

Name:

M339D=M389D Introduction to Actuarial Financial Mathematics

University of Texas at Austin

Practice Problems for In-Term One

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Notes: This is a closed book and closed notes exam. This exam is graded out of 50 points.

Time: 50 minutes

1.1. TRUE/FALSE QUESTIONS.

Problem 1.1. (2 points) An agent is **only** allowed to long a forward contract if he/she is willing to take physical delivery of the underlying asset.

Problem 1.2. (2 points) Denote the continuously compounded, risk-free interest rate by r and denote the equivalent annual effective interest rate by i . Then, $\ln(1 + i) = r$. *True or false?*

Problem 1.3. (2 pts) Two dice are rolled, the single most probable sum of the numbers of the upturned faces is 7. *True or false?*

1.2. MULTIPLE CHOICE QUESTIONS.

Problem 1.4. (5 pts) Let $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ be two functions given by

$$f(x) = 2x - 10$$

and

$$g(x) = \begin{cases} \min(x, 7) & \text{if } x \geq 0 \\ 0 & \text{if } x < 0 \end{cases}$$

Then, $g(f(7))$ equals ...

- (a) -4
- (b) 0
- (c) 4
- (d) 7
- (e) None of the above

Problem 1.5. *Source: Sample P exam, Problem #176.*

In a group of health insurance policyholders, 20% have high blood pressure and 30% have high cholesterol. Of the policyholders with high blood pressure, 25% have high cholesterol. A policyholder is randomly selected from the group. Calculate the probability that a policyholder has high blood pressure, **given** that the policyholder has high cholesterol.

- (a) 1/6
- (b) 1/5

- (c) $1/4$
- (d) $2/3$
- (e) $5/6$

Problem 1.6. Harry plays a simple lottery in which the winnings are distributed as follows:

- \$5 with probability 0.2,
- \$10 with probability 0.4,
- \$20 with probability 0.4.

It turns out that Harry has to pay a fee to collect his winnings. If the actual amount he wins is smaller than \$9, then the fee is defined to equal the amount that Harry won – thus, he walks away with nothing. If the actual amount he wins is between \$9 and \$15, he does not have to pay anything in fees and gets a bonus of \$4. If the actual amount he wins is larger than \$15, then he pays the \$15-fee and pockets the remainder. What is the expected value of the net amount Harry collects?

- (a) 3
- (b) 6.4
- (c) 7.6
- (d) 15
- (e) None of the above.

Problem 1.7. The current exchange rate is such that one Swiss Franc equals 1.07 USD. The continuously compounded risk-free interest rate for the Swiss Franc is 0.02. The continuously compounded risk-free interest rate for the USD is 0.05. You want to purchase such an amount of Swiss Francs today so that once that amount is deposited in a savings account it will grow to exactly 10,000 Swiss Francs in two years. How much will this purchase cost you today in USD?

- (a) 8979.341
- (b) 9607.894
- (c) 9681.76
- (d) 10280.45
- (e) None of the above.

Problem 1.8. You buy one share of discrete-dividend-paying stock today with the intention of holding onto this investment for at least one year. The stock price today is \$60 per share. The stock will pay \$2 in dividends per share in one quarter. Thereafter, the dividends increase by 2% and continue to be paid quarterly. Let the continuously compounded risk-free interest rate be equal to 0.04. What is the present value of all of the dividends you are entitled to over the next year?

- (a) 7.80
- (b) 7.94
- (c) 8.04
- (d) 8.35

- (e) None of the above.

Problem 1.9. Hermoine sells short one share of continuous-dividend-paying stock. The stock is currently valued at \$80 per share. The stock's dividend yield is 0.02. The continuously compounded risk-free interest rate is 0.04. Hermione intends to close the short sale in one year. What is the final stock price for which Hermione will break even?

- (a) 80
- (b) 80.28
- (c) 81.62
- (d) 83.26
- (e) None of the above.

Problem 1.10. The current market price of widgets is \$4 per widget. The widget factory plans to sell their next batch of 100 widgets in half a year. The total aggregate costs of production of widgets will be equal to \$350.

The factory enters 100 short forward contracts on widgets for delivery in half a year. The forward price is \$4.20 per widget.

What is the factory's profit if the final price of widgets in half a year ends up being \$4.40?

- (a) 30
- (b) 50
- (c) 70
- (d) 90
- (e) None of the above.

Problem 1.11. Maryam bakes batches of cupcakes for a cupcake convention. She buys forward 21 pounds of raspberries from a local farmer at the forward price of \$5.60 per pound.

She projects to bake 336 cupcakes and sell each for \$3. The total and aggregate non-raspberry costs of baking the cupcakes are \$200.

If the market price of raspberries on the day of the cupcake convention is \$5.40, what is Maryam's profit?

- (a) \$690.40
- (b) \$694.60
- (c) \$890.40
- (d) \$894.60
- (e) None of the above.

Problem 1.12. The **writer** of a call option has ...

- (a) an obligation to sell the underlying asset at the strike price.
- (b) a right, but **not** an obligation, to sell the underlying asset at the strike price.
- (c) an obligation to buy the underlying asset at the strike price.
- (d) a right, but **not** an obligation, to buy the underlying asset at the strike price.

(e) None of the above.