

BUSS386 Problem Set 6 — Solutions

Introduction to Options

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Problem 1 — Terminology check

- (a) A forward binds *both* sides to trade at T . An option gives the **buyer** the right to walk away; only the **seller** is bound.
- (b) Intrinsic value = $\max(S_t - K, 0)$ (call) or $\max(K - S_t, 0)$ (put); always ≥ 0 . Time value = price - intrinsic; also ≥ 0 but $\rightarrow 0$ as $t \rightarrow T$ and $\boxed{= 0 \text{ at expiry}}$.
- (c) Short put = collects premium today, loses if the underlying becomes more volatile (a wider distribution increases the chance of a deep ITM put). She is therefore $\boxed{\text{short volatility}}$.
- (d) *Volume* = contracts traded today (flow). *Open interest* = contracts currently outstanding (stock).
- (e) A higher dividend transfers value from stockholders to dividend-receivers. After the ex-div drop, S_t falls \Rightarrow calls (right to buy) lose value; puts (right to sell) gain.

Problem 2 — Payoff and profit table

- (a) Long call payoff = $\max(S_T - 100, 0)$, profit = payoff - 6. Short call mirror. Long put payoff = $\max(100 - S_T, 0)$, profit = payoff - 4. Short put mirror.

S_T	Long call		Short call		Long put		Short put	
	payoff	profit	payoff	profit	payoff	profit	payoff	profit
80	0	-6	0	+6	20	+16	-20	-16
95	0	-6	0	+6	5	+1	-5	-1
100	0	-6	0	+6	0	-4	0	+4
110	10	+4	-10	-4	0	-4	0	+4
120	20	+14	-20	-14	0	-4	0	+4

- (b) Breakeven long call: $S_T = K + c = \boxed{\$106}$. Breakeven long put: $S_T = K - p = \boxed{\$96}$.
- (c) $\boxed{\text{Short call}}$ has the larger max loss — unbounded as $S_T \rightarrow \infty$. Short put's max loss is bounded by $K - 0 - p = \$96$ (stock can't go below zero).

Problem 3 — KOSPI 200 option example

Multiplier $M = \text{₩} 250,000$ per index point; 5 contracts.

- (a) Spot $360 < \text{strike } 365 \Rightarrow$ call is **OTM**.
- (b) Intrinsic = $\max(360 - 365, 0) = 0$. Time value = price - intrinsic = $4.20 - 0 = 4.20$ pts.
- (c) Premium = $5 \times 4.20 \times 250,000 = \text{₩} 5,250,000$.
- (d) Total profit at expiry = $5 \times M \times [\max(S_T - 365, 0) - 4.20]$:

S_T	Payoff/contract (pts)	Total profit (₩)
350	0	$5 \times 250,000 \times (0 - 4.20) = -5,250,000$
365	0	$-5,250,000$
369.20	4.20	$5 \times 250,000 \times (4.20 - 4.20) = 0$
380	15	$5 \times 250,000 \times (15 - 4.20) = +13,500,000$
400	35	$5 \times 250,000 \times (35 - 4.20) = +38,500,000$

- (e) Breakeven at $S_T = K + c = 365 + 4.20 = 369.20$.
- (f) Required index move: $(369.20 - 360)/360 = 2.56\%$. A direct index investment would gain only 2.56%; with the call, the same move just covers the premium. Above breakeven, the call has $\sim 87\times$ leverage relative to spot ($M \cdot K/\text{premium}$ in S_T units).

Problem 4 — Insurance with a long put

- (a) $200 \text{ shares} \div 100 \text{ shares/contract} = 2$ puts. Premium = $2 \times 100 \times \$8 = \$1,600$.
- (b) Stock value = $200 \cdot S_T$. Put payoff = $200 \cdot \max(475 - S_T, 0)$. Hedged value = stock + put payoff - premium:

S_T	Stock ($\times 200$)	Put payoff	Hedged value (net of \$1,600)
400	80,000	15,000	$80,000 + 15,000 - 1,600 = \$93,400$
450	90,000	5,000	$90,000 + 5,000 - 1,600 = \$93,400$
475	95,000	0	$95,000 - 1,600 = \$93,400$
500	100,000	0	$100,000 - 1,600 = \$98,400$
550	110,000	0	$110,000 - 1,600 = \$108,400$

- (c) Worst-case = floor at $\$93,400 = K \cdot 200 - \text{premium} = 475 \cdot 200 - 1,600$, achieved for any $S_T \leq 475$.
- (d) Selling outright eliminates upside (gives up the $S_T = 550$ gain). Selling futures locks in a single price (no choice). The put preserves upside above \$475 at the cost of the \$1,600 premium (the “insurance deductible”).