Chapter 7 Rate of Return Analysis

7.1 (d)  
Given: cash flow series, rate of return = 15%, \( N = 3 \) years  
Find: \( X \)  
Approach: If the rate of return is known to be 15%, the net present value of the cash flow series at this rate of return should be zero.

\[
0 = -50,000 + X (P/A, 15\%, 3) + 10,000(P/F, 15\%, 3)
\]

\[
2.2832X = 43,425
\]

\[
X = 19,020
\]

7.2: (d)  
Given: \( P = 100, F = 33.50, N = 3 \) years  
Find: \( i^* \)  
Approach: Use the \((F/P, i, N)\) factor to establish equivalence between \( P \) and \( F \).

\[
100(F/P, i, 3) = 337.50
\]

\[
100(1+i)^3 = 337.50
\]

\[
i = 50\%
\]

7.3: (b)  
Given: cash flow series, \( N = 3 \) years  
Find: \( i^* \)  
Approach: Note that the project is a nonsimple investment as there are more than one sign changes in the net cash flow series. This indicates the possibility of having multiple rates of return. In fact, there are two rates of return—(38.61%,-61.93%).

The correct answer is (b).

7.4: (c)  
Given: cash flow series, \( N = \infty \) years  
Find: rate of return  
Approach: Since we are dealing with an infinite cash flow stream, use the capitalized equivalent worth formula, which is \( A/i \).
\[ CE(i) = \frac{A}{i} \]

\[
\begin{align*}
15,459 &= \frac{3,000}{i} \\
i &= 19.41\%
\end{align*}
\]

**7.5: (a)**

*Given:* \( I = 150,000, S = 0, \) annual O&M costs = $60,000, rate of return = 15%, \( N = 10 \) years  
*Find:* required maximum investment to achieve a 15% rate of return  
*Approach:* If the rate of return is known to be 15%, the total equivalent value of operating cash flows is  
Equivalent net savings at \( n = 0 \):
\[
PW(15\%) = (60,000)(A/P,15\%,10) = 301,120
\]

Scale of investment to breakeven = $301,120

**7.6: (a)**

*Given:* two cash flow series, \( N = 2 \) years  
*Find:* the range of MARR where Project 2 is preferred  
*Approach:* First create an incremental investment cash flow series by subtracting Project 1 from Project 2. Then determine the rate of return on this incremental investment.

\[
\begin{array}{c|c}
\text{Cash Flows} (2 - 1) & \\
\hline
0 & -800 \\
1 & 900 \\
2 & 0 \\
\end{array}
\]

\( IRR_{2-1} = 12.5\% \), indicating that Project 2 would be preferred over Project 1 when MARR < 12.5%. The correct answer is (a).

**7.7: (d)**

*Given:* financial facts  
*Find:* the correct statement  
*Approach:* Each project must be justified on its own merit. That is, the rate of return must exceed 20%. Since both projects fail to meet this requirement, the correct answer is (d).
7.8: (e)

Given: cash flow series, MARR = 10%, N = 4 years
Find: the incorrect statement
Approach: If the rate of return is known to be 10%, the net present value of the cash flow series at this rate of return should be zero.

\[ FW(10\%) = -100(F / P, 10\%, 4) + 20(F / P, 10\%, 3) + 49(F / P, 10\%, 2) + 25(F / P, 10\%, 1) + 33 \]

\[ \equiv 0 \]

\[ PW(10\%) = AE(10\%) = 0 \]

The incorrect statement is (c). The project’s IRR is 10%.

7.9: (c)

Given: two cash flow series with known IRRs, N = 3 years
Find: the correct statement
Approach: When we compare mutually exclusive investment projects based on the rate of return principle, we must apply the incremental analysis.

<table>
<thead>
<tr>
<th>n</th>
<th>Project A</th>
<th>Project B</th>
<th>Project B – Project A</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-3,000</td>
<td>-5,000</td>
<td>-2,000</td>
</tr>
<tr>
<td>1</td>
<td>1,350</td>
<td>1,350</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1,800</td>
<td>1,800</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>1,500</td>
<td>5,406</td>
<td>3,906</td>
</tr>
<tr>
<td>IRR</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
</tr>
</tbody>
</table>

The correct answer is (c), as Project B would be preferred over Project A as long as the MARR is less than 15%.

7.10: (c)

Given: two mutually exclusive projects and its incremental cash flows
Find: the correct statement
Approach: Note that if the airport’s MARR exceeds 5%, Vendor A is no longer viable option. If MARR > 7%, both vendors are eliminated.

The correct statement is (c).