TEXT APPENDIX IV Solutions to Questions and Problems
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1.1. Consider the following for both questions: return, risk timing of profits, tax implications, quality of information, ease of management, fit with other investments, amount of cash available to invest, etc.

1.2. There are varying opinions on this. One might ask how valuable the managers are to firms? Their compensation may be influenced by shareholders, members of the board of directors and management itself.

1.3. Managers may have an increased incentive to maximize firm profitability.

1.4. As the firm's performance improves, there is more money available to compensate management. Thus managers of strong firms have a larger base from which to draw their compensation. If the firm is profitable, managers draw more compensation by having their pay linked to performance.

1.5. Share prices are not entirely under the control of managers. Since other forces in the marketplace influence share prices, managers are subject to risks that are beyond their control and may demand additional compensation in return for assuming these risks. Furthermore, managers may be able to improperly manipulate the information that the market receives thereby manipulating share prices and their own compensation.

1.6. a. The chairman does not expect profits to grow, he does not want to accept the risks associated with variable compensation
b. The chairman expects profits to grow, he is willing to accept risks
c. The chairman expects that the level of firm profitability to persist beyond his retirement

1.7. Because real estate assets are very specialized with each buyer and seller dealing with different commodities, selling them requires more work. There is usually much more information available to the public regarding stocks than regarding specific real estate assets.

1.8. Primary financial markets exist to enable corporations and other institutions to sell securities to raise money. Secondary financial markets exist to provide liquidity for primary market participants.

1.9. Financial models that emphasize simplicity often have simplifying assumptions that render them unrealistic.

1.10. Since the he most unrealistic models frequently have assumptions that emphasize simplicity, relaxing or eliminating the most unrealistic assumptions can lend more reality to the models.

1.11. There is no single answer to this question. This issue is worthy of much discussion.

2.1. Automobile loans are more expensive to originate and collect on. Banks, because of their market power in the lending and savings industries, are able to borrow (through savings accounts) and lend at rates more favorable to themselves.

Home loan mortgages, because they tend to be well collateralized, are regarded as less risky than credit card loans, which are unsecured.

2.2. $FV_8 = 10{,}500\ (1 + 8 \times .09) = 10{,}500 \times 1.72 = 18{,}060$

2.3. a. [10% x $10,000,000] / 2 = $500,000

b. 10% x $10,000,000 = 2 x $500,000 = $1,000,000

c. $10,000,000 + $1,000,000 = Principal + interest in year five = $11,000,000

2.4. a. $FV_8 = 10{,}500\ (1 + .09)^8 = 10{,}500 \times 1.99256$
$= 20{,}921.908$

b. $FV_8 = 10{,}500\ (1 + \frac{.09}{2})^{2\times 8} = 10{,}500 \times 2.0223702$
$= 21{,}234.887$

c. $FV_8 = 10{,}500\ (1 + \frac{.09}{12})^{12\times 8} = 10{,}500 \times 2.0489212$
$= 21{,}513.673$

d. $FV_8 = 10{,}500\ (1 + \frac{.09}{365})^{365\times 8} = 10{,}500 \times 2.0542506$
$= 21{,}569.632$

e. $FV_8 = 10{,}500\ e^{.09\times 8} = 10{,}500 \times 2.0544332 = 21{,}571.549$

2.5 For example, let X_0 = $1000 in each case

For CD_1 : $FV_5 = 1000(1 + .12)^5 = 1{,}762.3417$

For CD_2 : $FV_5 = 1000(1 = \frac{.10}{365})^{365\times 5} = 1{,}648.6005$

2.6 Solve for X_0:

$$X_0 = \frac{FV_n}{(1+i)^n} = \frac{10{,}000}{(1+.08)^3} = 7938.322$$

2.7 Solve the following for APY:

$$\left(1+\frac{.09}{4}\right)^4 = (1+APY)$$
$$APY = \left(1+\frac{.09}{4}\right)^4 - 1 = .093083$$

2.8 In all cases here, $FV_n = 2X_0$. Thus, let $FV_n = 2000$ and $X_0 = 1000$

a. $2000 = 1000\ (1 + n \times .1);\ 2=(1 + n \times .1);$
$1 = .1n;\ n = 10$ years

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b. $2000 = 1000\ (1.1)^n$; using logs:
$\log 2000 = (\log 1000) + n \times \log (1.1)$
$3.30103 = 3 + n\cong(.04139)$;
$.30103 = n(.04139)$; $n = 7.2725$ years

c. $2000 = 1000\ (1 + \frac{.10}{12})^{12n}$;

$\log 2000 = (\log 1000) / [12 \cdot \log(1.008333)]$
$= n = 6.9603407$ years

d. $2000 = 1000\ e^{.1n}$; use natural logs:
$\ln 2000 = (\ln 1000) + .1n$; $n = 6.931478$ years

2.9. Many of the calculations for this problem will draw from the following expression:

$$FV_n = X\frac{(1+i)^n - 1}{i}$$

a. Use the terminal annuity formula - assuming end of year payments. Set TVA equal to \$1,000,000 then substitute for n to find that n=41.25. Thus, the client must make payments for 42 years, or until he is 65 years old.

b. Use the same substitution process as in part a to find that n=36.27. Thus, the client must make payments for 37 years. Alternatively, logs (natural, base 10 or other, it doesn't matter) can be used to solve this problem as follows:

$$FV_n = X\frac{(1+i)^n - 1}{i} \quad ; \quad \frac{FV_n \cdot i}{X} = (1+i)^n - 1$$

$$\log\left(\frac{FV_n \cdot i}{X} + 1\right) = n\log(1+i)\ ;\ \log\left(\frac{FV_n \cdot i}{X} + 1\right) \div \log(1+i) = n$$

$$n = \log\left(\frac{\$1{,}000{,}000 \cdot .12}{\$2{,}000} + 1\right) \div \log(1+.12) = \frac{\log(61)}{\log(1.12)} = 36.27$$

c. Now, using the FVA formula, and n equal to 17, substitute (or better still, solve algebraicly for CF) to find that the annual payment must be \$24,664.134.

d. Use the same process as in part c, except that n equals 27. The annual payment equals \$8,257.6423.

e. Use n equal to 27 and i equal to .12 to find that TVA equals \$5,904.0937.

f. Use the same process as in part e to find the following: a. the answer becomes: n=77.63 or 78 years; c. the answer becomes: payment = \$42,198.523; d. the answer becomes: payment = \$21,238.541

g. 17: simply divide \$1,000,000 by $(1.03)^{17}$ to obtain \$605,016.45; 27: simply divide \$1,000,000 by $(1.03)^{27}$ to obtain \$450,189.06

h. 17: simply divide \$1,000,000 by $(1.09)^{17}$ to obtain \$231,073.18
27: simply divide \$1,000,000 by $(1.09)^{27}$ to obtain \$97,607.807

3.1 a. $PV = \frac{CF_n}{(1+k)^n} = \frac{10{,}000}{(1+.20)^5} = \frac{10{,}000}{1.2^5} = \frac{10{,}000}{2.48832} = 4018.775$

b. $PV = \frac{10,000}{1.10^5} = \frac{10,000}{1.61051} = 6209.213$

c. $PV = \frac{10,000}{1.01^5} = \frac{10,000}{1.0510101} = 9514.656$

d. $PV = \frac{10,000}{1.0^5} = \frac{10,000}{1} = 10,000$

3.2. a. $PV = \frac{10,000}{1.1^{20}} = \frac{10,000}{6.7275} = 1486.436$

b. $PV = \frac{10,000}{1.1^{10}} = \frac{10,000}{2.5937425} = 3855.432$

c. $PV = \frac{10,000}{1.1^{1}} = \frac{10,000}{1.1} = 9090.909$

d. $PV = \frac{10,000}{1.1^{.5}} = \frac{10,000}{1.1^{.5}} = \frac{10,000}{1.0488088} = 9534.625$;

Note: 6 months is .5 of one year

e. $PV = \frac{10,000}{1.1^{.2}} = \frac{10,000}{1.0192449} = 9811.184$;

Note: 73 days is .2 of one year

3.3 $$PV = \sum_{t=1}^{n} \frac{CF_t}{(1+k)^t} = \frac{2000}{1.08^1} + \frac{3000}{1.08^2} + \frac{7000}{1.08^3}$$

PV = 1851.85 + 2572.02 = 5556.83 = 9980.70;
10,000 > 9980.70
Since P_0 > PV, the investment should not be purchased.

3.4 $$PV_n = CF\left[\frac{1}{k} - \frac{1}{k(1+k)^n}\right]$$

a. $PV_A = 2000\left[\frac{1}{.05} - \frac{1}{.05(1.05)^9}\right] = 2000[20-12.892178]$
$= 14,215.643$

b. $PV_A = 2000\left[\frac{1}{.10} - \frac{1}{.10(1.10)^9}\right] = 2000[10-4.2409762]$
$= 11,518.048$

c. $PV_A = \left[\frac{1}{.2} - \frac{1}{.2(1.2)^9}\right] = 2000[5-.9690335]$
$= 8,061.933$

3.5 $PV_p = \frac{CF}{K} = \frac{50}{.08} = 625$

Solutions to Questions and Problems

3.6. $CF_n = CF_1(1 + g)^{n-1}$

a. $CF_2 = 10{,}000\ (1 + .1)^{2-1} = 10{,}000\ (1 + .1)$
$= 10{,}000 \times 1.1 = 11{,}000$

b. $CF_3 = 10{,}000\ (1 + .1)^{3-1} = 10{,}000 \times 1.21 = 12{,}100$
c. $CF^5 = 10{,}000\ (1 + .1)^{5-1} = 10{,}000 \times 1.4641 = 14{,}641$

d. $CF_{10} = 10{,}000\ (1 + .1)^{10-1} = 10{,}000 \times 2.3579477$
$= 23,\ 579.477$

3.7. $PV_{ga} = CF_1 \times \left|\frac{1}{k-g} - \frac{(1+g)}{(k-g)(1+k)^n}\right| = 5000 * \left|\frac{1}{.02} - \frac{(1+.10)^7}{(.12-.10)(1+.12)^7}\right|$

$PV_{ga} = 5000 \times [50-44.075033] = 29{,}624.837$

3.8. $PV_{gp} = \frac{CF_1}{k-g} = \frac{100}{.12-.05} = 1428.5714$

3.9. \$60,000 per year for 20 years

a. PV = 500,000

b. $PV = 100{,}000 \left[\frac{1}{.05} - \frac{1}{.05(1.05)^8}\right] = 646{,}321.27$

c. $PV = 60{,}000 \left[\frac{1}{.05} - \frac{1}{.05(1.05)^{20}}\right] = 747{,}73262$

d. $PV = \frac{30{,}000}{.05} = 600{,}000$

Series (c) has the highest present value.

3.10.

a. PV = 500,000

b. $PV = 100{,}000 \left[\frac{1}{.2} - \frac{1}{.2(1.2)^8}\right] = 383{,}715.98$

c. $PV = 60{,}000 \left[\frac{1}{.2} - \frac{1}{.2(1.2)^{20}}\right] = 292{,}174.78$

d. $PV = \frac{30{,}000}{.2} = 150{,}000$

3.11. $Pay = Prin. / \left[\frac{1}{i} - \frac{1}{i(1+i)^n}\right]$;

Prin. = 200,000-50,000=150,000

a. $Pay = 150{,}000/\left[\frac{1}{.1} - \frac{1}{.1(1+.1)^{20}}\right]$

$= 150{,}000/8.5135637 = 17{,}618.944$

b. $\text{Pay} = 150{,}000/\left[\frac{1}{.008333} - \frac{1}{.008333(1.008333)^{240}}\right]$

$= 150{,}000/103.62442 = 1447.5352$

Note: 10% / 12 = .008333 ; 20 x 12 = 240

3.12. Plug discount rates into the present value annuity function until you find one that sets PV equal to the purchase price.

Try 15%: PV = 9543.1685 < 10,000
Try 13%: PV = 10,803.31 > 10,000
Try 14%: PV = 9,892.8294 < 10,000
Try 13.7%: PV = 10,001.638 > 10,000
Try 13.71%: PV = 9,997.977 < 10,000
Try 13.704%: PV = 10,000.174 > 10,000

Thus, K is approximately 13.704%

3.13. a. $PV = \frac{10{,}000}{1.1^{20}} = \frac{10{,}000}{6.7275} = 1486.436$

b. $PV = \frac{10{,}000}{(1+.1/12)^{12*20}} = \frac{10{,}000}{7.328074} = 1364.615$

c. $PV = \frac{10{,}000}{(1+.1/365)^{365*20}} = \frac{10{,}000}{7.3870321} = 1353.7236$

d. $PV = 10{,}000 * e^{-.1\cdot 20} = 1353.3528$

3.14. a. First, the monthly discount rate is .1÷12 = .008333

$PV = 1{,}000 *\left[\frac{1}{.008333} - \frac{1}{.008333(1+.008333)^{360}}\right]$

$= 1{,}000 * 113.95082 = \$113{,}950.82$

b. Yes, since the PV exceeds the $100,000 price

c. $100{,}000 = 1{,}000 *\left[\frac{1}{(k/12)} - \frac{1}{(k/12)*(1+k/12)^{360}}\right]$

Solve for k; by process of substitution, we find that k = .11627 .

3.15. $PV_{ga} = CF\left[\frac{(1+g)^0}{(1+k)^1} + \frac{(1+g)^1}{(1+k)^2} + \frac{\ldots}{\ldots} + \frac{(1+g)^{n-1}}{(1+k)^n}\right]$

$PV_{ga} * \frac{(1+k)}{(1+g)} = CF\left[\frac{(1+g)^{-1}}{(1+k)^0} + \frac{(1+g)^0}{(1+k)^1} + \frac{\ldots}{\ldots} + \frac{(1+g)^{n-2}}{(1+k)^{n-1}}\right]$

$PV_{ga} * \frac{(1+k)}{(1+g)} - PV_{ga} = CF\left[\frac{(1+g)^{-1}}{(1+k)^0} - \frac{(1+g)^{n-1}}{(1+k)^n}\right]$

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$$PV_{ga} * \frac{(1+k)-(1+g)}{(1+g)} = PV_{ga}\frac{(k-g)}{(1+g)} = CF\left[\frac{(1+g)^{-1}}{(1+k)^{0}} - \frac{(1+g)^{n-1}}{(1+k)^{n}}\right]$$

$$PV_{ga} = CF\left[\frac{1}{(k-g)} - \frac{(1+g)^{n}}{(k-g)(1+k)^{n}}\right]$$

3.16.a. 30 years * 12 months per year = 360 months

b. 9% per year ÷ 12 months = .0075 or .75%

c. Solve for the payment or periodic cash flow using the annuity factor with PV or Prin. equal to 300,000, k = .0075 and n = 360.

$$Payment = \$300{,}000 \div \left(\frac{1}{.0075} - \frac{1}{.0075(1+.0075)^{360}}\right) = \$2{,}413.87$$

d. The following amortization includes payment structures for the first three months plus the next two and the final two months.

Month	Beginning of Month Principal	Total Payment	Payment on Interest	Payment on Principal
1	300,000.00	2,413.87	2,250.00	163.87
2	299,836.13	2,413.87	2,248.77	165.10
3	299,671.03	2,413.87	2,247.53	166.34
4	299,504.69	2,413.87	2,246.29	167.58
5	299,337.11	2,413.87	2,245.03	168.84
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
358	7,134.33	2,413.87	53.51	2,360.36
359	4,773.97	2,413.87	35.80	2,378.07
360	2,395.90	2,413.87	17.97	2,395.90

Amortization schedule of $300,000 loan with equal monthly payments for thirty years at 9% interest per annum (.0075 per month). Students should be able to work through the figures on this table starting from the upper left hand corner, then working to the left then down. In this particular example, because n is large (360), use of a computerized spreadsheet will make computations substantially more efficient.

3.17. The following Three Stage Growth Model can be used to evaluate this stock:

$$P_0 = DIV_1\left[\frac{1}{k-g_1} - \frac{(1+g_1)^{n(1)}}{(k-g_1)(1+k)^{n(1)}}\right] + DIV_1\left[\frac{(1+g_1)^{n(1)-1}(1+g_2)}{(1+k)^{n(1)}(k-g_2)} - \frac{(1+g_1)^{n(1)-1}(1+g_2)^{n(2)-n(1)+1}}{(k-g_2)(1+k)^{n(2)}}\right]$$
$$+ \frac{DIV_1(1+g_1)^{n(1)-1}(1+g_2)^{n(2)-n(1)}(1+g_3)}{(k-g_3)(1+k)^{n(2)}}$$

$$P_0 = \$5\left[\frac{1}{.08-.15} - \frac{(1+.15)^{3}}{(.08-.15)(1+.08)^{3}}\right] + \$5\left[\frac{(1+.15)^{3-1}(1+.06)}{(1+.08)^{3}(.08-.06)} - \frac{(1+.15)^{3-1}(1+.06)^{6-3-1}}{(.08-.06)(1+.08)^{6}}\right]$$
$$+ \frac{\$5(1+.15)^{3-1}(1+.06)^{6-3}(1+0)}{(.08-0)(1+.08)^{6}} = 92.0171078$$

Since the $100 purchase price of the stock exceeds its $92.0171 value, the stock should not be purchased.

4.1 a. ROI = $\sum_{t=0}^{n} CF_t \div nP_0$

= (-100 + 200) /(1 ·(100))
= 1.00 or 100%

4.2 a. ROI = (40 - 20)/(7(20))
= .1428 or 14.28%

b. ROI = $(40/20)^{1/7} - 1$
= $(2)^{1/7} -1$
= .1041 or 10.41%

c. IRR = 10.41%; Note that ROI_{AG} = IRR when there is only a capital gain profit.

4.3 a. ROI = (500 + 4,800)/6(7,500)
= .1178 or 11.78%

b. IRR = 11.49%

4.4 a. ROI = (-100,000 + 20,000 + 20,000 + 20,000 + 20,000 + 60,000)/5(100,000)
= 40,000/500,000
= .08 or 8%

b. IRR = 10.21%

4.5 NPV = 0, by definition of IRR.

4.6 a. Dividends: Grove = $800
Dean = $200

b. Capital Gains: Grove = $1,100 - $1,000 = $100
Dean = $1,800 - $1,000 = $800

c. Arithmetic Mean Capital Gain Return:

Grove = (100 + 800)/8(1,000) = .1125 or 11.25%
Dean = (800 + 200)/8(1,000) = .125 or 12.5%

d. IRR:

Grove = 11.0165%
Dean = 9.5%

SUMMARY OF RESULTS

Company	Dividends	Cap Gains	ROI_a	IRR
Grove	800	100	11.25%	10.0%

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Dean	200	800	12.50%	9.5%

e. Which of the stocks performed better during their holding periods?

Under ROI_a = Dean
Under IRR = Grove

The performance evaluation depends on the measure used. Depends on the investor's time value of money. Higher time value indicates that IRR is more useful.

4.7

a. $ROI_A = \sum_{t=0}^{n} CF_t \div nP_0$

= (-100,000 + 50,000 - 50,000 + 75,000 + 75,000)/6(100,000)
= .083 or 8.3%

b. $100{,}000 = 50{,}000/(1+r)^2 - 50{,}000/(1+r)^3 + 75{,}000/(1+r)^4 + 75{,}000/(1+r)^6$

IRR = 9.32487405%, IRR = -227.776188859%,

c. There are actually two internal rates of return for this problem. However, 9.32487% seems to be a reasonable rate.

4.8 a. Its annual interest payments:

$i_y = Int/F_0$
$Int = i_y(F_0)$
$= (.12)(1000)$
$= \$120$

b. Its current yield:

$cy = Int/P_0$
$= 120/1{,}200$
$= .10$

c. With Equation 4.8, yield to maturity is found to be .04697429 or 4.697429%

4.9

a. Its annual interest payments: $120, or $60 every six months.
b. 120 ÷ 1200 = Its current yield = .10 or 10%.
c. Its yield to maturity:

$-1200 + 60/[1+(r/2)]^1 + 60/[1+(r/2)]^2 + \ldots + 60/[1+(r/2)]^5 + 1060/[1+(r/2)]^6$

r = .0476634

4.10. $PV_{ga} = CF_1 \times \left[\frac{1}{r-g} - \frac{(1+g)^n}{(r-g)(1+r)^n}\right] + \frac{CF_n}{(1+r)^n}$

CF_1 = \$3,000 , n = 20 , g = .10
Solve for r above to obtain IRR = .11794166365

4.11. First, compute 5 monthly returns as follows:

Date	t	P_t	P_{t-1}	DIV_t	r_t	NOTES
June 30	1	50	-	0	-	First Month
July 31	2	55	50	0	.100	(55÷50) - 1 = .10
Aug. 31	3	50	55	0	-.091	(50÷55) - 1 = -.091
Sep. 30	4	54	50	0	.080	(54÷50) - 1 = .08
Oct. 31	5	47	54	2	-.092	ex-\$2 dividend; [(47+2)÷54)]-1= -.092
Nov. 30	6 51	47		0	.081	(51÷47) - 1 = .085

Next, compute the 5-month geometric mean return for the fund:

$$ROI_g = \sqrt[5]{(1+.10)(1-.091)(1+.08)(1-.092)(1+.081)} - 1 = .0117$$

4.12. Each outcome has a one-third or .333 probability of being realized since the probabilities are equal and must sum to one.

b. E[SALES] = $(800{,}000 \cdot .333) + (500{,}000 \cdot .333) + (400{,}000 \cdot .333)$
E[SALES] = 566,667

c. var[sales] = [$(800{,}000 - 566{,}667)^2 \times .333 + (500{,}000 - 566{,}667)^2 \times .333 + (400{,}000 - 566{,}667) \times .333$] = 28,888,000,000 = σ^2_{SALES}

d. Expected return of Project A = $(.3\times.333)+(.15\times.333)+(.01\times.333)$ = .15333

e. Variance of A's Returns = [$(.3-.1533)^2 \times.333 + (.15-.1533)^2 \times.333 + (.01-.1533)^2 \times.333$] = .0140222 = σ_A^2

f. Expected Return of Project B = $(.2\times.333)+(.13\times.333)+(.09\times.333)$ = .14 .

Variance of B's Returns = [$(.2-.14)^2 \times.333 + (.13-.14)^2 \times.333 + (.09-.14)^2 \times.333$] = .0020666 = σ_B^2 .

g. Standard deviations are square roots of variances.

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$\sigma_{SALES} = 169{,}964$

$\sigma_A = .1184154$

$\sigma_B = .0454606$

h. $COV[SALES,A] = \sum_{i=1}^{n} (SALES_i - E[SALES]) * (R_{Ai} - E[R_A]) * P_i$

$$\begin{aligned} COV[SALES,A] &= (800{,}000 - 566{,}667) * (.3 - .1533) * .333 \\ &+ (500{,}000 - 566{,}667) * (.15 - .1533) * .333 \\ &+ (400{,}000 - 566{,}667) * (.01 - .1533) * .333 \\ &= 19{,}444 = \sigma_{SALES,\ A} \end{aligned}$$

i. $\rho_{s,A} = \dfrac{\sigma_{SALES,A}}{\sigma_{SALES} \times \sigma_A} = \dfrac{19{,}444}{169{,}964 \times .118} = .97$

j. First, find the covariance between sales and returns on B.

$$\begin{aligned} COV[SALES,B] &= (800{,}000 - 566{,}667) \times (.20 - .14) \times .333 \\ &+ (500{,}000 - 566{,}667) \times (.13 - .14) \times .333 \\ &+ (400{,}000 - 566{,}667) \times (.09 - .14) \times .333 \\ &= 7666.67 = \sigma_{SALES,\ B} \end{aligned}$$

$$\rho_{SALES,\ B} = \frac{\sigma_{SALES,B}}{\sigma_{SALES} \times \sigma_B} = \frac{7666}{169{,}964 \times .0454} = .993$$

k. Coefficient of Determination is simply Coefficient of Correlation squared: $.993 \times .993 = .986$

4.13. Project A has a higher expected return; however, it is riskier. Therefore, it does not clearly dominate Project B. Similarly, B does not dominate A. Therefore, we have insufficient evidence to determine which of the projects are better.

4.14

a. $\bar{R}_{Mc} = .062$

$\bar{R}_A = .106$

$R_M = .098$

b. $\sigma^2_{Mc} = .000696$ (Remember to convert returns to percentages.)

$\sigma^2_A = .008824$ (Square roots of these variances are standard

$\sigma^2_M = .001576$ deviations.)

c. COV[Mc,A] = [(.04−.062)×(.19−.106) + (.07−.062)×(.04−.106) + (.11−.062)×(−.04−.106) + (.04−.062)×(.21−.106) + (.05−.062) ×(.13−.106)] / 5 = −.001624

$$\rho_{Mc,A} = \frac{COV[Mc,A]}{\sigma_{Mc}\ \sigma_A} = \frac{-.001624}{.0264 \times .094} = -.6544$$

d. COV[Mc,A] = [(.04−.062)×(.15−.098) + (.07−.062)×(.10−.098) + (.11−.062)×(.03−.098) + (.04−.062)×(.12−.098) + (.05−.062)×(.09−.098)] / 5 = −.000956

$$\rho_{Mc,M} = \frac{COV[Mc,M]}{\sigma_L\ \sigma_M} = \frac{-.000956}{.0264 \times .039} = -.912$$

e. COV[M,A] = [(.15−.098)×(.19−.106) + (.10−.098)×(.04−.106) + (.03−.098)×(−.04−.106) + (.12−.098)×(.21−.106) + (.09−.098)×(.13−.106)]/5 = .003252

$$\rho_{M,A} = \frac{COV[M,A]}{\sigma_M\ \sigma_A} = \frac{.003252}{.039 \times .094} = .872$$

4.15. Assuming variance and correlation stability, the forecasted values would be the same as the historical values in Problem (4.14).

4.16. a. Since probabilities must sum to one, the probability must equal .15.
b. First, note that there is a .25 probability that the return will be .05 (.10+.05+.10) and .20 and .55 probabilities that the return will be .15. Thus, the expected return is .05×.25 + .10×.20 + .15×.55 = .115. The variance is $.25\times(.05-.115)^2 + .20\times(.10-.115)^2 + .55\times(.15-.115)^2 = .001775$, which implies a standard deviation equal to .04213.

4.17. Standardize returns by standard deviations and consult "z" tables:

$$\frac{R_i - E[R]}{\text{Standard Deviation}} = z.$$ Only use positive values for z.

Solutions to Questions and Problems

a. $\frac{.05 - .15}{.10} = z(\text{low}) = 1$ $\qquad$ $\frac{.25 - .15}{.10} = z(\text{high}) = 1$

From the "z" table, we see that the probability that the security's return will fall between .05 and .15 is .34. The value .34 is also the probability that the security's return will fall between .15 and .25. Therefore, the probability that the security's return will fall between .05 and .25 is .68.

b. From (4.16.a.), we see that the probability is .34.

c. .16

d. .0668

4.18. Simply reduce the standard deviations in the z scores in Problem (4.17) to .05.

a. .95

b. .47

c. .0228

d. .0013

4.19. Never, because coefficient of determination is always a positive squared value.

4.20.a. var = .0025; std.dev. = .05
b. -.00125

4.21.
a. VAR = .0025

b. 0 : The coefficient of correlation between returns on any asset and returns on a riskless asset must be zero. Riskless asset returns do not vary.

4.22.
a.

Date	Company X Return	Company Y Return	Company Z Return
1/09	-	-	-
1/10	0	0	.00207
1/11	.00249	.00625	-.00413
1/12	0	.00621	-.00207
1/13	.00248	.00617	-.00207
1/14	-.00248	0	.00208
1/15	.03980	.04907	.04158
1/16	.00239	-.00584	-.02994
1/17	-.00238	.00588	0
1/18	.00239	.00584	.00205
1/19	.00238	-.00581	0
1/20	-.00238	.00584	0

b., c.

Stock	Average Return	Standard Deviation
X	.004064	.011479

Y	.006693	.014150
Z	.000869	.015537

5.1. a. $\overline{R}_P = (w_T \cdot \overline{R}_T) + (w_D + \overline{R}_D) = (.5 \cdot .20) + (.5 \cdot .06) = .13$

b. $\sigma_P^2 = w_D^2 \cdot \sigma_D^2 + w_T^2 + \sigma_T^2 + 2 \cdot W_D \cdot W_T \cdot \sigma_D \cdot \sigma_T \cdot \rho_{D,T}$

$\sigma_P^2 = .5^2 \cdot 09^2 + .5^2 + .30^2 + 2 \cdot .5 \cdot .5 \cdot .09 \cdot .30 \cdot .4$

= .002025 + .0225 + .0054 = .029925

c. $\sigma_P = \sqrt{.029925} = .1729884$, since standard deviation is the square root of variance.

5.2.

a. $\overline{R}_P = .06, \sigma_P^2 = .0081, \sigma_P = .09$

b. $\overline{R}_P = .095, \sigma_P^2 = .0142312, \sigma_P = .1192948$

c. $\overline{R}_P = .165, \sigma_P^2 = .0551812, \sigma_P = .2349067$

d. $\overline{R}_P = .20, \sigma_P^2 = .09, \sigma_P = .3$

5.3. As proportions of funds invested in the Tilden Company increase, both expected portfolio return and portfolio variance (risk) levels will increase. Portfolio expected return increases because Tilden Company stock has a higher expected return. Portfolio variance increases because the correlation coefficient of .4 is not low enough to offset the high variance of returns on the Tilden Company stock. The slope of the curve should be positive; although, it should be more steep at the bottom.

5.4.

a. $\overline{R}_p$ = .075, Φ_p = .16

b. $\overline{R}_p$ = .075, Φ_p = .14

c. $\overline{R}_p$ = .075, Φ_p = .116619

d. $\overline{R}_p$ = .075, Φ_p = .0871770

5.5. Correlation coefficients have no effect on the expected return of the portfolio. However, a decrease in the correlation coefficients between security returns will decrease the variance or risk of that portfolio.

Solutions to Questions and Problems

5.6.a. $R_{p1} = .25$, $R_{p2} = .11$, $R_{p3} = -.045$; Since the portfolio weights are equal, each weight is .5.

b. $\bar{R}_p = (.20\times.25) + (.50\times.11) + (.30\times -.045) = .0915$

c. $\sigma_p^2 = (.25-.0915)^2 \times.20 + (.11-.0915)^2 \times.50 + (-.045-.0915)^2 \times.30$

$\sigma_p^2 = .0050244 + .0001711 + .0055896 = .0107851$; $\Phi_p = .1038517$

d. $\bar{R}_A = .093$; $\bar{R}_B = .09$

e. $\sigma_A^2 = (.30-.093)^2 \times.20 + (.12-.093)^2 \times.50 + (-.09-.093)^2 \times .30$

$\sigma_A^2 = .018981$; $\Phi_A = .1377715$

$\sigma_B^2 = (.20-.09)^2 \times.20 + (.10-.09)^2 \times.50 + (0-.09)^2 \times.30$

$\sigma_B^2 = .0049$; $\Phi_B = .07$

f. $\sigma_{AB} = (.30-.093)\times(.20-.09)\times.20 + (.12-.093)\times(.1-.09)\times.50$

$+ (-.09-.093)\times(0-.09)\times\cong.30 = .00963$

$$\rho_{AB} = \frac{.00963}{.1377715 \cong .07} = .9985478$$

g. $\bar{R}_p = (.5\times.093) + (.5\times.09) = .0915$; it is the same, though found by using portfolio weights and expected security returns rather than portfolio return outcomes and associated probabilities.

h. $\sigma_p^2 = .5^2 \times .1377715^2 + .5^2 \times .07^2 \times.5\times.5\times.1377715\times.07 \times.998548$

$\sigma_p^2 = .0107851$; $\sigma_p = .1038517$; the same as part c.

5.7.

Security weights are: $w_X = .167$, $w_Y = .333$, $w_Z = .5$

$\bar{R}_p = (.167\times.10) + (.333\times.15) + (.5\times.20) = .167$

$\sigma_p^2 = (.167\times.167\times.12\times.12\times1) + (.167\times.333\times.12\times.18\times.8)$

$+ (.167\times.5\times.12\times.24\times.7) + (.333\times.167\times.18\times.12\times.8)$

$+ (.333\times.333\times.18\times.18\times1) + (.333\times.5\times.18\times.24\times.6)$

$+ (.5\times.167\times.24\times.12\times.7) + (.5\times.333\times.24\times.18\times.6)$

$+ (.5\times.5\times.24\times.24\times1) = .0323144$; $\sigma_p = .179762$

5.8 Here, we want to find that w_A value that will set portfolio variance equal to zero. Remember that portfolio weights must sum to one. Thus, w_B is simply 1 - w_A. First, take what we know and substitute into the 2-security portfolio variance equation:

$$\sigma_p^2 = w_A^2 \cdot .10^2 + w_B^2 \cdot .18^2 + 2 \cdot w_A \cdot w_B \cdot .10 \cdot .18 \cdot -1 = 0$$

Since w_B is simply 1 - w_A, we substitute and simplify as follows:

$$0 = .01w_A^2 + .0324 \cdot (1 - w_A)^2 - .036 \cdot w_A \cdot (1 - w_A)$$

Now, we separate out the (1 - w_A) terms:

$$0 = .01w_A^2 + .0324 + .324{w_A}^2 - .0648w_A - .036w_A + .036w_A^2$$

Next, we combine similar terms:

$$0 = .0784w_A^2 - .1008w_A + .0324$$

Note that this expression is set up in descending order of exponents. Now let a=.0784, b=-.1008 and c=.0324. Solve for w_A using the quadratic formula:

$$w_A = \frac{-b + \sqrt{b^2 - 4ac}}{2a},$$ where a=.0784, b=-.1008 and c=.0324.

$$w_A = \frac{.1008 + \sqrt{.1008^2 - 4 \times .0784 \times .0324}}{2 \times .0784} = \frac{.1008 + 0}{.1568} = .64286,$$

Plugging in for a, b and c, we find that the portfolio is riskless when w_A = .64286. Thus, w_B = .35714. Riskless portfolios can be constructed from risky securities only when their returns are perfectly inversely correlated. Even in this case, only one combination of weights results in a riskless portfolio.

5.9. This would be a perfectly diversified portfolio; its standard deviation will be zero. Portfolio variance is determined as follows:

$$\sigma_p^2 = \sum_{\substack{i=1 \\ i \neq j}}^{n} \sum_{j=1}^{n} w_i w_j \sigma_{ij} + \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j \sigma_{ij} = 2(\sum_{\substack{i=1 \\ i<j}}^{n} \sum_{j=1}^{n} w_i w_j \sigma_{ij}) + \sum_{i=1}^{n} w_i^2 \sigma_i^2$$

$$\sigma_p^2 = 2(\sum_{\substack{i=1 \\ i<j}}^{\infty} \sum_{j=1}^{\infty} (1/\infty)^2 \cdot 0) + \sum_{i=1}^{\infty} (1/\infty)^2 \sigma_i^2 = 0 + 0 = 0$$

5.10 Portfolios a, d, e and f are dominant.
Portfolio b is not; it is dominated by d.
Portfolio c is not; it is dominated by d and e.

5.11

Solutions to Questions and Problems

Figure 1: THE EFFICIENT FRONTIER

b. Simply draw a line tangent to efficient frontier intercepting at 5%. The market portfolio return and risk levels are the coordinates of the point of tangency.

c. See part b to draw the CML.

d. $\dfrac{R_M - r_f}{\sigma_M}$

Fill in your numbers for R_M and Φ_M.

5.12 More Risk Averse: Lenders: Increasing risk aversion decreases borrowing; decreasing borrowing decreases risk.

5.13 Globalizing portfolios will shift the feasible region, efficient frontier and the Capital Market Line upwards and to the left.

5.14

Given:	$P_0 = 60$	$\Phi_a = .25$
	$P_1 = 65$	$\Phi_m = .16$
	$\Delta_{am} = .40$	$R_f = .05$
	Div= \$2	$R_m = .12$

$cov_{am} = \Phi_a \Phi_m \Delta_{am} = .25(.16)(.4) = .016$

a. $\boldsymbol{\beta = cov_{am}/\Phi_m^2 = .016/(.16)^2 = .016/.0256 = .625}$

b. $rr_a = R_f + \exists_a(R_m - R_f) = .05 + .625(.12 - .05) = .05 + .625(.07)$
$= .09375$

c. same as b = .09375

d. $PV = CF_a/(1 + rr_a) \quad = (65 + 2)/(1 + .09375)$
$= 67/1.09375 \quad = 61.257$

e. The stock is a good investment because PV > P_0 or \$61.257 > \$60.

5.15. Given:

Year	Holmes (R_h)	Warren (R_w)	R_m	R_f
1986	.12	.04	.10	.06
1987	.18	.20	.14	.06
1988	.07	.02	.06	.06
1989	.03	-.03	.02	.06
1990	.10	.09	.08	.06

Formulas:

$$cov_{ab} = \mathrm{E}_{t=1}^{n} (R_{at} - E(R_{at}))(R_{bt} - E(R_{bt})) \div n$$ where E(R) is the historical mean return

$$\Delta_{ab} = cov_{ab}/\Phi_a\Phi_b$$

$$\Phi_{ab} = \sum_{t=1}^{n} (R_{at} - \overline{(R_{at})})(R_{bt} - \overline{(R_{bt})}) \div n$$

$$\overline{R_a} = \sum_{t=1}^{n} R_t \div n$$

$$\beta_a = cov_{am}/\Phi_m^2$$

a. Calculate return standard deviations for each of the stocks and the market portfolio.

$$R_h = \sum_{t=1}^{5} R_{ht} \div n \quad = (.12 + .18 + .07 + .03 + .10)/5 \quad = .10$$

$$R_w = \sum_{t=1}^{5} R_{wt} \div n = (.04 + .20 + .02 - .03 + .09)/5 \quad = .064$$

$$\overline{R_m} = \sum_{t=1}^{5} R_{mt} \div n = (.10 + .14 + .06 + .02 + .08)/5 = .08$$

$$\Phi_h = \{[(.12 -.10)^2 + (.18 -.10)^2 + (.07 -.10)^2 + (.03 -.10)^2 + (.10 -.10)^2)]/5\}^{1/2} \quad = .050199$$

$$\Phi_w = \{[(.04 -.064)^2 + (.2 -.064)^2 + (.02 -.064)^2 + (-.03 -.064)^2 + (.09 -.064)^2)]/5\}^{1/2} \quad = .078128$$

Solutions to Questions and Problems

$$\Phi_m = \{[(.10 -.08)^2 + (.14 -.08)^2 + (.06 -.08)^2 + (.02 -.08)^2 + (.08 -.08)^2]/5\}^{1/2} = .04$$

b. Calculate correlation coefficients between returns on each of the stocks and returns on the market portfolio.

$$\Phi_{hm} = \sum_{t=1}^{5} (R_{ht} - E(R_{ht}))(R_{mt} - E(R_{mt})) \div n$$
$$= ((.12 -.10)(.10 -.08) + (.18 -.10)(.14 -.08) + (.07 -.10)(.06 -.08) + (.03-.10)(.02 -.08) + (.10 -.10)(.08 -.08))/5$$
$$= ((.02)(.02) + (.08)(.06) + (-.03)(-.02) + (-.07)(-.06) + 0)/5 = .002$$

$$\Phi_{hw} = \sum_{t=1}^{5} (R_{ht} - E(R_{ht}))(R_{wt} - E(R_{wt})) \div n$$
$$= ((.12 -.10)(.04 -.064) + (.18 -.10)(.20 -.064) + (.07 -.10)(.02 -.064) + (.03-.10)(-.03 -.064) + (.10 -.10)(.09 -.064))/5$$
$$= ((.02)(-.024) + (.08)(.136) + (-.03)(-.044) + (-.07)(-.094) + 0)/5 = .00366$$

$$\Phi_{wm} = \sum_{t=1}^{5} (R_{ht} - E(R_{ht}))(R_{wt} - E(R_{wt})) \div n$$
$$= ((.04 -.064)(.10 -.08) + (.20 -.064)(.14 -.08) + (.02 -.064)(.06 -.08) + (-.03 -.064)(.02 -.08) + (.09 -.064)(.08 -.08))/5 = .00284$$

$$\Delta_{hm} = cov_{hm}/\Phi_h\Phi_m = \Phi_{hm}/\Phi_h\Phi_m$$
$$= .002/((.0502)(.04)) = .996$$
$$\Delta_{wm} = cov_{wm}/\Phi_w\Phi_m = \Phi_{wm}/\Phi_w\Phi_m$$
$$= .00284/((.078)(.04)) = .909$$

c. Please see Figure 8.1 for guidance.

d. Calculate Betas for each of the stocks.

$$\beta_h = \Phi_h\Phi_m\Delta_{hm}/\Phi_m^2$$
$$= (.0502)(.04)(.996)/(.04)^2$$
$$= .0548/.04 = 1.25$$

$$\beta_w = \Phi_w\Phi_m\Delta_{wm}/\Phi_m^2$$
$$= .078(.04)(.909)/(.04)^2$$
$$= 1.775$$

$\beta_m = 1$

The betas should be equal to the slopes of the regression lines.

5.16

a. Historical returns for each of the 5 years.

$\bar{R}_p = w_h(\bar{R}_h) + w_w(\bar{R}_w)$

Year

1986 $\quad \bar{R}_p = w_h(\bar{R}_h) + w_w(\bar{R}_w)$
$= .12(.5) + .04(.5)$
$= .08$

1987 $\quad \bar{R}_p = w_h(\bar{R}_h) + w_w(\bar{R}_w)$
$= .18(.5) + .2(.5)$
$= .19$

1988 $\quad \bar{R}_p = w_h(\bar{R}_h) + w_w(\bar{R}_w)$
$= .07(.5) + .2(.5)$
$= .045$

1989 $\quad \bar{R}_p = w_h(\bar{R}_h) + w_w(\bar{R}_w)$
$= .03(.5) + -.03(.5)$
$= 0$

1990 $\quad \bar{R}_p = w_h(\bar{R}_h) + w_w(\bar{R}_w)$
$= .10(.5) + .09(.5)$
$= .095$

b. Historical portfolio standard deviation for the five-year period.

$$\Phi_p = \{[(.08-.082)^2+(.19-.082)^2+(.045-.082)^2+(0-.082)^2 +(.095-.082)^2 \div 5]\}^{1/2} = .0631$$

$$\Phi_p = (w_h^2\Phi_h^2 + w_w^2\Phi_w^2 + 2w_hw_w\Delta_{hw}\Phi_h\Phi_w)^{1/2}$$
$$= ((.5)^2(.050199)^2 + (.5)^2(.078)^2 + 2(.5)(.5)(.00366))^{1/2}$$
$$= .0631$$

Solutions to Questions and Problems

c. Historical correlation coefficient between the market portfolio and the investor's portfolio.

Δ_{pm} **= cov(p,m)/** $\Phi_p\Phi_m$
= .00242/(.0631≅.04) = .9587

d. The portfolio beta

$\beta_p = \Phi_p\Phi_m\Delta_{pm}/\Phi_m^2$
$= (.0631)(.04)(.9587)/(.04)^2$
$= 1.51 = w_H\exists_H + w_W\exists_W = .5≅1.25 + .5 ≅ 1.77$

e. The portfolio beta is a weighted average of individual security betas.

5.17 The same way as for stock betas except for the use of asset returns.

5.18 Zero, by definition

5.19 Perhaps managers are concerned about their own job security, prestige and other personal issues. On the other hand, Perhaps their shareholders cannot diversify away portfolio risk.

5.20

$\bar{R}_a = r_f + w_{ao}(E(R_o)) + w_{ac}(E(R_c)) = .05 + .03(1.25) + .4(.18)$
$= .05 + .0375 + .072 = .1595$

6.1. a. Payback period = 3.25 yrs ; reject

b. Expected return = 8% ; accept

c. $-100,000 + \$10,000/(1+r) + \$40,000/(1+r)^2 + \$40,000/(1+r)^3 + \$40,000/(1+r)^4 + \$10,000/(1+r)^5 = 0$
r = IRR = 12.1249% > .05 ; accept

d. $NPV = -100,000 + \$10,000/(1.05) + \$40,000/(1.05)^2 + \$40,000/(1.05)^3 + \$40,000/(1.05)^4 + \$10,000/(1.05)^5 = 21,100$
NPV = 21,100 > 0 ; accept

e. [$10,000/(1.05)^1 + $40,000/(1.05)^2 + $40,000/(1.05)^3 + $40,000/(1.05)^4 + $10,000/(1.05)^5] / 100,000 = 1.211
PI = 1.211 > 1 ; accept

f. Use NPV ; accept

6.2 a.

Machine A	Cash Flow
Time 0 cash flow =	-16,000

Time 1 cash flow = [100,000(.08-.01)(1-.3)]

$$+ \left[\frac{16{,}000-2000}{5} \times .3\right] = \quad + 5{,}740$$

Time 2 cash flow = [100,000(.07 x .7)]

+ [2800 x .3]= + 5,740

Time 3 cash flow = 4900 + 840 = + 5,740

Time 4 cash flow = + 5,740

Time 5 cash flow = 5740 + 2000 = + 7,740

Machine B

Time 0 cash flow = - 8,000

Time 1 cash flow = + 2,635

Time 2 cash flow = + 2,635

Time 3 cash flow = + 2,635

Time 4 cash flow = + 2,635

Time 5 cash flow = + 4,635

b. Payback A = 2.787 yrs. Payback B = 3.036 yrs.

ROI_A = 18.375% ROI_B = 17.9375%

IRR_A = 25% IRR_B = 23%

c. A 10% discount rate was given.

$$NPV_A = -16{,}000 + \frac{5740}{1.1} + \frac{5740}{1.1^2} + \frac{5740}{1.1^3} + \frac{5740}{1.1^4} + \frac{7740}{1.1^5} = 7000.96$$

$$NPV_B = -8{,}000 + \frac{2635}{1.1} + \frac{2635}{1.1^2} + \frac{2635}{1.1^3} + \frac{2635}{1.1^4} + \frac{4635}{1.1^5} = 3230.57$$

d. $PI_A = \frac{22996.49}{16{,}000} = 1.43756$

$PI_B = \frac{11228.49}{8{,}000} = 1.4038213$

e. Machine A: Its NPV is higher.

6.3 OLD NEW

Solutions to Questions and Problems

P_{-4} = 600,000	Depr = SL
TIV = 400,000	SV = 100,000
Depr = SL	P_o = 800,000
SV = 100,000	Prod = 80,000
n = 6 yrs.	Price = 10
Prod. = 50,000	T = .4
Price = 10	K = .12
T = .4	ITC = 40,000
K = .12	n = 6 yrs.

$$NPV_{old} = [(50{,}000 \times 10)(1-.4) + (600{,}000-100{,}000)/10 \times .4] \times \left[\left[\frac{1}{.12} - \frac{1}{.12(1.12)^6}\right] + \frac{100{,}000}{1.12^6}\right]$$

$$= [300{,}000 + 20{,}000] \times [4.1114] + 50{,}663 = 1{,}366{,}311$$

$$NPV_{new} = [-800{,}000 + 400{,}000 + 40{,}000]$$

$$+ [(80{,}000 \times 10)(1.-.4) + (800{,}000-100{,}000)/6 \times .4] \times \left[\frac{1}{.12} - \frac{1}{.12(1.12)^6}\right] + \frac{100{,}000}{1.12^6}$$

$$= -360{,}000 + 2{,}165{,}333 + 50{,}663 = 1{,}856{,}000$$

BUY THE NEW MACHINE

Now, try the new discount rate of 20%:

$$NPV_{OLD} = [320{,}000 \times 3.3255] + 33{,}489.80 = 1{,}097{,}649.80$$

$$NPV_{new} = -360{,}000 + 1{,}884{,}450 + 33{,}489.80 = 1{,}424{,}919.80$$

The answer does not change

6.4

RENT	BUY
Rent = 5,000	P_o = 100,000

g = .06
n = 40 yrs.
T = .3
K = .10

g = .06
Down = 20,000
i = 10%
mort. n = 10 yrs.
n = 40 yrs.
maint. = 1000
T = .3
K = .10

$$\text{Annual Mortgage Payment} = 80{,}000 \,/\, \left[\frac{1}{.1} - \frac{1}{.1(1.1)^{10}}\right] = 13{,}019.63$$

Amortization Table

t	Prin	Int	Pay. to Prin.
1	80,000	8000	5019
2	74,980	7498	5521
3	69,548	6945	6073
4	63,385	6338	6681
5	56,703	5670	7349
6	49,354	4935	8084
7	41,270	4127	8892
8	32,377	3237	9781
9	22,596	2259	10760
10	11,836	1183	11836

$$NPV_{rent} = -5000\left[\frac{1}{.1-.06} - \frac{1.06^{40}}{(.1-.06)(1.1)^{40}}\right] = -98{,}200.21$$

$$NPV_{buy} = -20{,}000 - 13{,}019.63 \times \left[\frac{1}{.10} - \frac{1}{.10(1.10)^{10}}\right]$$

$$- 1000 \times \left[\frac{1}{.1-.06} - \frac{1.06^{40}}{(.1-.06)(1.1)^{40}}\right]$$

$$+ \frac{.3\text{x}8000}{1.1} + \frac{.3\text{x}7498}{1.1^2} + \frac{.3\text{x}6945}{1.1^3} + \frac{.3\text{x}6338}{1.1^4} + \frac{.3\text{x}5670}{1.1^5}$$

Solutions to Questions and Problems

$$+\frac{.3\text{x}4935}{1.1^6}+\frac{.3\text{x}4127}{1.1^7}+\frac{.3\text{x}3237}{1.1^8}+\frac{.3\text{x}2259}{1.1^9}+\frac{.3\text{x}1183}{1.1^{10}}$$

$$+\frac{(1.06^{40})\text{ x }100{,}000}{1.1^{40}} = 89{,}679$$

6.5 $NPV_{lease} = -20000\left[\frac{1}{.1}-\frac{1}{.1(1.1)^5}\right][1-.3] = -53{,}071$

$NPV_{buy} = [-100{,}000 + 8{,}000]$

$$+\ [(100{,}000-15{,}000)/5]\text{ x }.3\text{ x }\left[\frac{1}{.1}-\frac{1}{.1(1.1)^5}\right]$$

$$+\ \frac{15000}{1.1^5} = -63{,}353.71$$

Leasing is preferred - its NPV is higher.

6.6 We evaluate cash flows on the old and new machines as follows:

$$NPV_{old} = [540{,}000(1-.4)+(\frac{700{,}000-100{,}000}{10}\times.4)][\frac{1}{.11}-\frac{1}{.11(1.11)^6}]+\frac{100{,}000}{(1+.11)^6} = 1{,}525{,}691.257$$

$$NPV_{new} = -900{,}000+45{,}000+300{,}000+[(700{,}000-240{,}000-300{,}000)\times.4]$$

$$+[900{,}000(1-.4)+(\frac{900{,}000-100{,}000}{6}\times.4)][\frac{1}{.11}-\frac{1}{.11(1.11)^6}]+\frac{100{,}000}{(1+.11)^6} = 2{,}027{,}583.21$$

Since $NPV_{NEW}>NPV_{OLD}$, the Smith Company should purchase the new machine.

6.7. First, evaluate cash flows associated with obtaining the MBA as follows:

NPV_{MBA} = -14,000*PVAF(.1,2)
+ [$30,000*(1.25)*PVGAF(.1,41,.06)]/$[1.1]^2$ = $338,771.5393

where PVAF(.1,2) is the two year present value annuity factor with a 10% discount rate and PVGAF (k = .1, n = 41 and g = .06) is the 41 year present value growing annuity factor with a 10% discount rate and a 6% growth rate. Next, evaluate the cash flows associated with working instead as follows:

NPV_{work} = +20,000*(1-.25)*PVGAF(.1,43,.05) = $259,414.06 ;

Select the higher NPV option; thus, the MBA is the appropriate alternative.

6.8. Evaluate cash flows on the alternatives as follows:

$$NPV_{old} = \{[(800{,}000-400{,}000)(1-.4)+(14{,}000\cdot.4)]\}[\frac{1}{.1}-\frac{1}{.1(1.1^{40})}]+\frac{100{,}000}{1.1^{40}} = 2{,}403{,}944.35$$

$$NPV_{new} = -1{,}800{,}000+900{,}000+\{[(,500{,}000-700{,}000)\cdot(1-.4)+((1{,}800{,}000-300{,}000-240{,}000)/40\cdot.4]\}$$
$$\cdot\left\{\frac{1}{.1}-\frac{1}{.1(1.1^{40)}}\right\}+\frac{300{,}000}{1.1^{40}} = 3{,}923{,}788.86$$

The new outlet should be purchased.

6.9.a. Net Present Value is determined as follows:

$$NPV = -4{,}000{,}000-200{,}000+\left[2{,}000{,}000(1-.4)+600{,}000\cdot.4\right]\left[\frac{1}{.125}-\frac{1}{.125(1.125)^5}\right]$$
$$-500{,}000\cdot(1-.4)\cdot\left[\frac{1}{.125-.3}-\frac{(1+.3)^5}{(.125-.3)(1.125^5)}\right]+\frac{(1{,}000{,}000+200{,}000)}{(1.125^{5)}} = -224{,}716.62$$

b. Set NPV equal to zero, solve for r and find that IRR = .1040408

6.10. First, determine an appropriate risk-adjusted discount rate for the Appling Company:

k_{Fox} = .05 + 0(.08-.05) = .05 ; &$_{Fox}$=0 since cov[R_{Fox},R_M] = 0

Note that the anticipated growth rate for the Appling Company equals g_{Fox} = -.05. The present value associated with the merger is determined as follows:

$$NPV_{Fox} = -970{,}000+\frac{150{,}000}{.05-.05} = 530{,}000$$

The merger should be completed since NPV > 0. (Note that the first year cash flow reflects one year of growth: CF_1 = 142,500.)

6.11. First, set up appropriate NPV functions for the machine purchase and for contracting out production as follows:

$$NPV_{BUY} = -\$5{,}000{,}000+\left\{\left[(35-20)(\#units)(1-.3)\right]+(\frac{5{,}000{,}000-300{,}000}{7}\cdot.3)\right\}\cdot\left[\frac{1}{.1}-\frac{1}{.1(1.1)^7}\right]$$
$$+\frac{300{,}000}{(1+.1)^7} = -\$3{,}865{,}413.92+(\$51.11839\cdot\#units)$$

Solutions to Questions and Problems

$$NPV_{CONTRACTOUT} = [(35-20)(\#units)(1-.3)]\left[\frac{1}{.1} - \frac{1}{.1(1.1)^7}\right] = 34.0789 \cdot \#unit$$

Solve for the number of units by setting equal the two NPVs:

$$-\$3{,}865{,}413.92 + (\$51.11839 \cdot \#units) = \$34.07893 \cdot \#units;$$

$$\#units = 226{,}850.75$$

6.12. The NPVs are the same. The working capital requirement offsets the difference between the purchase prices at time zero and the differences in salvage value in the tenth year. The depreciation write-offs are the same for both systems.

7.1. Too small: can't transact easily, higher order costs for cash, risky

Too high: high foregone interest costs

7.2. a. $\sqrt{\dfrac{2 \times 50 \times 200{,}000}{.05}} = 20{,}000 = c^*$

b. 20,000/2 = 10,000

c. $\dfrac{x}{c} = \dfrac{200{,}000}{20{,}000} = 10$

d. $\dfrac{365}{10} = 36.5$

e. $\dfrac{x}{c} \cdot B = 10 \cong 50 = 500$

f. $\dfrac{20{,}000}{2} \times 10 = \dfrac{C^*}{2} \times i = 500$

g. $\dfrac{x}{c^*} \cdot B + \dfrac{C^*}{2} \times i = 500 + 500 = 1000$

7.3. a. 1250 b. 1025

7.4. a. same; 20,000

b. $\dfrac{X}{C^*} \cong B + \dfrac{C^* + 2 \min}{2} \cong i = 500 + 650 = 1150$

7.5. a. $z = \sqrt[3]{\dfrac{3B\sigma_{cb}^2}{4i}} = 6694.32$

b. r.t.p. = min + z = 11,694.32

c. max = min + 3z = 25,082.97

d. z = r.t.p. - min. = 6694.32

e. max - r.t.p. = 2z = 13,388.65

f. a:12,331.06 b: 17,331.06 c: 41,993.18
d:12,331.06 e: 24,662.12

7.6. a. $\text{E.O.Q.} = \sqrt{\dfrac{2 \times Or \times D}{cc}} = \sqrt{\dfrac{2 \times 50 \times 100{,}000}{.1}} = 10{,}000$

b. $\dfrac{\text{EOQ}^{*} + 2\text{min}}{2} = 10{,}000$

c. $\dfrac{\text{D}}{\text{EOQ}} = 10$

d. 50 x 10 + .1 x [(10,000/2)+5000] = 1500

e. $\dfrac{365}{10} = 36.5$

8.1

	Jeffries Sporting Goods	Tunney Sporting Goods

Solutions to Questions and Problems

		(in thousands)	
a. i.	Current Ratio	7.00	1.67
ii.	Acid Test Ratio	4.50	1.00
iii.	Net Working Capital to Total Assets	.375	.14
iv.	Return on Equity	.333	.11
v.	Return on Assets	.25	.1655
vi.	Gross Profit Margin	.88	.90
vii.	Net Profit Margin	.25	.10
viii.	Financial Leverage	.625	.62
ix.	Debt-Equity Ratio	1.67	1.64
x.	Times Interest Earned	4.00	1.60
xi.	Dividend Payout	.25	.83

b. Efficiency might be measured in terms of profitability or perhaps in terms of use of assets or debt. In any case, the solution to this question might not be clear because the question is rather vague with regard to exactly what is meant by efficiency. In any case, the higher current ratio and acid test ratio of Jeffries indicates that it has greater solvency. The lower current ratio and acid test ratio of Tunney could indicate it may not be able to honor its short term obligations as quickly. The higher ROE of Jeffries indicates a greater return for common stockholders. Although the gross profit margin of Tunney is slighter larger, the significantly larger net profit margin of Jeffries indicates greater profitability. The higher TIE ratio of Jeffries is an advantage because it shows the extent to which its operating income can decline before its earnings are less than its annual interest costs. Tunney's higher dividend ratio indicates that it is paying out a greater percent of their earnings in dividends, as opposed to putting the money back into the business.

One might argue that the Jeffries Company is operating more efficiently. They are more solvent, and show a greater Return on Equity. Its higher TIE and lower debt-equity ratio also indicates that it is not as leveraged.

c. Efficiency frequently refers to what an investor receives relative to what he pays or invests. Return on equity may be an excellent measure of efficiency if this is how one regards efficiency.

d. Perhaps it makes more efficient use of current assets (higher liquidity ratios), more efficient use of capital markets (consider its leverage ratios and interest rates on debt) and more efficient use of its assets (consider its activity ratios).

e. Base your answer on the answers to parts a to d.

f. Jeffries would be the preferred company to lend to because of its lower TIE and debt-equity ratios. It also is more solvent (indicating its superior ability to fulfill its short-run obligations) and is more profitable (indicating its superior ability to survive in the long-run).

g. Because of Tunney's lower current ratio and acid test, and their higher TIE and debt-equity, Tunney has a greater risk of default. In order to determine probabilities of default, one would need to compare these ratios to industry standards or perform an appropriate statistical analysis (e.g: Altman Multi-discriminate Analysis).

h.

	Jeffries Sporting Goods	Tunney Sporting Goods
	(in thousands)	
Rev	500	500
CGS	62.5[1]	**50**[2]
FC	**300**	**300**
EBIT	**137.5**	**150**
INT	**100**	**150**
EBT	**37.5**	**0**
Taxes	**12.5**	**0**
NIAT	**25**	**0**

These forecasts are estimates which are based on relatively constant ratios over time. Your answer to this question is likely to vary from the one given here.

8.2 a. ROA and ROE of Charles Co. were right at industry levels in the late 90's, but have fallen off significantly in the early 00's. Thus, although Charles Co had average profitability, in recent years their profitability has fallen.

b. The acid test ratio of Charles Co is similar to the industry average, however, the current ratio has increased in the early 00's. This indicates an increase in inventories, which is the least liquid of the current assets. Thus, in the early 00's, Charles Co. probably has an increase in inventories.

c. It is possible that the lower profitability of Charles Co. is related to the higher insolvency. The higher inventories are an expense, and also indicate slower sales.

d. The cause seems to be related to inventory. This is also seen in the lower sales turnover of the early 00's. Charles Co. is probably not a good credit risk at this time because of their decreasing performance as compared to industry standards.

8.3. Common-Size Income Statements for Jefferies Sporting Goods Co & Tunney Sporting Goods Co

	Jeffries	Tunney
Revenues	100	100
COGS	12.50	10.00

[1]CGS is one eighth of revenue.

[2]CGS is one tenth of revenue

Solutions to Questions and Problems

Fixed Cost	37.50	50.00
EBIT	50.00	40.00
Interest	12.50	25.00
EBT	37.50	15.00
Taxes	12.50	5.00
NIAT	25.00	10.00
Dividends	6.25	8.33
Retained Earnings	18.75	1.67

Common Balance Sheet for Jefferies Sporting Goods Co & Tunney Sporting Goods Co

ASSETS

	Jeffries	Tunney
Cash	1.56	6.90
Market Securities	4.69	2.07
Accounts Receivable	21.88	11.72
Inventory	15.63	13.79
Total Cuurent Assets	43.75	34.48
Plant & Equipment	56.25	65.52
Total Fixed Assets	56.25	65.52
Total Assets	100	100

CAPITAL

Tax payable	1.56	5.17
Accounts Payable	4.69	15.52
Current Liabilities	6.25	20.69
Notes Payable	18.75	13.79
Bonds Payable	37.50	27.59
Long term Debt 56.25	41.38	
Total Debt	62.50	62.07
Equity	37.50	37.93
Capital	100.00	100.00

8.4. The DuPont Identity is structured as follows:

ROE = NIAT/Equity = NIAT/Sales x Sales/Assets x Assets/Equity

.333 = .25 x .5 x 2.6667 (Jeffries)

.1090909 = .10 x .4138 x 2.636 (Tunney)

8.5. The Jeffries Company is able to generate a much higher profit on each dollar of sales than is the Tunney Company. In addition, it seems to be able to use each unit of assets to generate a higher sales volume.

9.1. On Figure 9.4, given a range of potential EBIT levels, $EBIT_1$ to $EBIT_2$, the range of potential EPS levels with 100% equity financing is narrower (EPS_2 to EPS_3) then is the range for only 50% equity financing.

9.2. a. $DOL_L=1=GM_L/EBIT_L$ $DOL_S=GM_S/EBIT_S=700,000/400,000=1.75$

b. $DFL_L=1=EBIT_L/EBT_L$ $DFL_S=EBIT_S/EBT_S=400,000/350,000=1.1429$

c. $FPL_L=1=GM_L/EBT_L$ $FPL_S=GM_S/EBT_S=700,000/350,000=2$

d.

$$\Delta NIAT_L = (\%\Delta Sales \cdot FPL) \cdot NIAT_{00} = (.333 \cdot 1) \cdot 200{,}000 = 66{,}667; NIAT_{01} = 266{,}667$$

$$EPS_{L01} = \frac{NIAT_{L01}}{\#Shs} = \frac{266{,}667}{800} = 333.33$$

$$\Delta NIAT_S = (.333 \cdot 2) \cdot 175{,}000 = 166{,}667; NIAT_{S01} = \frac{291667}{400} = 729.17$$

e.

$$\Delta NIAT_L = (-.333 \cdot 1) \cdot 200{,}000 = -66{,}667; NIAT_{L01} = 133{,}333$$

$$EPS_{L01} = 166.67$$

$$\Delta NIAT_S = (-.333 \cdot 2) \cdot 175{,}000 = -166{,}667; NIAT_{S01} = 58{,}333.33, EPS_{S01} = 145.83$$

f. $\sigma_L^2 = 6{,}943.89; \sigma_L = 83.33; \sigma_s^2 = 85{,}071.39; \sigma_s = 291.67$

g. Sherman Company: its variance of returns is higher

9.3. No : Its Retained Earnings will be more variable. Fixed dividends are analogous to other fixed payments.

9.4. Yes : NIAT, Retained Earnings and Equity Value will all be more volatile. If Equity Value reaches zero, the firm will fail.

9.5. Not true : Highly levered firms are more likely to go bankrupt in bad years.

9.6. EPS_D= (600,000-50,000-36,000)(1-.4)/25,000 = 12,336

EPS_E=(600,000-50,000)(1-.4)/25,000+3,000 = 11,786

$EPS_D > EPS_E$ Therefore, sell debt

9.7. EPS_E=[(1.2*840,000)(.5)-100,000-0][1-.3]/100,000 = 2,828

EPS_D=[(1.2*840,000)(.5)-100,000-25,000][1-.3]/90,000 = 2,948

Solutions to Questions and Problems

$EPS_D > EPS_E$ Therefore, the company should have sold debt

9.8. Anticipated EPS would have been greater if sales had risen to 1,200,000 but would be less if sales had declined to 600,000. Verify by setting up income statements.

9.9. First, let EPS_D be the firm's EPS if the firm issues debt to buy back stock. Let .125 be the interest rate on new debt, 200,000 be the amount of new debt issued to repurchase shares, .5 be the income tax rate, 400 be the number of currently existing shares, \$200,000 be the reduction in equity (\$value) when shares are repurchased, \$400,000 be the current equity value. This means that 200,000/400,000 = .5 is the fraction of stock that the firm buys back and that 400,000/400 = 1000 is the current value of each share. Thus, the number of shares that the firm repurchases is [200,000/400,000*400,000/400] = 200. Our EPS if the firm issues debt to repurchase shares is computed as follows:

$$EPS_D^* = \frac{[EBIT^* - 50{,}000 - (.125^*200{,}000)] * [1-.5]}{400-[(200{,}000/400{,}000)*(400{,}000/400)]}$$

$$= EPS_E^* = \frac{[EBIT^* - 50{,}000][1-.5]}{400}$$

EPS_E^* is the EPS level if the firm does not repurchase shares by issuing additional debt. The two should be set equal to each other as above and below:

$$EPS_D^* = EPS_E^* = \frac{.5*EBIT^* - 75{,}000}{600}$$

$$= \frac{.5*EBIT^* - 25{,}000}{400}$$

Now, simplify the equations:

$$EPS = .0008333EBIT^* - 125 = .00125EBIT^* - 625$$

$$.000416667*EBIT^* = 500;\ EBIT^* = 1{,}200{,}000$$

9.10. They may be very risk averse when their jobs are threatened.

10.1. a. $K_D = \frac{INT}{D} = \frac{100{,}000}{800{,}000} = .125$

b. $K_D = K_D(1-T) = .125(1-.2) = .1$

c. $K_E = \frac{NIAT}{E} = \frac{80{,}000}{400{,}000} = .2$

d. $K_A = W_eK_e + W_DK_D = .15 = (.33*.2)+(.67*.125)$

10.2. a. $K_D = r_f = .08$

b.

$$B_u = \frac{\sigma_{ROA}}{\sigma_m}\rho_{ROA,M} = 0.25/0.1 \cdot .5 = 1.25$$

c. $K_A = r_f + B_u(r_m - r_f) = .08 + 1.25(.12-.08) = .13$

$$K_e = K_A + \frac{D}{E}\beta(r_m - r_f) = .13 + .5(1.25)(.04) = .155$$

d.

(Assume $\frac{D}{E}$ = .5 -it was omitted also)

10.3. Capital structure doesn't matter here. There are no taxes and CAPM assumptions hold.

10.4. Risk of equity increases as B_a rises. Debt remains riskless

$$K_\sigma, K_e, K_A$$

10.5. a.

all decrease. Alternative investments will pay lower rates of return. Before tax costs will decline if the firm enjoys tax write-off an interest payments

b. K_σ, K_e, K_A all increase. Bondholders face risks.

c. All increase.

d. Varies

10.6. See chapter

10.7. Accounting statement data is derived by accountants. Any supplement would be an improvement.

11.1. a. CF_{72} = 50,000-35,000 = 15,000 CF_{73} = 15,000

CF_{74} = 15,000

$$\sigma = 0$$

CF_{75} = 15,000 ..... CF_{81} = 15,000

b.

d. CF_{72} = -10,000 ..... CF_{72} = -10,000 = 50,000-60,000

CF_{77} = -10,000 ..... CF_{81} = 15,000

$$\sigma = 30{,}000$$

11.2 A. CF_{72} = 50,000 -12,000 = 38,000

CF_{73} = 50,000 -12,000 = 38,000

CF_{74} = 38,000

CF_{75} = 30,000

CF_{76} = 30,000

CF_{77} = 50,000 -20,000 = 30,000

CF_{78} = 50,000 -36,000 = 14,000

CF_{79} = 14,000

Solutions to Questions and Problems

CF_{80} = 14,000

CF_{81} = 50,000 -220,000 = -170,000

$$\sigma = 59{,}951.98$$

b.

c. Interest payments vary. With a long term note, the interest payments would remain constant.

11.3. Crocket Company is riskier. Its cash flow variance is higher.

11.4. When assets have short life expectancies.

11.5. $NPV_{OWN} = [-30{,}000(1-.3)+50{,}000*.3]\left[\frac{1}{.1} - \frac{1}{.1(1.1)^{20}}\right]$

$= -6{,}000 * 8.513$

$NPV_{OWN} = -51{,}081.36$

$NPV_{LEASE} = [-100{,}000(1-.3)]\left[\frac{1}{.1} - \frac{1}{.1(1.1)^{20}}\right] + 1{,}000{,}000$

$= -404{,}050.8$

$NPV_{OWN} > NPV_{LEASE}$ Therefore owning is better.

12.1. From a historical perspective, with two exceptions, 19th century banks operated within state boundaries. Federal regulation during the 20th century restricted banks geographic regions of operation (McFadden Act), areas of activities (Glass Steagall) and regulated mergers in the industry (The Bank Holding Company of 1956). U.S. banks have grown significantly since the later 20th century due to deregulatory activity.

12.2. See the response to Question 12.1.

12.3. Historically, banks were regulated only at the state level prior to 1863 when the National Currency Act was passed, providing for the COC and a national banking system. The Fed was created in 1913 in reaction to panics in the banking system and has served as the central bank of the U.S. since. FDIC was established by Glass Steagall due to the post-1929 failure of the banking system. Problems and crises in the banking system lead to new regulatory bodies in the banking system; generally, existing regulatory bodies retain at least part of their prior functions, perhaps with modifications.

13.1. According to the Pure Expectations Theory, we compute the two year spot rate
as follows:

$$(1+y_{0,2})^2 = \prod_{t=1}^{2}(1+y_{t-1,t}) = (1+.05)(1+.08) = 1.134$$

$$y_{0,2} = [(1+.05)(1+.08)]^{1/2} - 1 = \sqrt{1.134} - 1 = .0648944$$

13.2. The three year rate is based on a geometric mean of the short term spot rates as follows:

$$(1+y_{0,3})^3 = \prod_{t=1}^{3}(1+y_{t-1,t}) = (1+.05)(1+.06)(1+.07) = 1.19091$$

$$y_{0,3} = [(1+.05)(1+.06)(1+.07)]^{1/3} - 1 = \sqrt[3]{1.19091} - 1 = .0599686$$

13.3. The three-year rate is based on a geometric mean of the short term spot rates as follows:

$$(1+y_{0,3})^3 = (1.07)^3 = 1.22504 = \prod_{t=1}^{3}(1+y_{t-1,t}) = (1+.05)(1+.07)(1+y_{2,3})$$

We solve for $y_{2,3}$ as follows:

$$1.22504 \div [(1+.05)(1+.07)] - 1 = y_{2,3} = .07$$

13.4. Treasury instruments have negligible default and liquidity risk such that their yields imply riskless rates. This means that their yields are purely a function of the yield curve.

14.1 The following Single Stage Growth Model can be used to evaluate this stock:

$$P_0 = \frac{DIV_1}{(k-g)}$$

$$P_0 = \frac{\$1.80}{(.06-.04)} = \$90$$

Since the \$100 purchase price of the stock is less than its 90 value, the stock should not be purchased.

14.2. The following Two Stage Growth Model can be used to evaluate this stock:

$$P_0 = DIV\left[\frac{1}{k-g_1} - \frac{(1+g_1)^n}{(k-g_1)(1+k)^n}\right] + \frac{DIV_1(1+g_1)^{n-1}(1+g_2)}{(k-g_2)(1+k)^n}$$

$$P_0 = \$3\left[\frac{1}{.1-.2} - \frac{(1+.2)^7}{(.1-.2)(1+.1)^7}\right] + \frac{\$3(1+.2)^{7-1}(1+.03)}{(.1-.03)(1+.1)^7} = 92.8014519$$

Since the \$100 purchase price of the stock exceeds its 92.8014519 value, the stock should not be purchased.

14.3. The following Three Stage Growth Model can be used to evaluate this stock:

Solutions to Questions and Problems

$$P_0 = DIV\left[\frac{1}{k-g_1} - \frac{(1+g_1)^{n(1)}}{(k-g_1)(1+k)^{n(1)}}\right] + DIV_1\left[\frac{(1+g_1)^{n(1)-1}(1+g_2)}{(k-g_2)(1+k)^{n(1)}} - \frac{(1+g_1)^{n(1)-1}(1+g_2)^{n(2)-n(1)}}{(k-g_2)(1+k)^{n(2)}}\right]$$

$$+\frac{DIV_1(1+g_1)^{n(1)-1}(1+g_2)^{n(2)-n(1)}(1+g_3)}{(k-g_3)(1+k)^{n(2)}}$$

Solutions to Questions and Prolems

$$P_0 = \$5\left[\frac{1}{.08-.15} - \frac{(1+.15)^3}{(.08-.15)(1+.08)^3}\right] + \$5\left[\frac{(1+.15)^{3-1}(1+.06)}{(1+.08)^3(.08-.06)} - \frac{(1+.15)^{3-1}(1+.06)^{6-3}}{(.08-.06)(1+.08)^6}\right] = 92.0171078$$

Since the \$100 purchase price of the stock exceeds its \$92.0171 value, the stock should not be purchased.

15.1. a. c_T = \$33 - \$30 = \$3; p_T = 0

b. c_T = 0; p_T = \$30 - \$22 = \$8

c. c_T = -\$3; p_T = 0

d. c_T = 0; p_T = -\$8

e. \$3 - \$1.75 = \$1.25

f. \$0 - \$1.75 = -\$1.75

15.2. The hedge ratio for the call equals 1. Since the riskless return rate is .125, the call's current value must be \$4.8888889.

15.3. a. $c_T = MAX[0,S_T-X]$; c_T = \$0 or \$15

b. \$100/\$90 - 1 = .1111

c.

$$\alpha = \frac{C_u - C_d}{S_0(u-d)}$$

$$\alpha = \frac{15-0}{50(1.4-.6)} = .375$$

d.

$$C_0 = \frac{(1+r_f)\alpha S_0 + C_d - \alpha d S_0}{(1+r_f)}$$

$$C_0 = \frac{(1+.1111)\cdot .375\cdot 50 + 0 - .375\cdot .6\cdot 50}{(1+.1111)} = 8.625$$

15.4. First, find the hedge ratio:

$$\alpha = \frac{C_u - C_d}{S_0(u-d)}$$

$$\alpha = \frac{8-2}{12(1.33333 - .833333)} = 1$$

Now, value the call:

$$C_0 = \frac{(1+r_f)\alpha S_0 + C_d - \alpha d S_0}{(1+r_f)}$$

$$C_0 = \frac{(1+.125)\cdot .1 \cdot 12 + 2 - 1 \cdot .833333 \cdot 12}{(1+.125)} = 4.888889$$

15.5. a. d_1 = .6172; d_2 = .1178; $N(d_1)$ = .7314; $N(d_2)$ = .5469
c_0 = 11.05; with put-call parity: p_0 = 4.34
b. Use X=30; d_1 = .925; d_2 = .4245; $N(d_2)$ = .6644
$1-N(d_2)$ = .3356

15.6. The options are valued with the Black-Scholes Model in a step-by-step format in the following table:

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
d(1)	.957739	-.163836	.061699	.131638
d(2)	.657739	-.463836	-.438301	-.292626
N[d(1)]	.830903	.434930	.524599	.552365
N[d(2)]	.744647	.321383	.330584	.384904
Call	7.395	2.455	4.841	4.623
Put	0.939	5.416	7.803	5.665

15.7. Value the calls using the Black-Scholes Model:

$$c_0 = S_0 N(d_1) - Xe^{-rT}N(d_2)$$
$$d_1 = [\ln(S \div X) + (r + .5\Phi^2)T] \div \Phi\sqrt{T}$$
$$d_2 = d_1 - \Phi\sqrt{T}$$

Thus, we will first compute d_1, d_2, $N(d_1)$, $N(d_2)$ for each of the calls; then we will compute each call's value. We will then use put-call parity to value each put.

First find for each of the 15 calls values for d_1:

X	AUG	SEP	OCT
110	2.833394	1.129163	1.162841
115	1.417978	.617046	.658904
120	.062811	.126728	.176418
125	-1.237028	-.343571	-.286369

130	-2.485879	-.795423	-.731003

Next, find for each of the 15 calls values for d_2:

X	AUG	SEP	OCT
110	2.801988	1.042362	1.074632
115	1.386572	.530245	.570695
120	.031405	.039928	.088208
125	-1.268433	-.430371	-.374578
130	-2.517284	-.882222	-.819212

Now, find $N(d_1)$ for each of the 15 calls:

X	AUG	SEP	OCT
110	.997697	.870585	.877553
115	.921901	.731398	.745021
120	.525041	.550422	.570017
125	.108038	.365584	.387298
130	.006462	.213184	.232388

Next, determine $N(d_2)$ for each of the 15 calls:

X	AUG	SEP	OCT
110	.997461	.851378	.858730
115	.917214	.702029	.715897
120	.512527	.515925	.535145
125	.102322	.333463	.353987
130	.005913	.188828	.206333

Now use $N(d_1)$ and $N(d_2)$ to value the calls and put-call parity to value the puts.

CALLS

X	AUG	SEP	OCT
110	10.165	11.494	11.942
115	5.305	7.616	8.030
120	1.593	4.586	4.930
125	.193	2.488	2.741
130	.008	1.211	1.375

PUTS

X	Aug	Sep	Oct
110	0.003	.701	0.666
115	0.134	1.787	1.685
120	1.415	3.721	3.537

125		5.009	6.587	6.290
130	9.816	10.274	9.866	

The options whose values are underlined are overvalued by the market; they should be sold. Other options are undervalued by the market; they should be purchased.

16.1. 5 Canadian dollars are necessary :
(2.5. x .8) = 2 francs are required for 1 Canadian dollar.
Thus, 5 Canadian dollars are required for 10 francs.

16.2. $\frac{1}{2.5} = .4$ U.S. dollars needed for 1 franc before new rate

$$-.2 = \frac{F_1 - S_0}{S_0} \quad ; \quad -.2 = \frac{F_1 - .4}{.4} \; ; \; F_1 = .32$$

Now, .32 U.S. dollars are needed for 1 franc. 1/.32 = 3.125 francs are needed for 1 American dollar. (3.125 x .8) = 2.5 francs needed for 1 Canadian dollar. Thus, 4 Canadian dollars are required for 10 francs.

16.3. Using Purchase Power Parity:

Transaction Number	
1.	Short forward contract for one ounce of gold in U.S.
2.	Long forward contract for CHF700
3.	Long forward contract for one ounce of gold in Switzerland

Transaction Number	Time One Gold Position	Time One Mark Position	Time One Dollar Position
1.	-1 ounce		+$440
2.		+CHF700	-$437.5
3.	+1 ounce	-CHF700	
Totals	0	0	+$ 2.5

16.4. Using Interest Rate Parity:

Transaction Number	
1.	Borrow CHF1000 now in Switzerland at 12%; repay at Time One
2.	Buy $625 now for CHF1000
3.	Loan $625 at 10%; Collect proceeds at Time One
4.	Sell $622.22 at Time One at F_1=1.8 for CHF1120

Solutions to Questions and Problems

TIME ZERO POSITIONS

Transaction Number	Time Zero Franc Position	Time Zero Dollar Position
1.	+CHF1000	
2.	-CHF1000	+$625
3.		-$625
4.		
Totals	0	0

TIME ONE POSITIONS

Transaction Number	Time One Franc Position	Time One Dollar Position
1.	-CHF1120.00	
2.		
3.		+$687.50
4.	+CHF1120.00	-$622.22
Totals	0	+ $65.28

16.5 a. S_0 = .75; that is, .75 shekels are required to purchase 1 crown, since $.15 buys 1 crown and $.2 buys 1 shekel. Note that the spot rate of crown for shekels is 1/.75=1.333.

b. Using Purchase Power Parity:

$$\frac{(1+B_C)}{(1+B_I)} = \frac{F_1}{S_0} = \frac{(1+.06)}{(1+B)} = \frac{1.400}{1.333},$$

Solving for B, we find that the Israeli inflation rate is .92714%.

c. By the Fisher Effect, the real interest rate in Czech must be 5.66%:

$(1+i'_C)=(1+i_C)\div(1+B_C)$; $(1+i'_C) = (1.12)\div(1.06)$; $i'_C = .0566$

By the International Fisher Effect, the interest rate in Israel must also be .0566; real interest rates do not vary among countries.

d. By the Fisher Effect, the nominal Israeli interest rate must be 6.69139%:

$(1+i'_I)=(1+i_I)\div(1+B_I)$; $(1.0566) = (1+i_I)\div(1.0092714)$;

$i_I = .0669139$