Derivatives HW 5

Please hand-write your solutions and submit a PDF file named
`LastName_FirstName_HW5.pdf`

Due Date: October 28th, 3:30pm

1 Problem 1: Intrinsic vs. Time Value

Today's stock price is $S_0 = 112$ and the strike is $K = 110$ with maturity $T = 6$ months. A European call is quoted at $C_0 = 6.75$ and a European put at $P_0 = 3.20$ (same K, T).

1. Compute the intrinsic value and time value of the call.

2. Compute the intrinsic value and time value of the put.

3. Classify each option as ITM (in-the-money), ATM (at-the-money), or OTM (out-of-the-money) at $t = 0$ and briefly justify.

2 Problem 2: Moneyness

Let the strike be $K = 105$ and maturity $T = 9$ months. For underlying prices

$$S_0 \in \{85, \ 95, \ 105, \ 110, \ 125\},$$

1. For each S_0, classify the *call* and the *put* as ITM, ATM, or OTM.

2. On a single set of axes, sketch the *terminal payoffs* at T for the call and put with $K = 105$.

3 Problem 3: Binomial Option Pricing

- Implement both binomial models (Cox-Ross-Rubinstein and Jarrow-Rudd) with 5 periods. Show intermediate steps(node values, tree parameters).

- Price the following European Call and Put options on a dividend-paying stock using the binomial models:

  - Spot price = 100
  - Strike price = 100
  - Time to maturity: $T = 1$ year
  - Risk-free interest rate: $r = 4\%$ p.a.
  - Dividend yield: $q = 3\%$ p.a.
  - Stock volatility: 30% p.a.

- Compare the option prices from the binomial models to the analytical solutions obtained using the Black-Scholes formula. Comment on any discrepancy.

- Verify that the Put-Call parity holds using your computed results.