\[ \text{F vs H: } 30,000(0.35) + 50,000(i) = 80,000(0.20) \]
\[ i = 11\% \]

\[ \text{G vs H: } 50,000(0.25) + 30,000(i) = 80,000(0.20) \]
\[ i = 11.7\% \]

(b) Revenue = A = Pi

E: A = 20,000(0.20) = $4000
F: A = 30,000(0.35) = $10,500
G: A = 50,000(0.25) = $12,500
H: A = 80,000(0.20) = $16,000

(c) Conduct incremental analysis using results from part (a):

E vs DN: i = 20\% > MARR, eliminate DN
E vs F: i = 65\% > MARR, eliminate E
F vs G: i = 10\% < MARR, eliminate G
F vs H: i = 11\% < MARR, eliminate H
Select Alternative F

(d) Conduct incremental analysis using results from part (a).

E vs DN: i = 20\% >MARR, eliminate DN
E vs F: i = 65\% > MARR, eliminate E
F vs G: i = 10\% < MARR, eliminate G
F vs H: i = 11\% = MARR, eliminate F

Select alternative H
8.34 (cont)
(e) Conduct incremental analysis using results from part (a).

- E vs DN: \( i = 20\% \) > MARR, eliminate DN
- E vs F: \( i = 65\% \) > MARR, eliminate E
- F vs G: \( i = 10\% \) < MARR, eliminate G
- F vs H: \( i = 11\% \) < MARR, eliminate H

Select F as first alternative; compare remaining alternatives incrementally.

- E vs DN: \( i = 20\% \) > MARR, eliminate DN
- E vs G: \( i = 28.3\% \) > MARR, eliminate E
- G vs H: \( i = 11.7\% \) < MARR, eliminate H

Select alternatives F and G

8.37  Answer is (c)
8.40  Answer is (d)
8.43  Answer is (b)