Problem Set 1

Problem 1

a. We have that

$$D = 3A + 4B + 6C$$

which implies

$$4B = D - 3A - 6C$$

$$B = \frac{1}{4}(D - 3A - 6C)$$

$$\Rightarrow \text{Price}(B) = \frac{1}{4}(298 - 3 \times 38 - 6 \times 16) = 22$$

b. If the price of B was 24, there's an arbitrage opportunity that can be exploited. Even though there are many way to do this:

Buy D	- 298
Sell 3A	+ 114
Sell 4B	+ 96
Sell 6C	+ 96
Total	+ 8

or

Sell B	+ 24
Buy 1/4 D	- 74.5
Sell 3/4 A	+ 28.5
Sell 6/4 C	+ 24
Total	+ 2

Problem 2

a. Since

$$B = \frac{1}{4} A + 2D$$

$$2D = B - \frac{1}{4} A$$

$$D = \frac{1}{2} B - \frac{1}{8} A$$

so $\text{price}(D) = \frac{1}{2} 55 - \frac{1}{8} 76 = 18$

b. Similarly,

$$C = B + \frac{1}{2} E \Rightarrow E = 2(C - B)$$

so that

$$\text{price}(E) = 2(78 - 55) = 46$$

Problem 3

a. $r = \frac{1,080}{1,000} - 1 = 8\%$ per year w/ annual compounding

b. $\left(1 + \frac{r}{2}\right)^2 = \frac{1,080}{1,000} = 1.08$

$r = 2 \times (1.08^{1/2} - 1) = 7.85\%$ per year w/ semi-annual compounding

c. $\left(1 + \frac{r}{12}\right)^{12} = 1.08$

$r = 12\,(1.08^{1/12} - 1) = 7.72\%$ per year w/ monthly compounding

d. $e^r = 1.08$

$r = \ln(1.08) = 7.70\%$ per year w/ continuous compounding

Problem 4

$e^r = 1.09 \Rightarrow r = \ln(1.09) = 8.62\%$

Problem 5

T	1	5	10	15	20
r	5%	5.5%	6%	6%	6.5%
CF	100	150	200	250	300
DCF	95.12	113.94	109.76	101.64	81.76

PV = 502.22

Problem 6

a. $F = 100\, e^{0.10 \times 6/12} = 105.13$

b.

T	Today	6 months
Buy Forward	0	S − 102
Sell Stock	+ 100	− S
Deposit	− 97.03	+ 102
Total	+ 2.97	0

Problem 7

a. $F = 50\, e^{0.10 \times 12/12} = 55.26$

$PV = 0$ since the forward price is such that the value of the contract is zero for both parties.

b. i. $F = 45\, e^{0.10 \times 6/12} = 47.31$

$PV = (47.31 - 55.26)\, e^{-0.10 \times 6/12}$

$= -7.56.$

ii. It would cost 7.56 to close down the long position.