3.1. **Put-call parity.** Provide your **final solution only** to the following problem(s). Each problem will be worth 2 points.

**Problem 3.1.** A company forecasts to pay dividends of $0.90, $1.20 and $1.45 in 3, 6 and 9 months from now, respectively. Given that the interest rate is $r = 5.5\%$, how much dollar impact will dividends have on prices of 9–month options? More precisely, what is the present value of the projected dividend payments?

(a) $3.45
(b) $3.90
(c) $4.22
(d) $4.50
(e) None of the above.

**Problem 3.2.** A certain common stock is priced at $42.00 per share. Assume that the continuously compounded interest rate is $r = 10.00\%$ per annum. Consider a $50$–strike European call, maturing in 3 years which currently sells for $10.80. What is the price of the corresponding 3–year, $50$–strike European put option?

(a) $5.20
(b) $5.69
(c) $5.04
(d) $5.84
(e) None of the above.

**Problem 3.3.** A certain common stock is priced at $99.00 per share and pays a continuous dividend yield of $2\%$ per annum. Consider a $100$–strike European call and put, maturing in 9 months which currently sell for $11.71$ and $5.31$. Let the continuously compounded risk-free interest rate be denoted by $r$. Then,

(a) $0 \leq r < 0.05$
(b) $0.05 \leq r < 0.10$
(c) $0.10 \leq r < 0.15$
(d) $0.15 \leq r < 0.20$
(e) None of the above.

**Problem 3.4.** The initial price of a non-dividend-paying stock is $55$ per share. A 6–month, at-the-money call option is trading for $1.89$. Let the interest rate be $r = 0.065$. Find the price of the European put with the same strike, expiration and the underlying asset.

(a) $0.05$
(b) $0.13$
(c) $0.56$
(d) $0.88$
(e) None of the above
**Problem 3.5.** A stock currently sells for $32.00. A 6-month European call option with strike $35.00 has a premium of $2.27. Assuming a 6% continuous dividend yield and the continuously compounded, risk-free interest rate of 4%, what is the price of the otherwise identical put option as dictated by put-call parity?

(a) $5.05  
(b) $5.13  
(c) $5.52  
(d) $5.88  
(e) None of the above

**Problem 3.6.** A stock currently sells for $32.00. A 6-month European call option with a strike of $30.00 has a premium of $4.29, and the otherwise identical put has a premium of $2.64. Assume a 4% continuously compounded, risk-free rate. What is the net present value of the dividends payable over the next 6 months?

(a) $0.05  
(b) $0.13  
(c) $0.52  
(d) $0.94  
(e) None of the above

**Problem 3.7. Source: Problem #2 from the Sample FM(DM) questions.**

You are given the following information:

1. The current price to buy one share of XYZ stock is 500.
2. The stock does not pay dividends.
3. The risk-free interest rate, compounded continuously, is 6%.
4. A European call option on one share of XYZ stock with a strike price of $K$ that expires in one year costs $66.59.
5. A European put option on one share of XYZ stock with a strike price of $K$ that expires in one year costs $18.64.

Determine the strike price $K$.

(a) $449  
(b) $452  
(c) $480  
(d) $559  
(e) None of the above.

---

3.2. **Replicating portfolios.** Provide your complete solution to the following problem:

**Problem 3.8.** (5 points) Complete the following definition:

We say that a portfolio is a replicating portfolio for a certain European-style derivative security if: ...
Problem 3.9. Denote the continuously compounded interest rate by $r$. Let $V_{CC}(0)$ denote the price of a cash call on the asset $S$ with strike $K$ and exercise date $T$. Let $V_{CP}(0)$ denote the price of a cash put on the asset $S$ with strike $K$ and exercise date $T$. Then,

$$V_{CC}(0) + V_{CP}(0) =$$

(a) $e^{-rT}$
(b) 1
(c) $e^{rT}$
(d) $F_{0,T}^S(S)$
(e) None of the above

Problem 3.10. Denote the continuously compounded interest rate by $r$. Let $V_{AC}(0)$ denote the price of an asset call on the asset $S$ with strike $K$ and exercise date $T$. Let $V_{AP}(0)$ denote the price of an asset put on the asset $S$ with strike $K$ and exercise date $T$. Then, regardless of whether $S$ pays dividends or not,

$$V_{AC}(0) + V_{AP}(0) =$$

(a) $Ke^{-rT}$
(b) $S(0)$
(c) $F_{0,T}(S)$
(d) $F_{0,T}^P(S)$
(e) None of the above

Problem 3.11. Which of the following statements does NOT accurately reflect the relationship between various derivative securities and “synthetic” forward contracts?

(a) Forward = stock – zero-coupon bond
(b) Zero-coupon bond = stock – forward
(c) Prepaid forward = forward – zero-coupon bond
(d) Stock = forward + zero-coupon bond
(e) All of the above are accurate.

3.3. Currency options. Provide your complete solution to the following problem(s):

Problem 3.12. (5 points) Suppose that the exchange rate is 0.95 USD per euro, and that the euro-denominated continuously compounded interest rate is 4%, while the dollar-denominated continuously compounded interest rate is 6%. The price of a 1-year 0.93-strike European call on the euro is $0.0571. What is the price of the corresponding European put?

Problem 3.13. (8 points) The price of a 6-month dollar denominated call option on the euro with a $0.90 strike is $0.0404. The price of an otherwise equivalent put option is $0.0141. Assume that for the dollar we have $r = 5\%$.

a. (5 pts) What is the 6-month dollar-euro forward price?

b. (3 pts) If the euro-denominated annual continuously compounded interest rate is 3.5%, what is the spot exchange rate?
**Problem 3.14.** (5 points) Assume that the current exchange rate is $1.3 per euro. The continuously compounded interest rate for the euro is 0.03, while continuously compounded interest rate for the USD is 0.04.

Let the price of an at-the-money USD-denominated European call on the euro with exercise date in 6 months be equal to 0.053.

What is the price of an at-the-money Euro-denominated put on the USD with the exercise date in 6 months?

---

3.4. **Chooser options.** Provide your **final answer** only for the following problems.

**Problem 3.15.** (2 points) The initial price of a chooser option is greater than or equal to the price of a regular European call on the same asset with the same strike and exercise date. **True or false?**

**Problem 3.16.** (5 points) Consider a chooser option on a stock $S$ whose current price is $100 per share. Assume that we are using our usual notation, i.e., let $V_{CH}(0, t^*, T, K)$ denote the time−0 price of a chooser option with choice date $t^*$, exercise date $T$ and strike price $K$. Then, the following inequality holds:

(a) $V_{CH}(0, t^*, T, K) \leq V_P(0, T, K)$
(b) $V_{CH}(0, t^*, T, K) \leq V_C(0, T, K)$
(c) $\max(V_P(0, T, K), V_C(0, T, K)) \leq V_{CH}(0, t^*, T, K)$
(d) $V_{CH}(0, t^*, T, K) < \max(V_P(0, T, K), V_C(0, T, K))$
(e) None of the above