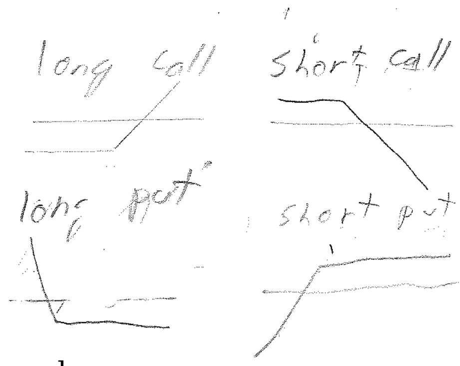

TTA-45036 Introduction to Financial Engineering and Derivatives Markets

Exam
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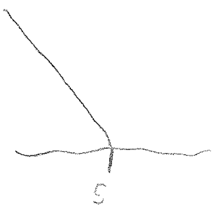
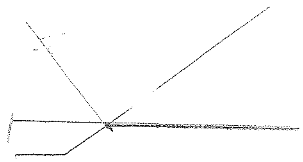


This is a closed-book exam, a non-programmable calculator allowed. Please answer in English. Good luck!

Question 1.

- Explain the following concepts and terms:
  a) Settlement (1 p) – päivän tasaus – end of stock day
  b) Open interest (1 p) – ~~[illegible]~~ futuurien määrä
  c) Incomplete markets (1 p) – tarkka hinta ei tiedossa
- A straddle is an options strategy in which the investor holds a position in both a call and put with the same strike price and expiration date. Draw a profit diagram of the straddle that consists of the following options:
  - A long call option with strike \$10 EUR and premium (price) \$2.
  - A long put options with strike \$10 EUR and premium \$1.5.

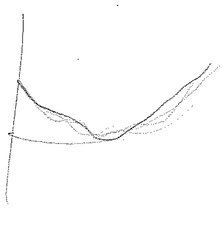
  

  Draw profit curves for the call, the put, and for the portfolio (in profit curves, subtract the premium from the payoff). The underlying price can vary between 0 and 20 EUR. (2 p). 0 2 4 6 8 10 12 14 16 18 20
- Explain why a straddle can be appropriate when an investor is expecting a large volatility in stock price but does not know in which direction the move will be. (1 p). riski, minimoidaan tappiot

Question 2.

a) Why one should never early exercise an American call option in the absence of dividends. *Exact* answers expected. (2 p) Strike ei ole koskaan suurempi kuin option hinta

b) Why do you get a 'smile' effect when you plot implied volatilites of options against their strike prices (2 p) – enemmän kannattaa myydä



Puolesta

- antaa yhtiön keskittyä ydintoimintaan riskittömästi.

Vastaan

- osakkaan omistajat voivat myös hedgata, joka sekoittaa yrityksen toimintaa
- jos kilpailijat eivät hedgaa se ei välttämättä kannata

c) Why companies should and should not hedge risks in interest rates, exchange rates, commodity prices and other variables affecting their business (i.e. arguments in favor of hedging and against hedging)? (2 p)

Question 3.

a) Show that no-arbitrage bounds for the European put option prices are

$$P(t,T) < KD(t,T)$$
$$P(t,T) > (KD(t,T) - S(t))^+,$$

where $S(t)$ is stock price at time t and $P(t,T)$ is the price of a put at time t with maturity time T, $T > t$. Moreover, $D(t,T)$ is a discount factor (with risk-free interest rate) from time T to time t. Assume that you can borrow or lend any amount of money at the risk-free interest rate. (2 p)

vastaoletus ja taulukot

b) Let the current stock price $S_0 = 1$, strike price $K = 0.96$, continuously compounded interest rates $r = 0.05$, time to maturity $T = 2$ years, and volatility $\sigma = 0.25$. The stock pays no dividends. What is Black-Scholes price of the European call option? (1 p)

Black Scholes sijoitus

c) A stock is worth \$10 today and *monthly* return coefficients are $U = 1.2$ and $D = 1/U$ (i.e. stock price will be either \$10 $\times$ 1.2 or \$10/1.2 after the first month). The continuously compounded risk free interest rate (annual) is 2%. The strike price is \$9.5 and time to maturity 2 months. What is the price of a European *put* option with two-step binomial tree (with $\Delta t = 1/12$)? Second, suppose that market price for the European *call* option is \$1. How could one exploit an arbitrage opportunity? (3 p)

Binomial-model tehtävä
- laske payoutit
- laske puun arvot