Chapter 5
Problems: 1, 2, 3, 5, 8, 12, 14(a), 15(a), 16, 21, 27, 31, 37

Chapter 7
Problems: 1, 2, 3, 6, 7, 17

Chapter 8
Problems: 1, 3, 4, 5, 10

Chapter 9
Problems: 2, 3, 6, 8, 10, 13

Chapter 10
Problems: 1, 2, 3, 4, 6, 8, 10, 12, 18

Chapter 11
Problems: 1, 2, 3, 4, 5, 6, 7, 13, 14, 15
Solutions to End-of-Chapter Problems

Chapter 5
Problems: 1, 2, 3, 5, 8, 12, 14(a), 15(a), 16, 21, 27, 31, 37

5-1
\[
\begin{array}{cccccc}
0 & 10\% & 1 & 2 & 3 & 4 & 5 \\
\hline
\text{PV} = 10,000 & & & & & \\
\end{array}
\]

\[FV_5 = ?\]

\[FV_5 = 10,000(1.10)^5 = 10,000(1.61051) = 16,105.10.\]

Alternatively, with a financial calculator enter the following: N = 5, I/YR = 10, PV = -10000, and PMT = 0. Solve for FV = 16,105.10.

5-2
\[
\begin{array}{cccccc}
0 & 7\% & 5 & 10 & 15 & 20 \\
\hline
\text{PV} = ? & & & & & \\
\end{array}
\]

\[FV_{20} = 5,000\]

With a financial calculator enter the following: N = 20, I/YR = 7, PMT = 0, and FV = 5000. Solve for PV = 1,292.10.

5-3
\[
\begin{array}{ccc}
0 & \text{I/YR} = ? & 18 \\
\hline
\text{PV} = 250,000 & & \text{FV}_{18} = 1,000,000 \\
\end{array}
\]

With a financial calculator enter the following: N = 18, PV = -250000, PMT = 0, and FV = 1000000. Solve for I/YR = 8.01% ≈ 8%.

5-5
\[
\begin{array}{cccccc}
0 & 12\% & 1 & 2 & \cdots & N - 2 & N - 1 & N \\
\hline
\text{PV} = 42,180.53 & 5,000 & 5,000 & \cdots & 5,000 & 5,000 & \text{FV} = 250,000 \\
\end{array}
\]

Using your financial calculator, enter the following data: I/YR = 12; PV = -42180.53; PMT = -5000; FV = 250000; N = ? Solve for N = 11. It will take 11 years to accumulate $250,000.

5-8
Using a financial calculator, enter the following: N = 60, I/YR = 1, PV = -20000, and FV = 0. Solve for PMT = $444.89.

\[
\text{EAR} = \left(1 + \frac{I_{\text{NOM}}}{M}\right)^M - 1.0
\]

\[= (1.01)^{12} - 1.0\]

\[= 12.68\%.
\]

Alternatively, using a financial calculator, enter the following: NOM% = 12 and P/YR = 12. Solve for EFF% = 12.6825%. Remember to change back to P/YR = 1 on your calculator.
5-12 These problems can all be solved using a financial calculator by entering the known values shown on the time lines and then pressing the I/YR button.

a. \[ \begin{array}{cccccc}
0 & \text{I/YR = ?} & 1 \\
+700 & & -749 \\
\end{array} \]

With a financial calculator, enter: \( N = 1, \ PV = 700, \ PMT = 0, \) and \( FV = -749. \) \( I/YR = 7\% . \)

b. \[ \begin{array}{cccccc}
0 & \text{I/YR = ?} & 1 \\
-700 & & +749 \\
\end{array} \]

With a financial calculator, enter: \( N = 1, \ PV = -700, \ PMT = 0, \) and \( FV = 749. \) \( I/YR = 7\% . \)

c. \[ \begin{array}{cccccc}
0 & \text{I/YR = ?} & 10 \\
+85,000 & & -201,229 \\
\end{array} \]

With a financial calculator, enter: \( N = 10, \ PV = 85000, \ PMT = 0, \) and \( FV = -201229. \) \( I/YR = 9\% . \)

d. \[ \begin{array}{cccccc}
0 & \text{I/YR = ?} & 1 & 2 & 3 & 4 & 5 \\
+9,000 & -2,684.80 & -2,684.80 & -2,684.80 & -2,684.80 & -2,684.80 \\
\end{array} \]

With a financial calculator, enter: \( N = 5, \ PV = 9000, \ PMT = -2684.80, \) and \( FV = 0. \) \( I/YR = 15\% . \)

5-14 a. \[ \begin{array}{cccccccccc}
0 & 10\% & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
400 & 400 & 400 & 400 & 400 & 400 & 400 & 400 & 400 & 400 & 400 \\
FV = ? \\
\end{array} \]

With a financial calculator, enter \( N = 10, \ I/YR = 10, \ PV = 0, \) and \( PMT = -400. \) Then press the FV key to find \( FV = 6,374.97. \)

5-15 a. \[ \begin{array}{cccccccccc}
0 & 10\% & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
PV = ? & 400 & 400 & 400 & 400 & 400 & 400 & 400 & 400 & 400 & 400 & 400 \\
\end{array} \]

With a financial calculator, simply enter the known values and then press the key for the unknown. Enter: \( N = 10, \ I/YR = 10, \ PMT = -400, \) and \( FV = 0. \) \( PV = 2,457.83. \)

5-16 \( PV_{7\%} = 100/0.07 = 1,428.57. \) \( PV_{14\%} = 100/0.14 = 714.29. \)

When the interest rate is doubled, the PV of the perpetuity is halved.

5-21 a. If Crissie expects a 7\% annual return on her investments:

\begin{align*}
\text{1 payment} & \quad 10 \text{ payments} & \quad 30 \text{ payments} \\
N = 10 & \quad N = 30 & \\
I/YR = 7 & \quad I/YR = 7 & \\
PMT = 9500000 & \quad PMT = 5500000 & \\
\end{align*}
FV = 0  
FV = 0
PV = $61,000,000  
PV = $66,724,025  
PV = $68,249,727

Crissie should accept the 30-year payment option as it carries the highest present value ($68,249,727).

b. If Crissie expects an 8% annual return on her investments:

<table>
<thead>
<tr>
<th>1 payment</th>
<th>10 payments</th>
<th>30 payments</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 10</td>
<td>N = 30</td>
<td></td>
</tr>
<tr>
<td>I/YR = 8</td>
<td>I/YR = 8</td>
<td></td>
</tr>
<tr>
<td>PMT = 950000</td>
<td>PMT = 550000</td>
<td></td>
</tr>
<tr>
<td>FV = 0</td>
<td>FV = 0</td>
<td></td>
</tr>
</tbody>
</table>

PV = $61,000,000  
PV = $63,745,773  
PV = $61,917,808

Crissie should accept the 10-year payment option as it carries the highest present value ($63,745,773).

c. If Crissie expects a 9% annual return on her investments:

<table>
<thead>
<tr>
<th>1 payment</th>
<th>10 payments</th>
<th>30 payments</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 10</td>
<td>N = 30</td>
<td></td>
</tr>
<tr>
<td>I/YR = 9</td>
<td>I/YR = 9</td>
<td></td>
</tr>
<tr>
<td>PMT = 950000</td>
<td>PMT = 550000</td>
<td></td>
</tr>
<tr>
<td>FV = 0</td>
<td>FV = 0</td>
<td></td>
</tr>
</tbody>
</table>

PV = $61,000,000  
PV = $60,967,748  
PV = $56,505,097

Crissie should accept the lump-sum payment option as it carries the highest present value ($61,000,000).

d. The higher the interest rate, the more useful it is to get money rapidly, because it can be invested at those high rates and earn lots more money. So, cash comes fastest with #1, slowest with #3, so the higher the rate, the more the choice is tilted toward #1. You can also think about this another way. The higher the discount rate, the more distant cash flows are penalized, so again, #3 looks worst at high rates, #1 best at high rates.

5-27  
a. Bank A: \( I_{\text{NOM}} = \text{Effective annual rate} = 4\% \).

Bank B:

\[
\text{Effective annual rate} = \left(1 + \frac{0.035}{365}\right)^{365} - 1.0 = (1.000096)^{365} - 1.0 \\
= 1.035618 - 1.0 = 0.035618 = 3.5618\%.
\]

With a financial calculator, you can use the interest rate conversion feature to obtain the same answer. You would choose Bank A because its EAR is higher.

b. If funds must be left on deposit until the end of the compounding period (1 year for Bank A and 1 day for Bank B), and you think there is a high probability that you will make a withdrawal during the year, then Bank B might be preferable. For example, if the withdrawal is made after 6 months, you would earn nothing on the Bank A account but \( (1.000096)^{365/2} - 1.0 = 1.765\% \) on the Bank B account.

Ten or more years ago, most banks were set up as described above, but now virtually all are computerized and pay interest from the day of deposit to the day of withdrawal, provided at least $1 is in the account at the end of the period.
5-31  a.  

\[
\begin{array}{ccccc}
0 & 1 & 2 & 3 & 4 \\
PV = ? & -10,000 & -10,000 & -10,000 & -10,000 \\
\end{array}
\]

With a calculator, enter \( N = 4 \), \( I/YR = 5 \), \( PMT = -10000 \), and \( FV = 0 \). Then press \( PV \) to get \( PV = \$35,459.51 \).

b. At this point, we have a 3-year, 5% annuity whose value is \$27,232.48. You can also think of the problem as follows:

\[
\$35,459.51 \times (1.05) - 10,000 = 27,232.49.
\]

5-37  a. Using the information given in the problem, you can solve for the length of time required to pay off the card.

\( I/YR = 1.5 \) (18%/12); \( PV = 350 \); \( PMT = -10 \); \( FV = 0 \); and then solve for \( N = 50 \) months.

b. If Simon makes monthly payments of \$30, we can solve for the length of time required before the account is paid in full.

\( I/YR = 1.5 \); \( PV = 350 \); \( PMT = -30 \); \( FV = 0 \); and then solve for \( N = 12.921 \approx 13 \) months.

With \$30 monthly payments, Simon will only need 13 months to pay off the account.

c. Total payments @ \$10/month: \( 50 \times 10 = 500.00 \)

Total payments @ \$30/month: \( 12.921 \times 30 = 387.62 \)

Extra interest = \$112.38
Chapter 7
Problems: 1, 2, 3, 6, 7, 17

7-1 With your financial calculator, enter the following:
\[ N = 10; \ I/YR = \text{YTM} = 9\%; \ PMT = 0.08 \times 1,000 = 80; \ FV = 1000; \ PV = V_b = ? \]
\[ PV = \$935.82. \]

7-2 \[ V_b = \$985; \ M = \$1,000; \ Int = 0.07 \times \$1,000 = \$70. \]
\[ a. \ N = 10; \ PV = -985; \ PMT = 70; \ FV = 1000; \ YTM = ? \]
\[ \text{Solve for} \ I/YR = \text{YTM} = 7.2157\% = 7.22\%. \]
\[ b. \ N = 7; \ I/YR = 7.2157; \ PMT = 70; \ FV = 1000; \ PV = ? \]
\[ \text{Solve for} \ V_b = PV = \$988.46. \]

7-3 The problem asks you to find the price of a bond, given the following facts: \[ N = 2 \times 8 = 16; \ I/YR = 8.5/2 = 4.25; \ PMT = (0.09/2) \times 1,000 = 45; \ FV = 1000. \]

7-6 a. 
<table>
<thead>
<tr>
<th>Time</th>
<th>Years to Maturity</th>
<th>Price of Bond C</th>
<th>Price of Bond Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>t = 0</td>
<td>4</td>
<td>$1,012.79</td>
<td>$693.04</td>
</tr>
<tr>
<td>t = 1</td>
<td>3</td>
<td>1,010.02</td>
<td>759.57</td>
</tr>
<tr>
<td>t = 2</td>
<td>2</td>
<td>1,006.98</td>
<td>832.49</td>
</tr>
<tr>
<td>t = 3</td>
<td>1</td>
<td>1,003.65</td>
<td>912.41</td>
</tr>
<tr>
<td>t = 4</td>
<td>0</td>
<td>1,000.00</td>
<td>1,000.00</td>
</tr>
</tbody>
</table>

b. 

![Bond Price Paths](image)
<table>
<thead>
<tr>
<th>Bond Type</th>
<th>Price at 8%</th>
<th>Price at 7%</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-year, 10% annual coupon</td>
<td>$1,134.20</td>
<td>$1,210.71</td>
<td>6.75%</td>
</tr>
<tr>
<td>10-year zero</td>
<td>463.19</td>
<td>508.35</td>
<td>9.75%</td>
</tr>
<tr>
<td>5-year zero</td>
<td>680.58</td>
<td>712.99</td>
<td>4.76%</td>
</tr>
<tr>
<td>30-year zero</td>
<td>99.38</td>
<td>131.37</td>
<td>32.19%</td>
</tr>
<tr>
<td>$100 perpetuity</td>
<td>1,250.00</td>
<td>1,428.57</td>
<td>14.29%</td>
</tr>
</tbody>
</table>

7-17 First, we must find the price Joan paid for this bond.

\[ N = 10, \ I/YR = 9.79, \ PMT = 110, \ FV = 1000 \]
\[ PV = -$1,075.02. \ V_0 = $1,075.02. \]

Then to find the one-period return, we must find the sum of the change in price and the coupon received divided by the starting price.

\[
\text{One-period return} = \frac{\text{Ending price} - \text{Beginning price} + \text{Coupon received}}{\text{Beginning price}}
\]

\[
\text{One-period return} = \frac{($1,060.49 - $1,075.02 + $110)}{\$1,075.02}
\]

\[
\text{One-period return} = 8.88\%.
\]
Chapter 8
Problems: 1, 3, 4, 5, 10

8-1 \( \hat{r} = (0.1)(-50\%) + (0.2)(-5\%) + (0.4)(16\%) + (0.2)(25\%) + (0.1)(60\%) \)
\[ = 11.40\%. \]
\[ \sigma^2 = (-50\% - 11.40\%)^2(0.1) + (-5\% - 11.40\%)^2(0.2) + (16\% - 11.40\%)^2(0.4) \]
\[ + (25\% - 11.40\%)^2(0.2) + (60\% - 11.40\%)^2(0.1) \]
\[ \sigma^2 = 712.44; \ \sigma = 26.69\%. \]
\[ CV = \frac{26.69\%}{11.40\%} = 2.34. \]

8-3 \( r_{RF} = 6\%; \ r_M = 13\%; \ b = 0.7; \ r = ? \)
\[ r = r_{RF} + (r_M - r_{RF})b \]
\[ = 6\% + (13\% - 6\%)(0.7) \]
\[ = 10.9\%. \]

8-4 \( r_{RF} = 5\%; \ RP_M = 6\%; \ r_M = ? \)
\[ r_M = 5\% + (6\%)1 = 11\%. \]
\[ r \text{ when } b = 1.2 = ? \]
\[ r = 5\% + 6\%(1.2) = 12.2\%. \]

8-5 a. \( r = 11\%; \ r_{RF} = 7\%; \ RP_M = 4\%. \)
\[ r = r_{RF} + (r_M - r_{RF})b \]
\[ 11\% = 7\% + 4\%b \]
\[ 4\% = 4\%b \]
\[ b = 1. \]

b. \( r_{RF} = 7\%; \ RP_M = 6\%; \ b = 1. \)
\[ r = r_{RF} + (r_M - r_{RF})b \]
\[ = 7\% + (6\%)1 \]
\[ = 13\%. \]
An index fund will have a beta of 1.0. If $r_M$ is 12.0% (given in the problem) and the risk-free rate is 5%, you can calculate the market risk premium ($RP_M$) calculated as $r_M - r_{RF}$ as follows:

\[ r = r_{RF} + (RP_M)b \]
\[ 12.0\% = 5\% + (RP_M)1.0 \]
\[ 7.0\% = RP_M. \]

Now, you can use the $RP_M$, the $r_{RF}$, and the two stocks’ betas to calculate their required returns.

**Bradford:**

\[ r_B = r_{RF} + (RP_M)b \]
\[ = 5\% + (7.0\%)1.45 \]
\[ = 5\% + 10.15\% \]
\[ = 15.15\%. \]

**Farley:**

\[ r_F = r_{RF} + (RP_M)b \]
\[ = 5\% + (7.0\%)0.85 \]
\[ = 5\% + 5.95\% \]
\[ = 10.95\%. \]

The difference in their required returns is:

15.15% – 10.95% = 4.2%. 
Chapter 9
Problems: 2, 3, 6, 8, 10, 13

9-2 \[ D_1 = \$0.50; \ g = 7\%; \ r_s = 15\%; \ \hat{P}_o = ? \]

\[ \hat{P}_o = \frac{D_1}{r_s - g} = \frac{\$0.50}{0.15 - 0.07} = \$6.25. \]

9-3 \[ P_0 = \$20; \ D_0 = \$1.00; \ g = 6\%; \ \hat{P}_i = ?; \ r_s = ? \]

\[ \hat{P}_i = P_0(1 + g) = \$20(1.06) = \$21.20. \]

\[ \hat{r}_s = \frac{D_0}{P_0} + g \]
\[ = \frac{\$1.00(1.06)}{\$20} + 0.06 \]
\[ = \frac{\$1.06}{\$20} + 0.06 = 11.30\%. \quad r_s = 11.30\%. \]

9-6 \[ D_p = \$5.00; \ V_p = \$60; \ r_p = ? \]

\[ r_p = \frac{D_p}{V_p} = \frac{\$5.00}{\$60.00} = 8.33\%. \]

9-8 a. \[ V_p = \frac{D_p}{r_p} = \frac{\$10}{0.08} = \$125. \]

b. \[ V_p = \frac{\$10}{0.12} = \$83.33. \]

9-10 \[ \hat{P}_o = \frac{D_1}{r_s - g} = \frac{D_1(1 + g)}{r_s - g} = \frac{\$5[1 + (-0.05)]}{0.15 - (-0.05)} = \frac{\$5(0.95)}{0.15 + 0.05} = \frac{\$4.75}{0.20} = \$23.75. \]
9-13 The problem asks you to determine the value of $\hat{P}_3$, given the following facts: $D_1 = $2, $b = 0.9$, $r_{RF} = 5.6\%$, $RP_M = 6\%$, and $P_0 = $25. Proceed as follows:

Step 1: Calculate the required rate of return:

\[ r_s = r_{RF} + (r_{M} - r_{RF})b = 5.6\% + (6\%)0.9 = 11\%. \]

Step 2: Use the constant growth rate formula to calculate $g$:

\[ \hat{r}_s = \frac{D_1}{P_0} + g \]

\[ 0.11 = \frac{2}{25} + g \]

\[ g = 0.03 = 3\%. \]

Step 3: Calculate $\hat{P}_3$:

\[ \hat{P}_3 = P_0(1 + g)^3 = $25(1.03)^3 = $27.3182 \approx $27.32. \]

Alternatively, you could calculate $D_4$ and then use the constant growth rate formula to solve for $\hat{P}_3$:

\[ D_4 = D_1(1 + g)^3 = $2.00(1.03)^3 = $2.1855. \]

\[ \hat{P}_3 = \frac{2.1855}{0.11 - 0.03} = $27.3182 \approx $27.32. \]
Chapter 10
Problems: 1, 2, 3, 4, 6, 8, 10, 12, 18

10-1 \[ r_d(1 - T) = 0.12(0.65) = 7.80\%. \]

10-2 \[ P_p = \$47.50; \ D_p = \$3.80; \ r_p = ? \]
\[ r_p = \frac{D_p}{P_p} = \frac{\$3.80}{\$47.50} = 8\%. \]

10-3 40% Debt; 60% Common equity; \( r_d = 9\% \); \( T = 40\% \); WACC = 9.96%; \( r_s = ? \)
\[ WACC = (w_d)(r_d)(1 - T) + (w_c)(r_s) \]
\[ 0.0996 = (0.4)(0.09)(1 - 0.4) + (0.6)r_s \]
\[ 0.0996 = 0.0216 + 0.6r_s \]
\[ 0.078 = 0.6r_s \]
\[ r_s = 13\%. \]

10-4 \( P_0 = \$30; \ D_1 = \$3.00; \ g = 5\%; \ r_s = ? \)
\[ a. \ r_s = \frac{D_1}{P_0} + g = \frac{\$3.00}{\$30.00} + 0.05 = 15\%. \]
\[ b. \ F = 10\%; \ r_e = ? \]
\[ r_e = \frac{D_1}{P_0(1 - F)} + g = \frac{\$3.00}{\$30(1 - 0.10)} + 0.05 \]
\[ = \frac{\$3.00}{\$27.00} + 0.05 = 16.11\%. \]

10-6 \[ a. \ r_s = \frac{D_1}{P_0} + g = \frac{\$2.14}{\$23} + 7\% = 9.3\% + 7\% = 16.3\%. \]
\[ b. \ r_s = r_{RF} + (r_{M} - r_{RF})b \]
\[ = 9\% + (13\% - 9\%)1.6 = 9\% + (4\%)1.6 = 9\% + 6.4\% = 15.4\%. \]
\[ c. \ r_s = Bond \ rate + Risk \ premium = 12\% + 4\% = 16\%. \]
\[ d. \ Since \ you \ have \ equal \ confidence \ in \ the \ inputs \ used \ for \ the \ three \ approaches, \ an \ average \ of \ the \ three \ methodologies \ probably \ would \ be \ warranted. \]
\[ r_s = \frac{16.3\% + 15.4\% + 16\%}{3} = 15.9\%. \]
10-8  Debt = 40%, Common equity = 60%.

\[ P_0 = 22.50, \quad D_0 = 2.00, \quad D_1 = 2.00(1.07) = 2.14, \quad g = 7\% . \]

\[ r_s = \frac{D_1}{P_0} + g = \frac{2.14}{22.50} + 7\% = 16.51\% . \]

\[ \text{WACC} = (0.4)(0.12)(1 - 0.4) + (0.6)(0.1651) \]
\[ = 0.0288 + 0.0991 = 12.79\% . \]

10-10  If the investment requires $5.9 million, that means it requires $3.54 million (60%) of common equity and $2.36 million (40%) of debt. In this scenario, the firm would exhaust its $2 million of retained earnings and be forced to raise new stock at a cost of 15%. Needing $2.36 million in debt, the firm could get by raising debt at only 10%. Therefore, its weighted average cost of capital is:  
\[ \text{WACC} = 0.4(10\%)(1 - 0.4) + 0.6(15\%) = 11.4\% . \]

10-12  a.  \[ r_d = 10\%, \quad r_d(1 - T) = 10\%(0.6) = 6\% . \]

\[ w_d = 45\%; \quad D_0 = 2; \quad g = 4\%; \quad P_0 = 20; \quad T = 40\% . \]

Project A: Rate of return = 13\%.

Project B: Rate of return = 10\%.

\[ r_s = \frac{2(1.04)}{20} + 4\% = 14.40\% . \]

b.  \[ \text{WACC} = 0.45(6\%) + 0.55(14.40\%) = 10.62\% . \]

c.  Since the firm’s WACC is 10.62\% and each of the projects is equally risky and as risky as the firm’s other assets, MEC should accept Project A. Its rate of return is greater than the firm’s WACC. Project B should not be accepted, since its rate of return is less than MEC’s WACC.
### Chapter 11

**Problems: 1, 2, 3, 4, 5, 6, 7, 13, 14, 15**

**11-1** Financial calculator solution: Input \( CF_0 = -52125, CF_{1-8} = 12000 \), \( I/YR = 12 \), and then solve for \( NPV = $7,486.68 \).

**11-2** Financial calculator solution: Input \( CF_0 = -52125, CF_{1-8} = 12000 \), and then solve for \( IRR = 16\% \).

**11-3** MIRR: PV costs = $52,125.

| PV | 12% | 0 | 12,000 | 2 | 12,000 | 3 | 12,000 | 4 | 12,000 | 5 | 12,000 | 6 | 12,000 | 7 | 12,000 | 8 | 12,000 |
|----|-----|---|--------|---|--------|---|--------|---|--------|---|--------|---|--------|---|--------|
| 0  | 12% | 1 | 12,000 | 2 | 12,000 | 3 | 12,000 | 4 | 12,000 | 5 | 12,000 | 6 | 12,000 | 7 | 12,000 | 8 | 12,000 |
|    |     |   |        |   |        |   |        |   |        |   |        |   |        |   |        |   |        |
| 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 |

\[ \times (1.12)^4 \]
\[ \times (1.12)^3 \]
\[ \times (1.12)^2 \]

Financial calculator solution: Obtain the FVA by inputting \( N = 8 \), \( I/YR = 12 \), \( PV = 0 \), \( PMT = 12000 \), and then solve for \( FV = $147,596 \). The MIRR can be obtained by inputting \( N = 8 \), \( PV = -52125 \), \( PMT = 0 \), \( FV = 147596 \), and then solving for \( I/YR = 13.89\% \).

**11-4** Since the cash flows are a constant $12,000, calculate the payback period as: $52,125/$12,000 = 4.3438, so the payback is about 4 years.

**11-5** Project K’s discounted payback period is calculated as follows:

<table>
<thead>
<tr>
<th>Period</th>
<th>Annual Cash Flows</th>
<th>Discounted @12% Cash Flows</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>($52,125)</td>
<td>($52,125.00)</td>
<td>($52,125.00)</td>
</tr>
<tr>
<td>1</td>
<td>12,000</td>
<td>10,714.29</td>
<td>41,410.71</td>
</tr>
<tr>
<td>2</td>
<td>12,000</td>
<td>9,566.33</td>
<td>31,844.38</td>
</tr>
<tr>
<td>3</td>
<td>12,000</td>
<td>8,541.36</td>
<td>23,303.02</td>
</tr>
<tr>
<td>4</td>
<td>12,000</td>
<td>7,626.22</td>
<td>15,676.80</td>
</tr>
<tr>
<td>5</td>
<td>12,000</td>
<td>6,809.12</td>
<td>8,867.68</td>
</tr>
<tr>
<td>6</td>
<td>12,000</td>
<td>6,079.57</td>
<td>2,788.11</td>
</tr>
<tr>
<td>7</td>
<td>12,000</td>
<td>5,428.19</td>
<td>2,640.08</td>
</tr>
<tr>
<td>8</td>
<td>12,000</td>
<td>4,846.60</td>
<td>7,486.68</td>
</tr>
</tbody>
</table>

The discounted payback period is \[ 6 + \frac{2,788.11}{5,428.19} \] years, or 6.51 years.
11-6  a. Project A: Using a financial calculator, enter the following:

   CF₀ = -25, CF₁ = 5, CF₂ = 10, CF₃ = 17, I/YR = 5; NPV = $3.52.

Change I/YR = 5 to I/YR = 10; NPV = $0.58.

Change I/YR = 10 to I/YR = 15; NPV = -$1.91.

Project B: Using a financial calculator, enter the following:

   CF₀ = -20, CF₁ = 10, CF₂ = 9, CF₃ = 6, I/YR = 5; NPV = $2.87.

Change I/YR = 5 to I/YR = 10; NPV = $1.04.

Change I/YR = 10 to I/YR = 15; NPV = -$0.55.

b. Using the data for Project A, enter the cash flows into a financial calculator and solve for IRRₐ = 11.10%. The IRR is independent of the WACC, so it doesn’t change when the WACC changes.

Using the data for Project B, enter the cash flows into a financial calculator and solve for IRRₜ = 13.18%. Again, the IRR is independent of the WACC, so it doesn’t change when the WACC changes.

c. At a WACC = 5%, NPVₐ > NPVₜ so choose Project A.

At a WACC = 10%, NPVₜ > NPVₐ so choose Project B.

At a WACC = 15%, both NPVs are less than zero, so neither project would be chosen.

11-7  a. Project A:

   CF₀ = -6000; CF₁₋₅ = 2000; I/YR = 14.

Solve for NPVₐ = $866.16. IRRₐ = 19.86%.

MIRR calculation:

Using a financial calculator, enter N = 5; PV = -6000; PMT = 0; FV = 13220.21; and solve for MIRRₐ = I/YR = 17.12%.
Payback calculation:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF</td>
<td>-6,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
</tr>
</tbody>
</table>

Cumulative CF: -6,000 -4,000 -2,000 0 2,000 4,000

Regular Payback\(_A\) = 3 years.

Discounted payback calculation:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF</td>
<td>-6,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
</tr>
</tbody>
</table>

Discounted CF: -6,000 1,754.39 1,538.94 1,349.94 1,184.16 1,038.74

Cumulative CF: -6,000 -4,245.61 -2,706.67 -1,356.73 -172.57 866.17

Discounted Payback\(_A\) = 4 + \$172.57/\$1,038.74 = 4.17 years.

Project B:

\(\text{CF}_0 = -18,000; \text{CF}_{1-5} = 5,600; \text{I/YR} = 14.\)

Solve for NPVB = $1,225.25. IRRB = 16.80%.

MIRR calculation:

\[
\begin{array}{cccccc}
0 & \text{14%} & 1 & 2 & 3 & 4 & 5 \\
-18,000 & 5,600 & 5,600 & 5,600 & 5,600 & 5,600 \\
\times (1.14)^0 & & & & & \\
\times (1.14)^1 & & & & & \\
\times (1.14)^2 & & & & & \\
\times (1.14)^3 & & & & & \\
\times (1.14)^4 & & & & & \\
\times (1.14)^5 & & & & & \\
\hline
6,384.00 & 7,277.76 & 8,296.65 & 9,458.18 & & 37,016.59
\end{array}
\]

Using a financial calculator, enter N = 5; PV = -18,000; PMT = 0; FV = 37,016.59; and solve for MIRRB = I/YR = 15.51%.

Payback calculation:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF</td>
<td>-18,000</td>
<td>5,600</td>
<td>5,600</td>
<td>5,600</td>
<td>5,600</td>
<td>5,600</td>
</tr>
</tbody>
</table>

Cumulative CF: -18,000 -12,400 -6,800 -1,200 4,400 10,000

Regular Payback\(_B\) = 3 + \$1,200/\$5,600 = 3.21 years.
Discounted payback calculation:

\[
\begin{array}{cccccc}
0 & 1 & 2 & 3 & 4 & 5 \\
| & | & | & | & |
\hline
-18,000 & 5,600 & 5,600 & 5,600 & 5,600 & 5,600 \\
\end{array}
\]

Discounted CF: -18,000 4,912.28 4,309.02 3,779.84 3,315.65 2,908.46
Cumulative CF: -18,000 -13,087.72 -8,778.70 -4,998.86 -1,683.21 1,225.25

Discounted Payback_B = 4 + $1,683.21/$2,908.46 = 4.58 years.

Summary of capital budgeting rules results:

<table>
<thead>
<tr>
<th>Project A</th>
<th>Project B</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV</td>
<td>$866.16</td>
</tr>
<tr>
<td>IRR</td>
<td>19.86%</td>
</tr>
<tr>
<td>MIRR</td>
<td>17.12%</td>
</tr>
<tr>
<td>Payback</td>
<td>3.0 years</td>
</tr>
<tr>
<td>Discounted payback</td>
<td>4.17 years</td>
</tr>
</tbody>
</table>

b. If the projects are independent, both projects would be accepted since both of their NPVs are positive.

c. If the projects are mutually exclusive then only one project can be accepted, so the project with the highest positive NPV is chosen. Accept Project B.

d. The conflict between NPV and IRR occurs due to the difference in the size of the projects. Project B is 3 times larger than Project A.

11-13 Because both projects are the same size you can just calculate each project’s MIRR and choose the project with the higher MIRR.

Project X: 0 12% 1 2 3 4
-1,000 100 300 400 700.00
\[
1,000 \times (1.12)^3 \times (1.12)^2 \times 1.12 = 448.00
\]

\[
1,000 \times (1.12)^3 = 376.32
\]

\[
1,000 \times (1.12)^3 = 140.49
\]

\[
1,000 \times 13.59\% = \text{MIRR}_X = 1,664.81
\]

\[
$1,000 = $1,664.81/(1 + \text{MIRR}_X)^4$.
\]

Project Y: 0 12% 1 2 3 4
-1,000 1,000 50 50 50 50.00
\[
1,000 \times (1.12)^3 \times (1.12)^2 \times 1.12 = 1,404.93
\]

\[
1,000 \times (1.12)^3 = 125.44
\]

\[
1,000 \times (1.12)^3 = 56.00
\]

\[
1,000 \times 13.10\% = \text{MIRR}_Y = 1,636.37
\]

\[
$1,000 = $1,636.37/(1 + \text{MIRR}_Y)^4$.
\]

Thus, since \(\text{MIRR}_X > \text{MIRR}_Y\), Project X should be chosen.

Alternate step: You could calculate the NPVs, see that Project X has the higher NPV, and just calculate \(\text{MIRR}_X\).
NPV\textsubscript{X} = $58.02 and NPV\textsubscript{Y} = $39.94.

11-14 a. HCC: Using a financial calculator, enter the following data: CF\textsubscript{0} = -600000; CF\textsubscript{1-5} = -50000; I/YR = 7. Solve for NPV = -$805,009.87.

LCC: Using a financial calculator, enter the following data: CF\textsubscript{0} = -100000; CF\textsubscript{1-5} = -175000; I/YR = 7. Solve for NPV = -$817,534.55.

Since we are examining costs, the unit chosen would be the one that has the lower PV of costs. Since HCC’s PV of costs is lower than LCC’s, HCC would be chosen.

b. The IRR cannot be calculated because the cash flows are all one sign. A change of sign would be needed in order to calculate the IRR.

c. HCC: I/YR = 15; solve for NPV = -$767,607.75.


When the WACC increases from 7% to 15%, the PV of costs are now lower for LCC than HCC. The reason is that when you discount at a higher rate you are making negative CFs smaller and thus improving the results, unknowingly. Thus, if you were trying to risk adjust for a riskier project that consisted just of negative CFs then you would use a lower cost of capital rather than a higher cost of capital and this would properly adjust for the risk of a project with only negative CFs.

11-15 a. Using a financial calculator, calculate NPVs for each plan (as shown in the table below) and graph each plan’s NPV profile.

<table>
<thead>
<tr>
<th>Discount Rate</th>
<th>NPV Plan A</th>
<th>NPV Plan B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>$2,400,000</td>
<td>$30,000,000</td>
</tr>
<tr>
<td>5</td>
<td>1,714,286</td>
<td>14,170,642</td>
</tr>
<tr>
<td>10</td>
<td>1,090,909</td>
<td>5,878,484</td>
</tr>
<tr>
<td>12</td>
<td>857,143</td>
<td>3,685,832</td>
</tr>
<tr>
<td>15</td>
<td>521,739</td>
<td>1,144,596</td>
</tr>
<tr>
<td>16.7</td>
<td>339,332</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>-1,773,883</td>
</tr>
</tbody>
</table>

![NPV Profile Graph](image)

- **Plan A**
- **Plan B**
- **Crossover Rate = 16%**
- **IRR\textsubscript{A} = 20%**
- **IRR\textsubscript{B} = 16.7%**
The crossover rate is approximately 16%. If the cost of capital is less than the crossover rate, then Plan B should be accepted; if the cost of capital is greater than the crossover rate, then Plan A is preferred. At the crossover rate, the two projects’ NPVs are equal.

b. Yes. Assuming (1) equal risk among projects, and (2) that the cost of capital is a constant and does not vary with the amount of capital raised, the firm would take on all available projects with returns greater than its 12% WACC. If the firm had invested in all available projects with returns greater than 12%, then its best alternative would be to repay capital. Thus, the WACC is the correct reinvestment rate for evaluating a project’s cash flows.