1. Consider a European call option and a European put option on a nondividend-paying stock. You are given:

(i) The current price of the stock is 60.

(ii) The call option currently sells for 0.15 more than the put option.

(iii) Both the call option and put option will expire in $\boxed{4}$ years.

(iv) Both the call option and put option have a strike price of 70.

Calculate the continuously compounded risk-free interest rate.

$\boxed{r = ?}$

(A) 0.039

(B) 0.049

(C) 0.059

(D) 0.069

(E) 0.079

Put-Call Parity

$$\underbrace{V_C(0) - V_P(0)}_{\text{ll (ii)}} = S(0) - PV_{0,T}(K)$$

$$0.15 = 60 - 70e^{-4r}$$

$$70e^{-4r} = 60 - 0.15$$

$$e^{-4r} = \frac{59.85}{70}$$

ln

$$-4r = \ln\left(\frac{59.85}{70}\right)$$

$$r = -\frac{1}{4}\ln\left(\frac{59.85}{70}\right) = 0.03916$$

77. You are given:

i) The current price to buy one share of XYZ stock is 500.

ii) The stock does not pay dividends.

iii) The continuously compounded risk-free interest rate is 6%.

iv) A European call option on one share of XYZ stock with a strike price of *K* that expires in one year costs 66.59.

v) A European put option on one share of XYZ stock with a strike price of *K* that expires in one year costs 18.64.

Using put-call parity, calculate the strike price, *K*.

$\rightarrow$: $V_c(0) - V_p(0) = S(0) - PV_{0,T}(K)$

$66.59 - 18.64 = 500 - Ke^{-0.06}$

$Ke^{-0.06} = 500 - 66.59 + 18.64$

$K = e^{0.06} \cdot 452.05 = 480.0032$

(A) 449

(B) 452

(C) 480

(D) 559

(E) 582

78. The current price of a non-dividend paying stock is 40 and the continuously compounded risk-free interest rate is 8%. You are given that the price of a 35-strike call option is 3.35 higher than the price of a 40-strike call option, where both options expire in 3 months.

Calculate the amount by which the price of an otherwise equivalent 40-strike put option exceeds the price of an otherwise equivalent 35-strike put option.

$\rightarrow$: $\boxed{V_c(0, K=35)} - \boxed{V_p(0, K=35)} = \cancel{S(0)} - 35e^{-0.08(0.25)}$

$-\ \boxed{V_c(0, K=40)} + \boxed{V_p(0, K=40)} = -\cancel{S(0)} + 40e^{-0.02}$

$3.35 - \boxed{(V_p(0,K=35) - V_p(0,K=40))} = 5e^{-0.02}$

answer $= 5e^{-0.02} - 3.35 = 1.55$

(A) 1.55

(B) 1.65

(C) 1.75

(D) 3.25

(E) 3.35

Chooser Options (aka "as you like it" options).

0 — chooser option written

t^* — the "choice" date

T — exercise data

K... strike price

At time t^*, the chooser option's owner decides whether the option becomes a call or a put (always w/ strike K and exercise date T).

Assume that the owner is rational.

Q: What is their criterion for choosing between a call and a put @ time t^*?

→: Notation.

- $V_{CH}(t, t^*, T)$ — t: valuation date; t^*: choice date; T: exercise date
- $V_{C/P}(t$, exercise date, strike price$)$ — t: valuation date

Our criterion

$$V_{CH}(t^*, t^*, T) = \max\left(\overbrace{V_C(t^*, T, K)}^{a}, \overbrace{V_P(t^*, T, K)}^{b}\right)$$

$$= V_C(t^*, T, K) + \left(\boxed{V_P(t^*, T, K) - V_C(t^*, T, K)}\right)_+$$

$$= \boxed{V_C(t^*, T, K)} + \underbrace{\left(\underbrace{Ke^{-r(T-t^*)}}_{= K^*} - S(t^*)\right)_+}_{\text{The Payoff a European put w/ strike } K^* \text{ and exercise date } t^*}$$

|| PUT-CALL PARITY

A replicating portfolio for the chooser option:

$$\begin{cases} \bullet \text{ a long call w/ strike } K \text{ and exercise date } T \\ \bullet \text{ a long put w/ strike } K^* \text{ and exercise date } t^* \end{cases}$$

$$\Rightarrow \boxed{\begin{aligned} V_{CH}(0, t^*, T) &= V_C(0, T, K) + V_P(0, t^*, K^*) \\ &= V_P(0, T, K) + V_C(0, t^*, K^*) \end{aligned}}$$

20. Assume the Black-Scholes framework. Consider a stock, and a European call option and a European put option on the stock. The current stock price, call price, and put price are 45.00, 4.45, and 1.90, respectively.

Investor A purchases two calls and one put. Investor B purchases two calls and writes three puts.

The current elasticity of Investor A's portfolio is 5.0. The current delta of Investor B's portfolio is 3.4.

Calculate the current put-option elasticity.

(A) –0.55

(B) –1.15

(C) –8.64

(D) –13.03

(E) –27.24

21-24. DELETED

t^*... choice date

25. Consider a chooser option (also known as an as-you-like-it option) on a nondividend-paying stock. At time 1, its holder will choose whether it becomes a European call option or a European put option, each of which will expire at time 3 with a strike price of $\boxed{\$100}$. K

T exercise date

The chooser option price is \$20 at time $t = 0$. $V_{CH}(0,1,3)=20$

The stock price is \$95 at time $t = 0$. Let $C(T)$ denote the price of a European call option at time $t = 0$ on the stock expiring at time T, $T > 0$, with a strike price of \$100.

You are given:

(i) The risk-free interest rate is 0. $K^*=K$

(ii) $C(1) = \$4$. $V_c(0,1,K=100)=4$

Determine $C(3)$. $V_c(0,3,K=100)=?$

$$V_{CH}(0,1,3)=20=\underbrace{V_c(0,3,K=100)}_{\cancel{?}\ \boxed{11}}+\boxed{V_p(0,1,K^*=100)}$$

$$V_p(0,1,K^*=100) = V_c(0,1,K^*=100) + PV_{0,1}(K^*) - S(0) = 4+100-95=9$$

(A) \$ 9

(B) \$11

(C) \$13

(D) \$15

(E) \$17