

**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. You can answer in English or in Finnish. Good luck!

Question 1. Explain the following concepts and terms:

- a) Efficient markets (1 p)
- b) Incomplete markets (1 p)
- c) Put option (1 p)
- d) Implied volatility (1 p)
- e) Short selling (1 p)
- f) Forward contract (1 p)

Question 2.

- a) What is the difference between Black-Scholes implied volatility and historical volatility estimated from time-series? Are you better off using implied volatility or historical volatility to forecast future volatility? Why? (3 p)
- b) Mathematical finance assumes that financial markets do not allow for profitable arbitrage and that the liquid markets price instruments correctly. Why to use mathematical arbitrage-free models to price options and other derivative securities at all if market prices are already assumed to be correct? (3 p)

Question 3.

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

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

- b) On a non-dividend paying stock, why should one never exercise an American call option before its expiry?

Question 4. A stock is worth \$10 today and it is either \$12 or \$8.33 after one month and the risk free interest rate (annual) is 2%. The strike price is \$9.5 and time to maturity 3 months.

- a) What is the price of a European call option? (2 p)
- b) What is the price of a European put option? (2 p)
- c) Suppose that market price for the European call option is \$1.5. How do you exploit an arbitrage opportunity? (2 p)