European puts. Collars.

Provide your **final answer only** to the following problem(s):

**Problem 3.1.** (2 pts) A (long) put is a short position with respect to the underlying asset price. *True or false?*

**Solution:** TRUE

**Problem 3.2.** (2 points) A covered put consists of a written put and a short position in the underlying asset. *True or false?*

**Solution:** TRUE

**Problem 3.3.** (2 points) A producer of oranges wishes to hedge using put options on oranges. She should *write* put options. *True or false?*

**Solution:** FALSE

**Problem 3.4.** (5 points) Farmer Jayne bought a $1.70 strike put option for $0.11 and sold a $1.75 strike call option for a premium of $0.14. Both options expire in six months. Her total costs of producing the corn are $1.65 per bushel. She will sell the 20,000–bushel corn crop in six months. Assume that the effective interest rates for a six month period are 4.0% What is the minimum per-bushel profit in her strategy?

(a) $624  
(b) $1,624  
(c) $2,624  
(d) $3,624  
(e) None of the above.

**Solution:** (b) or (e)

Per bushel, Farmer Jayne’s profit is

\[(K_1 - S_T)_+ - (S_T - K_2)_+ - 1.65 + S_T - (P - C)(1 + i)\]

where \(S_T\) denotes the price of a bushel of corn in six months, i.e., at time \(T = 0.5\), and where \(K_1 = 1.70, K_2 = 1.75, C = 0.14, P = 0.11\) and \(i = 0.04\). If you draw the graph of the profit above, you will notice that it is nondecreasing in \(S_T\). This means that the minimum profit occurs for \(S_T = 0\). In that case, the profit for the 20,000 bushels of corn is

\[20,000(1.70 - 1.65 - (-0.03)(1.04)) = 1,624.\]

The price per bushel is 1624/20000 = 0.0812.

**Problem 3.5.** (5 points) A portfolio consists of the following:

- one long 40–strike put option,
- one long 50–strike call options,
- two short 60–strike put options.

All of the options are European, with the same underlying asset and the same exercise date. What is the portfolio’s payoff if the final price of the underlying asset equals $65?

(a) 5  
(b) 10  
(c) 15  
(d) 25
(e) None of the above.

Solution: \( (c) \)

\[
(40 - 65)_+ + (65 - 50)_+ - 2(60 - 65)_+ = 15
\]