**SOLUTIONS TO PRACTICE PROBLEMS**

**Chapter 1:**

1. \( \text{HPR} = \frac{\text{Ending Value}}{\text{Beginning Value}} = \frac{77.39}{50} = 1.5478 \)

2. \( \text{Annual HPR} = (\text{HPR})^{1/n} = (1.5478)^{1/5} = 1.0913 \)  
   \[ \text{Annual HPY} = \text{Annual HPR} - 1 = 1.0913 - 1 = 0.0913 = 9.13\% \]

<table>
<thead>
<tr>
<th>Time</th>
<th>Price of X-Tech</th>
<th>Return (%)</th>
<th>HPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/01/94</td>
<td>50</td>
<td>14</td>
<td>1.14</td>
</tr>
<tr>
<td>3/01/95</td>
<td>57</td>
<td>16</td>
<td>1.16</td>
</tr>
<tr>
<td>3/01/96</td>
<td>66.12</td>
<td>12</td>
<td>1.12</td>
</tr>
<tr>
<td>3/01/97</td>
<td>74.05</td>
<td>-5</td>
<td>0.95</td>
</tr>
<tr>
<td>3/01/98</td>
<td>70.35</td>
<td>10</td>
<td>1.10</td>
</tr>
<tr>
<td>3/01/99</td>
<td>77.39</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Arithmetric Mean  
   \[ = \frac{1}{N} \sum_{t=1}^{N} \text{HPY}_t = \frac{14 + 16 + 12 + -5 + 10}{5} = 9.4\% \]

4. Geometric Mean  
   \[ \prod_{t=1}^{N} (\text{HPR}_t)^{1/N} - 1 \\ = [(1.14)(1.16)(1.12)(0.95)(1.10)]^{1/5} - 1 \\ = 1.0913 - 1 = 0.09132 = 9.13\% \]

5. \( \text{E(R)} = (0.15)(-5) + (0.60)(5) + (0.25)(15) = 6\% \)

6. \( \sigma = [(0.15)(-5 - 6)^2 + (0.60)(5 - 6)^2 + (0.25)(15 - 6)^2]^{1/2} = 6.25\% \)

7. \( \text{CV} = \text{Standard Deviation of Returns/Expected Rate of Return} = 6.25/6 = 1.04 \)

The table provided below can be used to obtain answers for 8 to 11.

<table>
<thead>
<tr>
<th>Stock</th>
<th>Shares</th>
<th>Price(t)</th>
<th>MV(t)</th>
<th>Price(t+1)</th>
<th>MV(t+1)</th>
<th>HPR</th>
<th>HPY</th>
<th>Weight</th>
<th>Weighted HPY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>10</td>
<td>150</td>
<td>12</td>
<td>180</td>
<td>1.2</td>
<td>0.2</td>
<td>0.29</td>
<td>0.058</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>15</td>
<td>375</td>
<td>16</td>
<td>400</td>
<td>1.07</td>
<td>0.07</td>
<td>0.71</td>
<td>0.048</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>525</td>
<td>580</td>
<td></td>
<td>0.106</td>
</tr>
</tbody>
</table>

8. HPY for stock 1 = \((180/150) - 1\) = .2 = 20\%

9. HPY for stock 2 = \((400/375) - 1\) = .07 = 7\%

10. Market weight for stock 1 = \(150/525 = .29 = 29\%\)  
    Market weight for stock 2 = \(375/525 = .71 = 71\%\)
11. Portfolio HPY = .29(.20) + .71(.07) = .106 = 10.6%

CHAPTER 3

12. Maturity premium = 10.12 - 7.56 = 2.56%

13. Default premium = 11.64 - 10.12 = 1.52%

14. Large firm stock risk premium = 13.23 – 7.56 = 5.67%

15. Small firm stock risk premium = 15.46 - 13.23 = 2.23%

CHAPTER 3 APPENDIX

16. Alpine's average return equals
   \[(5 + 9 + 11 - 10 + 12) ÷ 5 = 27 ÷ 5 = 5.4\]

   Tauber's average return equals
   \[(9 + 16 - 16 + 12 + 9) ÷ 5 = 30 ÷ 5 = 6.0\]

\[
\begin{array}{c|c|c}
\text{Alpine} & \text{Tauber} \\
(A - A_{\text{mean}}) & (T - T_{\text{mean}}) \\
5 - 5.4 = -0.4 & 9 - 6 = 3 \\
9 - 5.4 = 3.6 & 16 - 6 = 10 \\
11 - 5.4 = 5.6 & -16 - 6 = -22 \\
-10 - 5.4 = -15.4 & 12 - 6 = 6 \\
12 - 5.4 = 6.6 & 9 - 6 = 3 \\
\end{array}
\]

\[
\begin{align*}
[A - A_{\text{mean}}] x [T - T_{\text{mean}}] & = \sum [A - A_{\text{mean}}] x [T - T_{\text{mean}}] \\
(-0.4) x (3.0) & = -1.2 \\
(3.6) x (10) & = 36.0 \\
(5.6) x (-22) & = -123.2 \\
(-15.4) x (6) & = -92.4 \\
(6.6) x (3) & = 19.8 \\
\end{align*}
\]

\[
\text{COV}_{AT} = -161.00 ÷ 5 = -32.20
\]

17. Using the data from the previous problem

\[
\begin{array}{c|c|c}
\text{Alpine} & \text{Tauber} \\
(A - A_{\text{mean}})^2 & (T - T_{\text{mean}})^2 \\
(5 - 5.4)^2 & (9 - 6)^2 = 9 \\
(9 - 5.4)^2 & (16 - 6)^2 = 100 \\
(11 - 5.4)^2 & (12 - 6)^2 = 36 \\
(-10 - 5.4)^2 & (12 - 6)^2 = 36 \\
(12 - 5.4)^2 & (9 - 6)^2 = 9 \\
\text{Sum} & 325.2 & \text{Sum} & 638 \\
\end{array}
\]

\[
\begin{align*}
\sigma_A^2 = 325.2 ÷ 5 = 65.04 & \quad \sigma_T^2 = 638 ÷ 5 = 127.6 \\
\sigma_A = 8.06 & \quad \sigma_T = 11.30 \\
\end{align*}
\]

\[
\rho_{A,Y} = \frac{\text{COV}_{A,T}}{\sigma_A \sigma_T} = -32.20 ÷ (8.06)(11.30) = -0.354
\]
Chapter 4:

18. Letting \( P = \) price and \( Q = \) quantity of shares, Kathy's share will represent 40% of \( PQ \).
   Thus \( 0.40X = 60,000 \) and \( X = 60,000 / 0.40 = 150,000 \).
   \( \therefore \) At $40 per share, she can purchase \( (150,000 / 40) = 3,750 \) shares.

19. Profit = \((50 - 40)(3750)\) = $37,500

20. Margin = (Market Value - Debit Balance) ÷ Market Value, where
    Debit Balance = initial loan value = \((150,000 - 60,000) = 90,000\)
    Market Value = Price x Number of Shares = 3750P
    Thus \( 0.25 = (3750P - 90,000) / 3750P \)
    \( P = 32.00 \)

21. Profit = $4225 - $3225 - $85 - $60 - $55 - (1-0.60)(4225)(0.05) = $664.80

22. Rate of Return = Profit ÷ Initial investment
    Initial investment = \((0.60 \times 4225) = 2,535 \)
    \( \therefore \) Rate of Return = $664.80/$2,535.00 = 26.22%

Chapter 5:

USE THE FOLLOWING INFORMATION FOR THE NEXT TWO PROBLEMS

<table>
<thead>
<tr>
<th>Number of shares</th>
<th>Closing Prices (per share)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Companies</td>
<td>Day T</td>
</tr>
<tr>
<td>1</td>
<td>2,000</td>
</tr>
<tr>
<td>2</td>
<td>7,000</td>
</tr>
<tr>
<td>3</td>
<td>5,000</td>
</tr>
<tr>
<td>4</td>
<td>4,000</td>
</tr>
</tbody>
</table>

(a) Assume that a stock price-weighted indicator consisted of the four issues with their prices. What are the values of the stock indicator for Day T and T + 1 and what is the percentage change?
   a) 36.25, 38.75, 6.9%
   b) 38.75, 36.25, -6.9%
   c) 100, 106.9, 6.9%
   d) 107.48, 106.33, 1.15%
   e) None of the above
Therefore the index closed up $38.75/36.25 - 1 = 6.9\%$

(c) 24

For a value-weighted series, assume that Day T is the base period and the base value is 100. What is the new index value for Day T + 1 and what is the percentage change in the index from Day T?

a) 106.33, 6.33\%

b) 107.48, 7.48\%

c) 109.93, 9.93\%

d) 108.7, 8.7\%

e) None of the above

<table>
<thead>
<tr>
<th>Number of shares</th>
<th>Price</th>
<th>Market value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Companies</td>
<td>outstanding</td>
<td>Day T</td>
</tr>
<tr>
<td>1</td>
<td>2,000</td>
<td>30.00</td>
</tr>
<tr>
<td>2</td>
<td>7,000</td>
<td>55.00</td>
</tr>
<tr>
<td>3</td>
<td>5,000</td>
<td>20.00</td>
</tr>
<tr>
<td>4</td>
<td>4,000</td>
<td>40.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Base value equal to an index of 100

<table>
<thead>
<tr>
<th>Number of shares</th>
<th>Price</th>
<th>Market value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Companies</td>
<td>outstanding</td>
<td>Day T + 1</td>
</tr>
<tr>
<td>1</td>
<td>2,000</td>
<td>25.00</td>
</tr>
<tr>
<td>2</td>
<td>7,000</td>
<td>60.00</td>
</tr>
<tr>
<td>3</td>
<td>5,000</td>
<td>25.00</td>
</tr>
<tr>
<td>4</td>
<td>4,000</td>
<td>45.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Index = $\frac{775,000}{705,000} \times 100 = 109.93$

Therefore the index closed up 9.93\%

USE THE FOLLOWING INFORMATION FOR THE NEXT FIVE PROBLEMS

<table>
<thead>
<tr>
<th>Stock Price</th>
<th># Shares</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Y Z</td>
<td>X Y Z</td>
</tr>
<tr>
<td>Jan. 13, 2005</td>
<td>20 40 30</td>
</tr>
<tr>
<td>Jan. 15, 2005</td>
<td>27 45 8</td>
</tr>
</tbody>
</table>

*2:1 Split on Stock Z after Close on Jan. 13, 2005

**3:1 Split on Stock X after Close on Jan. 15, 2005

The base date for index calculations is January 13, 2005
(b) 25 Calculate a price weighted average for January 13th.

a) 32  
b) 30  
c) 36.13  
d) 34  
e) None of the above

January 13 index = \((20 + 40 + 30) ÷ 3 = 30\)

(b) 26 What is the divisor at the beginning of January 14th?

a) 3.0  
b) 2.5  
c) 2.2734  
d) 1.9375  
e) None of the above

January 14 adjusted divisor = \((20 + 40 + 15) ÷ X = 30\)
X = 2.5

(d) 27 Calculate a price weighted average for January 16th.

a) 30  
b) 32  
c) 34  
d) 36.13  
e) None of the above

Step 1: January 15 index = \((27 + 45 + 8) ÷ 2.5 = 32\)

Step 2: January 16 divisor = \((9 + 45 + 8) ÷ X = 32\)
X = 1.9375

Step 3: January 16 index = \((20 + 40 + 10) ÷ 1.9375 = 36.13\)

(b) 28 Calculate a value weighted index for Jan. 13th if the initial index value is 100.

a) 111.54  
b) 100  
c) 102.31  
d) 123.07  
e) None of the above

January 13 index = 100 by definition

(a) 29 Calculate a value weighted index for January 15th if the initial index value is 100.

a) 102.31  
b) 100  
c) 123.07  
d) 111.54  
e) None of the above

Base Value ( January 13) = \((20)(1000) + (40)(2000) + (30)(1000) = $130,000\)

January 15 Value = \((27)(1000) + (45)(2000) + (8)(2000) = 133,000\)

Index = \((133,000 ÷ 130,000) \times 100 = 102.3077\)
Chapter 7:

USE THE FOLLOWING INFORMATION FOR THE NEXT TWO PROBLEMS

<table>
<thead>
<tr>
<th>Asset (A)</th>
<th>Asset (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E(R_A) = 7%</td>
<td>E(R_B) = 9%</td>
</tr>
<tr>
<td>(σ_A) = 6%</td>
<td>(σ_B) = 5%</td>
</tr>
<tr>
<td>W_A = 0.6</td>
<td>W_B = 0.4</td>
</tr>
<tr>
<td>COV_A,B = 0.0014</td>
<td></td>
</tr>
</tbody>
</table>

(d) 30 What is the expected return of a portfolio of two risky assets if the expected return E(R_i), standard deviation (σ_i), covariance (COV_i,j), and asset weight (W_i) are as shown above?

a) 5.8%
b) 6.1%
c) 6.9%
d) 7.8%
e) 8.9%

E(R_p) = W_AE(R_A) + W_BE(R_B)
= (0.6)(7) + (0.4)(9) = 7.8%

(a) 31 What is the standard deviation of this portfolio?

a) 4.87%
b) 3.62%
c) 4.13%
d) 5.76%
e) 6.02%

σ_p = [(WA)2(σ_A)^2 + (WB)2(σ_B)^2 + 2(W_A)(W_B)(COV_A,B)]^{1/2}
= [(0.6)^2(0.06)^2 (0.4)^2(0.05)^2 + 2(0.6)(0.4)(0.0014)]^{1/2}
= (0.002368)^{1/2} = 4.87%

USE THE FOLLOWING INFORMATION FOR THE NEXT TWO PROBLEMS

<table>
<thead>
<tr>
<th>Asset (A)</th>
<th>Asset (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E(R_A) = 10%</td>
<td>E(R_B) = 14%</td>
</tr>
<tr>
<td>(σ_A) = 7%</td>
<td>(σ_B) = 8%</td>
</tr>
<tr>
<td>W_A = 0.7</td>
<td>W_B = 0.3</td>
</tr>
<tr>
<td>COV_A,B = 0.0013</td>
<td></td>
</tr>
</tbody>
</table>

(e) 32 What is the expected return of a portfolio of two risky assets if the expected return E(R_i), standard deviation (σ_i), covariance (COV_i,j), and asset weight (W_i) are as shown above?

a) 6.4%
b) 9.1%
c) 10.2%
d) 10.8%
e) 11.2%

E(R_p) = W_AE(R_A) + W_BE(R_B)
= (0.7)(10) + (0.3)(14) = 11.2%
What is the standard deviation of this portfolio?

a) 4.51%
b) 5.94%
c) 6.75%
d) 7.09%
e) 8.62%

\[
\sigma_p = \left[ (W_A)^2 (\sigma_A)^2 + (W_B)^2 (\sigma_B)^2 + 2(W_A)(W_B)(\text{COV}_{A,B}) \right]^{1/2}
\]
\[
= \left[ (0.7)^2 (0.07)^2 (0.3)^2 (0.08)^2 + 2(0.7)(0.3)(0.0013) \right]^{1/2}
\]
\[
= (0.003523)^{1/2} = 5.94\%
\]

Use the following information to answer the following questions:

<table>
<thead>
<tr>
<th>Asset (A)</th>
<th>Asset (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( E(R_A) = 16% )</td>
<td>( E(R_B) = 9% )</td>
</tr>
<tr>
<td>( (\sigma_A) = 14% )</td>
<td>( (\sigma_B) = 8% )</td>
</tr>
<tr>
<td>( W_A = ? )</td>
<td>( W_B = ? )</td>
</tr>
</tbody>
</table>

Correlation coefficient \( \gamma(A, B) = -0.20 \)

a. If 30 percent of fund is invested in stock A, what would the portfolio’s standard deviation be?

\[
E\left( \sigma_{\text{port}}^2 \right) = W_A^2 \sigma_A^2 + W_B^2 \sigma_B^2 + 2W_A \sigma_A \sigma_B \gamma(A, B)
\]

Substituting the numbers into the formula above:

Portfolio variance = \( E(\sigma^2) = 0.00396 \); Standard deviation = \( \sigma = 0.0629 = 6.29\% \)

b. Assume that \( W_A \) and \( W_B \) are not known and that your risk tolerance measured by portfolio standard deviation is 11%. What percentage of fund should be invested in stock A? How much in stock B?

c. Assume that \( W_A \) and \( W_B \) are not known and that you want to minimize the portfolio risk measured by portfolio standard deviation. What percentage of fund should be invested in stock A? How much in stock B?

Chapter 8:

d) 35 Calculate the expected return for E Services which has a beta of 1.5 when the risk free rate is 0.05 and you expect the market return to be 0.11.

a) 10.6%
b) 12.1%
c) 13.6%
d) 14.0%
e) 16.2%

\[
k = 0.05 + 1.5(0.11 - 0.05) = 0.1400 = 14.00\%
\]
(c) 36 Calculate the expected return for F Inc. which has a beta of 1.3 when the risk free rate is 0.06 and you expect the market return to be 0.125.

a) 12.65%
b) 13.55%
c) 14.45%
d) 15.05%
e) 16.34%

\[ k = 0.06 + 1.3 \times (0.125 - 0.06) = 0.1445 = 14.45\% \]

(d) 37 Recently you have received a tip that the stock of Buttercup Industries is going to rise from $76.00 to $85.00 per share over the next year. You know that the annual return on the S&P 500 has been 13% and the 90-day T-bill rate has been yielding 3% per year over the past 10 years. If beta for Buttercup is 1.0, will you purchase the stock?

a) Yes, because it is overvalued.
b) Yes, because it is undervalued.
c) No, because it is undervalued.
d) No, because it is overvalued.
e) Yes, because the expected return equals the estimated return.

Expected Return = 3 + (1.0)(13 - 3) = 13.0%
Estimated Return = (85 - 76) \times \frac{76}{76} = 11.84\%

Estimated Return < Expected Return
∴ Stock is overvalued and should not be purchased.

USE THE FOLLOWING INFORMATION FOR THE NEXT THREE PROBLEMS

You expect the risk-free rate (RFR) to be 5 percent and the market return to be 9 percent. You also have the following information about three stocks.

<table>
<thead>
<tr>
<th>STOCK</th>
<th>BETA</th>
<th>CURRENT PRICE</th>
<th>EXPECTED PRICE</th>
<th>EXPECTED DIVIDEND</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>1.50</td>
<td>$22</td>
<td>$23</td>
<td>$0.75</td>
</tr>
<tr>
<td>Y</td>
<td>0.50</td>
<td>$40</td>
<td>$43</td>
<td>$1.50</td>
</tr>
<tr>
<td>Z</td>
<td>2.00</td>
<td>$45</td>
<td>$49</td>
<td>$1.00</td>
</tr>
</tbody>
</table>

(b) 38 What are the required rates of return for the three stocks (in the order X, Y, Z)?

a) 16.50%, 5.50%, 22.00%
b) 11.00%, 7.00%, 13.00%
c) 7.95%, 11.25%, 11.11%
d) 6.20%, 2.20%, 8.20%
e) 15.00%, 3.50%, 7.30%

(a) 39 What are the estimated rates of return for the three stocks (in the order X, Y, Z)?

a) 7.95%, 11.25%, 11.11%
b) 6.20%, 2.20%, 8.20%
c) 16.50%, 5.50%, 22.00%
d) 11.00%, 7.00%, 13.00%
e) 15.00%, 3.50%, 7.30%
What is your investment strategy concerning the three stocks?

a) Buy stock Y, it is undervalued.
b) Buy stock X and Z, they are undervalued.
c) Sell stocks X and Z, they are overvalued.
d) Sell stock Y, it is overvalued.
e) Choices a and c

<table>
<thead>
<tr>
<th>STOCK</th>
<th>REQUIRED</th>
<th>ESTIMATED</th>
<th>EVALUATION</th>
</tr>
</thead>
</table>
| X     | 0.05 + 1.5(0.09 - 0.05) = 11.0% | \[
\frac{23 - 22 + 0.75}{22} = 7.95% \]
|       |          |           | overvalued |
| Y     | 0.05 + 0.5(0.09 - 0.05) = 7.0% | \[
\frac{43 - 40 + 1.50}{40} = 11.25% \]
|       |          |           | undervalued |
| Z     | 0.05 + 2.0(0.09 - 0.05) = 13.0% | \[
\frac{49 - 45 + 1.00}{45} = 11.11% \]
|       |          |           | overvalued |

USE THE FOLLOWING INFORMATION FOR THE NEXT TWO PROBLEMS

The National Motor Company's last dividend was $1.25 and the directors expect to maintain the historic 4 percent annual rate of growth. You plan to purchase the stock today because you feel that the growth rate will increase to 7 percent for the next three years and the stock will then reach $25.00 per share.

(d) 41 How much should you be willing to pay for the stock if you require a 16 percent return?

a) $17.34
b) $18.90
c) $19.09
d) $19.21
e) None of the above

You believe \( g = 7\% \):

\[
D_1 = D_0 (1+g) = 1.25 (1+.07) = 1.3375
\]
\[
D_2 = D_1 (1+g) = 1.3375 (1+.07) = 1.4311
\]
\[
D_3 = D_2 (1+g) = 1.4311 (1+.07) = 1.5313
\]
P_3 = 25

\[
P_0 = \text{sum of the present values of } D_1, D_2, D_3, \text{ and } P_3 = \$19.21 \text{ per share}
\]

(c) 42 How much should you be willing to pay for the stock if you feel that the 7 percent growth rate can be maintained indefinitely and you require a 16 percent return?

a) $11.15
b) $14.44
c) $14.86
d) $18.90
e) $19.24

Constant growth model: \( P_0 = \frac{D_1}{r-g} = \frac{1.3375}{0.16-0.07} = \$14.86 \text{ per share} \)