BUSS386 Problem Set 8

Trading Strategies Involving Options

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Problem 1 — Synthetic positions

A European call on a non-dividend stock with $K = 50$, $T = 0.5$ trades at \$4.20. The corresponding European put trades at \$2.80. $S_0 = 51$ and $r = 4\%$ c.c.

(a) Verify put-call parity holds (compute LHS − RHS).

(b) You want to synthesize a short stock position using options + bonds. List the three legs (long/short call, long/short put, long/short bond of face value K at T), and the total cost today.

(c) In one sentence, when would you prefer the synthetic short to an actual short sale?

Problem 2 — Covered call on KOSPI 200 ETF

KODEX KOSPI 200 ETF trades at ₩40,000 per share. A 1-month call on the ETF with $K =$ ₩41,000 trades at ₩500. You own 1,000 shares and write 1,000 covered calls. Ignore TVM and contract-size adjustments.

(a) Compute total premium received in ₩.

(b) Compute total portfolio value at expiry for $S_T \in \{38{,}000;\ 40{,}000;\ 41{,}000;\ 42{,}000;\ 45{,}000\}$.

(c) What is the maximum portfolio value? At what S_T?

(d) What is the breakeven S_T relative to the original ₩40,000 spot?

(e) In one sentence, what is the trade-off relative to just holding the ETF?

Problem 3 — Zero-cost collar

A founder owns 1,000,000 shares of her company's stock at \$80. She wants to hedge for 1 year. Available:

- 1-year put with $K_p =$ \$70 at premium \$3.50 per share.
- 1-year call with $K_c =$ \$95 at premium \$3.50 per share.

(a) Verify that the collar is zero-cost.

(b) Compute the hedged portfolio value at expiry for $S_T \in \{60, 70, 80, 95, 110\}$ per share. (Multiply by 1,000,000.)

(c) What is the minimum and maximum value of the collared position?

(d) In one sentence, why might the founder prefer a collar to selling the stock?

Problem 4 — Bear spread with calls

1-year European calls on a stock: $K_1 = \$45$ at \$8, $K_2 = \$55$ at \$3. Construct a bear spread with these calls.

(a) Which option do you buy and which do you sell? What is the net cash flow today?

(b) Complete the profit table for $S_T \in \{40, 45, 50, 55, 60\}$.

(c) Compute max profit, max loss, and breakeven S_T.

Problem 5 — Butterfly arbitrage

European calls on the same underlying and maturity: $K = 90$ at \$13, $K = 100$ at \$7, $K = 110$ at \$3.

(a) Construct a long butterfly with these three strikes. Net premium today?

(b) Show the payoff at expiry for $S_T \in \{85, 95, 100, 105, 115\}$.

(c) The long butterfly must have non-negative cost. Does it here? If not, what is the arbitrage?

Problem 6 — Straddle vs strangle

A trader expects a large move in a stock currently at \$100 over the next month, but is unsure of direction. Available 1-month options:

- ATM straddle: $K = \$100$ call at \$4 + $K = \$100$ put at \$4.
- OTM strangle: $K_c = \$105$ call at \$2 + $K_p = \$95$ put at \$2.

(a) Compute the cost of each strategy.

(b) For each strategy, find the breakeven S_T values.

(c) For each strategy, compute profit at $S_T \in \{85, 92, 100, 108, 115\}$.

(d) Which strategy is better if the realized move is small (within ± 3)? If large (beyond ± 10)? Justify in one sentence each.

Problem 7 — Iron condor on SPX 0DTE

SPX is at 5,800. A trader sells an iron condor expiring *today* (0DTE) with strikes 5,750 / 5,780 / 5,820 / 5,850. Net credit received \$8 (index points). Multiplier \$100 per point.

(a) List the four legs (long/short, put/call, strike).

(b) Compute max profit and max loss per contract. At what S_T does each occur?

(c) What is the probability-weighted "moneyness" lesson here? (One sentence.)

(d) If realized SPX moves are larger than implied vol on average, are iron condors profitable in expectation? (One sentence.)

Problem 8 — Box spread financing

You execute a long box spread on SPX with $K_1 = 5{,}700$ and $K_2 = 5{,}900$, expiry 6 months out. The four legs cost a net premium of \$197.50 today (per box). $r = 4\%$ c.c. for the same maturity.

(a) Confirm that the box pays a constant $K_2 - K_1 = \$200$ at expiry, regardless of S_T.

(b) Compute the implied interest rate of the box spread financing.

(c) Compare to the 4% market rate: is the box rich or cheap?

(d) In one sentence, why does this rate sometimes differ from the Treasury rate?