M339D : February 16th, 2026.

European Put Options.

Usually, a right but not an obligation to SELL an underlying @ the strike price!

At time 0: The writer and the buyer of the put agree on:

- the underlying asset: $S(t), t \geq 0$;
- the exercise date T;
- the strike/exercise price K

The put premium $V_P(0)$ is paid by the put's buyer to the put's writer.

At time T:

- The put's owner has a right but not an obligation to sell one unit.
- The put's writer is obligated to do what the put's owner decides.

The put owner's optimal behavior is:

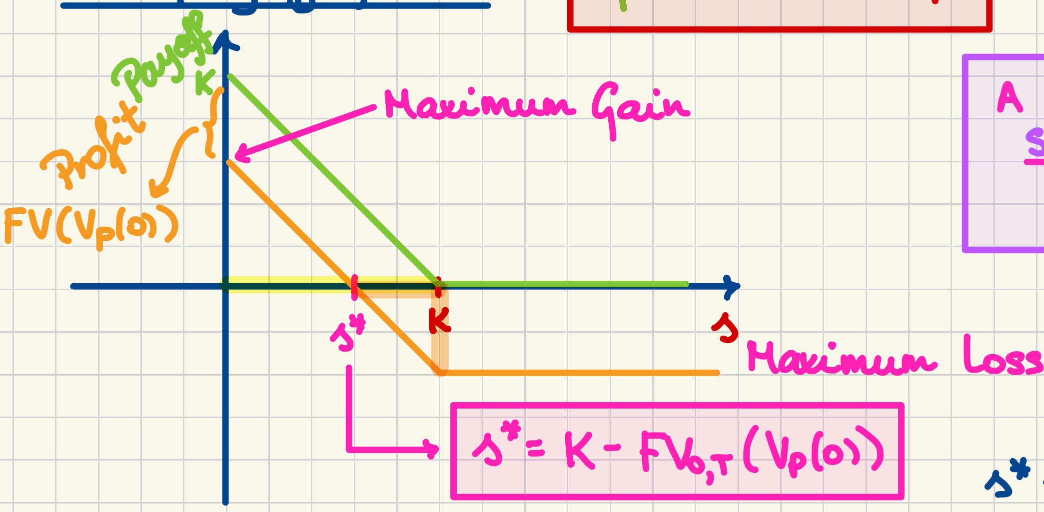
		PAYOFF:
IF $S(T) < K$,	then exercise.	$K - S(T)$
IF $S(T) \geq K$,	then do not exercise.	0

The payoff:

$$\boxed{V_P(T) = \max(K - S(T), 0) = (K - S(T))_+}$$

The payoff f'tion:

$$\boxed{v_P(s) = (K - s)_+}$$



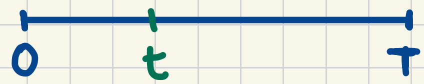
$$\boxed{s^* = K - FV_{0,T}(V_P(0))}$$

A LONG PUT IS A SHORT POSITION w.r.t. the underlying.

$$s^* + FV_{0,T}(V_P(0)) = K$$

Moneyness.

Consider an option written @ time·0 w/ an exercise date T.



Imagine the $\boxed{\text{cashflow}}$ that would happen if the option were exercised @ time·t.

e.g.,
call $\underline{S(t) - K}$
put $\underline{K - S(t)}$

If the cashflow is
$$\begin{cases} > 0, & \text{the option is in·the·money} \\ = 0, & \text{the option is } \boxed{\text{@·the·money}} \\ < 0, & \text{the option is out of the money} \end{cases}$$

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Problem Set #6

European put options.

DISTRACTION!

Problem 6.1. The initial price of the market index is $900. After 3 months the market index is priced at $915. The nominal rate of interest convertible monthly is 4.8%. The premium on the put, with a strike price of $930, is $8.00. What is the profit at expiration for a **long** put?

(a) $15.00 loss
(b) $6.90 loss
(c) $6.90 gain ✓
(d) $15.00 gain
(e) None of the above.

$i^{(12)}$

$\Rightarrow$ effective monthly $j = \frac{i^{(12)}}{12} = 0.004$

$\longrightarrow$:

$$FV_{0,T}(V_P(0)) = 8 \cdot (1.004)^3$$

$$\underline{\text{Payoff}} = (K - S(T))_+ = (930 - 915)_+ = 15$$

$$\text{Profit} = 15 - 8(1.004)^3 = \underline{6.90} \quad \square$$

Problem 6.2. **Sample FM(DM) #12**

Consider a European put option on a stock index without dividends, with 6 months to expiration, and a strike price of $\boxed{1,000}$. Suppose that the nominal annual risk-free rate is 4% **convertible semiannually**, and that the put costs $\boxed{74.20}$ now. What price must the index be in 6 months so that being long the put would produce the same profit as being short the put?

:(i.r. A. 922.83
B. 924.32
:(PAYOFF C. 1,000.00
:(CALL D. 1,075.68
:(CALL+i.r. E. 1,077.17

effective per half-year is

$j = \frac{0.04}{2} = 0.02$

We're really looking for the break-even price.

$S^* = K - FV_{0,T}(V_P(0))$

$= 1000 - 74.20(1.02) = \underline{924.32}$

$\square$

Problem 6.3. Farmer Shaun is producing sweet potatoes. He intends to harvest 10,000−cartons' worth in six months. His total costs are \$12.00 per carton.

He wishes to hedge using European put options. There are two puts on sweet potatoes with the exercise date in six months available: one with the strike price of \$13 per carton and another with the strike price of \$15 per carton. Their premiums are \$0.15 and \$0.18, respectvely.

Assume that the prevailing risk-free interest rate is 4% effective for the half-year period.

At harvest time, in six months, it turns out that the sweet-potato spot price equals \$14. What would Farmer Shaun's profit be if he had decided to hedge using the \$13-strike put versus his profit if he had decided to use the \$15-strike put to hedge?

Focus on the payoff w/out production costs.

unhedged : $S(T)$

hedge : $(K-S(T))_+$

total hedged :

$$S(T) + (K-S(T))_+ = \begin{cases} K & \text{if } K > S(T) \\ S(T) & \text{if } K \leq S(T) \end{cases}$$

$$= \max(S(T), K)$$

$\boxed{\text{FLOOR} = \text{long underlying} + \text{long put}}$