SOLUTIONS TO SELECTED PROBLEMS

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

CHAPTER 10

Solutions included for: 2, 5, 8, 11, 12, 14, 16, 20, 23, 24, 27, 29, 32, 35, 38, 41, 44, and 46

10.2 Incremental cash flow analysis is mandatory for the ROR method and B/C method. (See Table 10.2 and Section 10.1 for comments.)

10.5 (a) Hand solution: Choose the AW or PW method at 0.5% for equal lives over 60 months.

Computer solution: Either the PMT function or the PV function can give single-cell solutions for each alternative.

(b) The B/C method was the evaluation method in chapter 9, so rework it using AW.

Hand solution: Find the AW for each cash flow series on a per household per month basis.

\[ AW_1 = 1.25 - 60(A/P,0.5\%,60) \]
\[ = 0.09 \]

\[ AW_2 = 8.00 - 500(A/P,0.5\%,60) \]
\[ = -1.67 \]

Select program 1

10.8 (a) Bonds are debt financing
(b) Stocks are always equity
(c) Equity
(d) Equity loans are debt financing, like house mortgage loans

10.11 (a) Select 2. It is the alternative investing the maximum available with incremental \( i^* > 9\% \)
(b) Select 3
(c) Select 3
(d) MARR = 10\% for alternative 4 is opportunity cost at $400,000 level
10.14 (a) Calculate the two WACC values.

\[
WACC_1 = 0.6(12\%) + 0.4(9\%) = 10.8\%
\]

\[
WACC_2 = 0.2(12\%) + 0.8(12.5\%) = 12.4\%
\]

Use approach 1, with a D-E mix of 40%-60%

(b) Let \(x_1\) and \(x_2\) be the maximum costs of debt capital.

Alternative 1: \(10\% = WACC_1 = 0.6(12\%) + 0.4(x_1)\)

\[
x_1 = \frac{10\% - 0.6(12\%)}{0.4} = 7\%
\]

Debt capital cost would have to decrease from 9\% to 7\%.

Alternative 2: \(10\% = WACC_2 = 0.2(12\%) + 0.8(x_2)\)

\[
x_2 = \frac{10\% - 0.2(12\%)}{0.8} = 9.5\%
\]

Debt capital cost would, again, have to decrease; now from 12.5\% to 9.5\%.

10.16 WACC = cost of debt capital + cost of equity capital

\[
= (0.4)[0.667(8\%) + 0.333(10\%)] + (0.6)[(0.4)(5\%) + (0.6)(9\%)]
\]

= 7.907\%

10.20 Before-taxes: WACC = 0.4(9\%) + 0.6(12\%) = 10.8\% per year

After-tax:

After-tax WACC = (equity)(equity rate) + (debt)(before-tax debt rate)(1–\(T_e\))

\[
= 0.4(9\%) + 0.6(12\%)(1-0.35)
\]

= 8.28\% per year

10.23 Equity cost of capital is stated as 6\%.

Debt cost of capital benefits from tax savings.

Before-tax bond annual interest = 4 million (0.08) = $320,000

Annual bond interest NCF = 320,000(1 – 0.4) = $192,000

Effective quarterly dividend = 192,000/4 = $48,000

Find quarterly \(i^*\) using a PW relation.

\[
0 = 4,000,000 - 48,000(P/A,i^*,40) - 4,000,000(P/F,i^*,40)
\]

\[
i^* = 1.2\% per quarter = 4.8\% per year (nominal)
\]

Debt financing at 4.8\% per year is cheaper than equity funds at 6\% per year.

(Note: The correct answer is also obtained if the before-tax debt cost of 8\% is used to estimate the after-tax debt cost of 8\%(1 - 0.4) = 4.8\%).
10.24 (a) **Bank loan:**

Annual loan payment = 800,000 \((A/P, 8\%, 8)\) = $139,208
Principal payment = 800,000/8 = $100,000
Annual interest = 139,208 – 100,000 = $39,208
Tax saving = 39,208(0.40) = $15,683
Effective interest payment = 39,208 – 15,683 = $23,525
Effective annual payment = 23,525 + 100,000 = $123,525

The AW-based \(i^*\) relation is:
\[
0 = 800,000(A/P, i^*, 8) - 123,525
\]
\[
i^* = 4.95\%
\]

**Bond issue:**

Annual bond interest = 800,000(0.06) = $48,000
Tax saving = 48,000(0.40) = $19,200
Effective bond interest = 48,000 – 19,200 = $28,800

The AW-based \(i^*\) relation is:
\[
0 = 800,000(A/P, i^*, 10) - 28,800 - 800,000(A/F, i^*, 10)
\]
\[
i^* = 3.6\% \quad \text{(RATE or IRR function)}
\]

Bond financing is cheaper.

(b) Bonds cost 6% per year, which is less than the 8% loan. The answer is the same before-taxes.

10.27 Debt capital cost: 9.5% for $6 million

Equity -- common stock: 100,000(32) = $3.2 million or 32% of total capital

\[R_c = \frac{1.10}{32} + 0.02 = 5.44\%
\]

Equity -- retained earnings: cost is 5.44% for this 8% of total capital.

\[\text{WACC} = 0.6(9.5\%) + 0.32(5.44\%) + 0.08(5.44\%) = 7.88\%
\]

10.29 Determine the effective annual interest rate \(i_a\) for each plan.

Plan 1: \(i_a\) for debt = \((1 + 0.00583)^{12} - 1 = 7.225\%
\(i_a\) for equity = \((1 + 0.03)^2 - 1 = 6.09\%
\[\text{WACC}_A = 0.5(7.225\%) + 0.5(6.09\%) = 6.66\%
\]

Plan 2: \(i_a\) for 100% equity = \[\text{WACC}_B = (1 + 0.03)^2 - 1 = 6.09\%
\]

Plan 3: \(i_a\) for 100% debt = \[\text{WACC}_C = (1 + 0.00583)^{12} - 1 = 7.225\%
\]

Plan 2: 100% equity has the lowest before-tax WACC.

Chapter 10
10.32 Two independent, revenue projects with different lives. Select all those with \( AW > 0 \).

Equity capital is 40% at a cost of 7.5% per year
Debt capital is 5% per year, compounded quarterly. Effective rate after taxes is

After-tax debt \( i^* = [(1 + 0.05/4)^4 - 1] (1-0.3) = 3.5665\% \) per year

\[
WACC = 0.4(7.5\%) + 0.6(3.5665\%) = 5.14\% \text{ per year}
\]

\( MARR = WACC = 5.14\% \)

(a) At \( MARR = 5.14\% \), select both independent projects.

(b) With 2% added for higher risk, only project W is acceptable.
10.35  **100% equity financing**

MARR = 8.5% is known. Determine PW at the MARR.

\[ PW = -250,000 + 30,000(P/A,8.5\%,15) = -$874 \]

Conclusion: 100% equity does not meet the MARR requirement

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**60%-40% D-E financing**

Loan principal = 250,000(0.60) = $150,000
Loan payment = 150,000(A/P,9\%,15) = $18,609 per year

Cost of 60% debt capital is 9% for the loan.

WACC = 0.4(8.5\%) + 0.6(9\%) = 8.8\%
MARR = 8.8\%

\[ \text{Annual NCF} = \text{project NCF} - \text{loan payment} = $11,391 \]
\[ \text{Amount of equity invested} = 250,000 - 150,000 = $100,000 \]

\[ PW = -100,000 + 11,391(P/A,8.8\%,15) = -$7,087 \]

Conclusion: 60% debt-40% equity mix does not meet the MARR requirement

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10.38 All points will increase, except the 0% debt value. The new WACC curve is relatively higher at both the 0% debt and 100% debt points and the minimum WACC point will move to the right.

Conclusion: The minimum WACC will increase with a higher D-E mix, since debt and equity cost curves rise relative to those for lower D-E mixes.

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10.41 **Attribute**

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<th>Importance</th>
<th>Logic</th>
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<td>1</td>
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<td>Most important (100)</td>
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<td>10</td>
<td>10% of problem</td>
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<tr>
<td>3</td>
<td>50</td>
<td>1/2(100)</td>
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<td>4</td>
<td>37.5</td>
<td>0.75(50)</td>
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<td>5</td>
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<td>Same as #1</td>
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\[ W_i = \frac{\text{Score}}{297.5} \]
10.41 (cont) Attribute \( W_i \)  
1 0.336  
2 0.034  
3 0.168  
4 0.126  
5 0.336  
\[ \frac{\text{1.000}}{} \]

10.44 (a) Both sets of ratings give the same conclusion, alternative 1, but the consistency between raters should be improved somewhat. This result simply shows that the weighted evaluation method is relatively insensitive to attribute weights when an alternative (1 here) is favored by high (or disfavored by low) weights.

(b) Vice president  

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Select alternative 2

Assistant vice president  

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Select 3

Rating differences on alternatives by attribute can make a significant difference in the alternative selected, based on these results.

10.46. Sum the ratings in Table 10.5 over all six attributes.
Total 470 515 345

Select alternative 2; the same choice is made.