Problem Set 2

Problem 1

$$F = 5{,}000\, e^{(0.08-0.04)\times 8/12} = \underline{5{,}135.13}$$

Problem 2

a. $F = 1.05\, e^{(0.05-0.03)\times 8/12} = \underline{1.0641}$

b. In this case, in eight months you will sell €10,000,000 and receive in exchange $10,640,973.50.

c. If the forward price was 1.08 instead of 1.0641, you should sell €100m forward. To have the €100m at hand, buy $€100\, e^{-0.03\times 8/12}m = €98.0199$m today and put them in a bank account in € growing at 3% per year. That would cost you today $98.0199 \times 1.05 = \$102.9209$m. To pay for this, borrow $108 e^{-0.05\times 8/12}$m $= \$104.4593$m. You can do this because you will sell the €100m in 8 months for $108m. You then generate an arbitrage profit of $\underline{\$1.538\text{m}}$.

Problem 3

a. $D = 4e^{-0.08\times 1/12} + 4e^{-0.08\times 4/12} = 7.87$

$F = (120 - 7.87)e^{+0.08\times 6/12} = 116.71$

b. If the forward price was 120, you should sell the stock forward and buy the stock cash today. The stock will pay \$4 in one month, \$4 in four months, and you will sell it for \$120 in six months. Therefore, you can borrow

$$\underbrace{4e^{-0.08\times 1/12}}_{\text{payable in one month}} + \underbrace{4e^{-0.08\times 4/12}}_{\text{payable in four months}} + \underbrace{120e^{-0.08\times 6/12}}_{\text{payable in six months.}}$$

$= \$123.16$

After buying the stock, your arbitrage profit is <u>\$3.16</u> per share.

Problem 4

The present value of the storage cost is

$$D = -\left[\frac{1.1}{4} + \frac{1.1}{4}e^{-0.08\times 3/12} + \frac{1.1}{4}e^{-0.08\times 6/12} + \frac{1.1}{4}e^{-0.08\times 9/12}\right]$$

$= -\$1.07$ per ounce

Thus,

$$F = (31.04 - (-1.07))e^{0.08\times 12/12} = \underline{\$34.78}$$

Problem 5

When you short a futures, you gain if the futures goes down and loss if the futures price increases.

Day	Futures	P&L	Margin Acct.
0	6,101.24		30,000
1	6,084.32	+ 846.00	30,846
2	6,105.89	- 1,078.50	29,767.50
3	6,101.21	- 216.00	29,551.50

Problem 6

If the stock price at maturity is \$250, the call is in-the-money and the payoff is \$25. The profit is then $25 - 14.40 = \underline{\$10.6}$

Problem 7

If the stock price at maturity is \$380, the put pays off $400 - 380 = \$20$, so the profit is $20 - 103.9 = \underline{-\$83.9}$.

Problem 8

The payoffs of the stock, the short call and the long put are as follow (for 100 shares):

Stock Price	105	135	165	195
Stock	10,500	13,500	16,500	19,500
Short Call	0	0	-1,500	-4,500
Long Put	0	0	0	0
Total Payoff	10,500	13,500	15,000	15,000

The cost of the strategy is

$$12{,}000 + 2{,}100 - 1{,}500 = \$12{,}600$$

↑ Long stock, ↑ Long Put, ↑ short Call

The profit is then the payoff minus the cost.

Stock Price	105	135	165	195
Profit	-2,100	900	2,400	2,400

Problem 9

$13,000 ⟶ 100 shares

$5,000 ⟶ 1,000 puts

$3,000 ⟶ Deposit

The total payoff if the stock price is $90 is

Stock ⟶ $100 \times 90 = \$9000$

Puts ⟶ $1{,}000 \times 10 = \$10{,}000$

Deposit ⟶ $3{,}000\, e^{0.05 \times 6/12} = \$3{,}075.95$

Total ⟶ 22,075.95

Your profit is then $22{,}075.95 - 20{,}000 = \underline{\$2{,}075.95}$