This document contains 3 questions.

1. [default,Q8]

   Consider the one-period binomial model where the bank account has interest rate $r = 0$, and the stock takes values $S_0 := 4$, and $S_1$ can take the values 5 and 3.

   (a) Is this model free of arbitrage?
   A. No B. Yes

   (b) What should be the price $P_0$ for a put option on $S$ with strike $K = 4$?

   A. 0 B. 1/2 C. 1 D. None of the above

   Suppose that such a put option was sold at a price 1. To realise an arbitrage, how many shares $h \in \mathbb{R}$ should I buy/sell if

   (c) I *sell* one option?
   A. No arbitrage is possible B. $h = 0$ C. $h = -1$ D. $h \in [-1, 0]$ E. None of the above

   (d) I *buy* one option?
   A. No arbitrage is possible B. $h = 0$ C. $h = -1$ D. $h \in [-1, 0]$ E. None of the above

2. [default,O9]

   Consider a trinomial market model. This is the model consisting of one bond with risk-free interest rate $r > -1$, and one stock with price $S_0 > 0$ at time 0, and whose price at time 1 it takes the three values $d, m, u$ with probability respectively $q, 1 - (p + q), p$; we assume that $0 < d < m < u$ and $p, q \in (0, 1)$. For some values of parameters (in the range described above) this model free of arbitrage, and for some it is not; on which of the parameters $p, q, d, m, u, r$ does this depend on?

   A. all of them B. $d, m, u, r$ C. $d, u, r$ D. $p, q, d, u, r$ E. None of the above

3. [default,O3c]

   Define the random variables

| $\omega$ | $\omega_1$ | $\omega_2$ | $\omega_3$ |
|---|---|---|---|
| $S_1(\omega)$ | 2 | 4 | 10 |
| $Y_1(\omega)$ | 4 | 2 | $-4$ |

   Consider a one-period trinomial model $(B, S)$ with interest rate $r = 1$ (so $B_0 = 1, B_1 = 1 + r$), and a stock whose price is given by $S_0 = 2$ at time 0 and by $S_1$ at time 1. Here $\Omega = \{x_1, x_2, x_3\}$ is the underlying probability space, on which is defined a probability $\mathbb{P}$ such that $\mathbb{P}(\{\omega\}) > 0$ for every $\omega \in \Omega$).

   (a) Is this model free of arbitrage?
   A. No B. Yes

   (b) Consider the derivative with payoff $Y_1$ at time 1. Is $Y_1$ replicable (in the model $(B, S)$)?
   A. No B. Yes

   (c) Is the model $(B, S)$ *complete*, i.e., can *any* option be replicated in this model?
   A. No B. Yes

   (d) What is the smallest price $p$ at which an infinitely risk-averse agent would be willing to sell $Y_1$?
   A. 1 B. 2 C. There exists no such $p$ D. Not enough info to answer E. None of the above