The University of Texas at Austin
In-Class Work 5

M339D Intro to Financial Math

September 18, 2026

European Call Options

Problem 5.1. A stock's price today is \$1000 and the annual effective interest rate is given to be 5%. You write a one-year, \$1,050-strike call option for a premium of \$10 while you simultaneously buy the stock. What is your **profit** if the stock's spot price in one year equals \$1,200?

a. \$150.00.
b. \$139.90.
c. \$10.50.
d. \$39.00.
e. None of the above.

Solution. (c)

$$S(T) - 1000(1.05) - (S(T) - K)_+ + 10(1.05) = 1050 - 990(1.05) = 10.50.$$

Problem 5.2. The initial price of a non-dividend-paying asset is \$100. A six-month, \$95-strike European call option is available at a \$8 premium. The equals 0.04. What is the break-even point for this call option?

a. 86.64
b. 87.00.
c. 103.00.
d. 103.16.
e. None of the above.

Solution. (d)
We need to solve for s in

$$(s - 95)_+ = 8e^{0.02} \Rightarrow \quad s = 95 + 8e^{0.02} = 103.16$$

Problem 5.3. The price of gold in half a year is modeled to be equally likely to equal any of the following prices

$$\$1000, \quad \$1100, \quad \text{and} \quad \$1240.$$

Consider a half-year, \$1050-strike European call option on gold. What is the expected payoff of this option according to the above model?

Solution.

$$50 \times \frac{1}{3} + 190 \times \frac{1}{3} = \frac{240}{3} = 80.$$

Problem 5.4. For what values of the final asset price is the profit of a long forward contract with the forward price $F = 100$ and delivery date T in one year smaller than the profit of a long call on the same underlying asset with the strike price $K = 100$ and the exercise date T. Assume that the call's premium equals \$10 and that the annual effective interest rate equals 10%.

Express your asnwer as an interval.

Solution. The profit function of the forward contract is $v_F(s) = s - 100$. The profit function of the call is

$$v_C(s) - 10 \times 1.10 = (s - 100)_+ - 11.$$

For $s \geq 100$, the call's profit is smaller than the forward contract's profit. So, we focus on $s < 100$. Here we have to solve for s^* in

$$s^* - 100 = -11 \quad \Rightarrow \quad s^* = 89.$$

The answer is $[0, 89)$.

Problem 5.5. *Source: Sample IFM (Derivatives - Intro), Problem#11*
The current stock price is \$40, and the effective annual interest rate is 8%.

You observe the following option prices:

- The premium for a \$35-strike, 1-year European call option is \$9.12.
- The premium for a \$40-strike, 1-year European call option is \$6.22.
- The premium for a \$45-strike, 1-year European call option is \$4.08.

Assuming that all call positions being compared are f long, at what 1-year stock price range does the \$45-strike call produce a higher profit than the \$40-strike call, but a lower profit than the \$35-strike call?

Express your answer as an interval.

Solution. The profit curve for a long European call option with strike K and exercise date T has the following form:

$$(s - K)_+ - FV_{0,T}(V_C(0, K)),$$

where $V_C(0, K)$ denotes the time-0 premium of the call with strike K. So, in the present problem, we have the following three profit curves:

$$\begin{aligned}
(s - 35)_+ - 9.12(1.08) &= (s - 35)_+ - 9.85,\\
(s - 40)_+ - 6.22(1.08) &= (s - 40)_+ - 6.72,\\
(s - 45)_+ - 4.08(1.08) &= (s - 45)_+ - 4.41.
\end{aligned}$$

In order to figure out the region in which the \$45-strike call to has a higher profit than the \$40-strike call, we need to solve the following inequality:

$$(s - 40)\_ + -6.72 < (s - 45)\_ + -4.41.$$

If $0 \leq s \leq 40$, this inequality becomes

$$-6.72 < -4.41.$$

We conclude that all values $s \leq 40$ satisfy inequality (). If $40 < s < 45$, the above inequality () becomes

$$s - 40 - 6.72 < -4.41 \quad \Rightarrow \quad s < 42.31.$$

So, all $s \in [0, 42.31)$ satisfy the aboce inequality. If $s \geq 45$, the inequality is trivially wrong.

In order to figure out the region in which the \$45-strike call to has a lower profit than the \$35-strike call, we need to solve the following inequality:

$$(s-45)_{\_}+-4.41<(s-35)_{\_}+-9.85.$$

If $s \leq 35$, we get no solutions to the inequality. If $35 < s < 45$, the above inequality () becomes

$$-4.41 < s - 35 - 9.85 \quad \Rightarrow \quad 40.44 < s.$$

So, any $s \in (40.44, 45)$ satisfies the inequality. Finally, if $s \geq 45$, our inequality becomes

$$s - 45 - 4.41 < s - 35 - 9.85 \Rightarrow \quad -49.41 < -44.85.$$

So, any $s \geq 45$ satisfies the inequality.

Pooling all of our conclusions together, we get the final answer $s \in (40.44, 42.31)$