

Dept of Mathematics and Statistics
King Fahd University of Petroleum & Minerals

AS288: Actuarial Science Problem Lab II
- SOA FM Exam Prep

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Major Exam 2 Term 122 FORM A

Monday 15 April 2013 6.30pm-8.00pm

Name _____ ID#: _____ Serial #: _____

Instructions.

1. Please turn off your cell phones and place them under your chair. Any student caught with mobile phones on during the exam will be considered under the **cheating rules** of the University.
2. If you need to leave the room, please do so quietly so not to disturb others taking the test. No two person can leave the room at the same time. No extra time will be provided for the time missed outside the classroom.
3. Only materials provided by the instructor can be present on the table during the exam.
4. Do not spend too much time on any one question. If a question seems too difficult, leave it and go on.
5. Use the blank portions of each page for your work. Extra blank pages can be provided if necessary. If you use an extra page, indicate clearly what problem you are working on.
6. Only answers supported by work will be considered. Unsupported guesses will not be graded.
7. While every attempt is made to avoid defective questions, sometimes they do occur. In the rare event that you believe a question is defective, the instructor cannot give you any guidance beyond these instructions.
8. Mobile calculators, I-pads, or communicable devices are disallowed. Use regular scientific and/or financial calculator only. Write important steps to arrive at the solution of the following problems.

The test is 90 minutes, GOOD LUCK, and you may begin now!

Question	Total Marks	Marks Obtained	Comments
1	3+1=4		
2	3+1=4		
3	3+1=4		
4	3+1=4		
5	4+1=5		
6	4+1=5		
7	3+1=4		
8	4+1=5		
9	4+1=5		
Total	40		

Extra blank page

- 1 (3+1=4 marks) A house is worth 300000. A three-year fire insurance policy with a deductible of 30000 is purchased for the house. The following three-year call options to buy the house may be purchased at the time the insurance is written.

Strike price K	Call Option price
270000	\$74825
300000	\$58168

The continuously compounded risk-free rate is 4%. What is the price of the insurance?

- a) 14293
- b) 21820
- c) 24244
- d) 25386
- e) 34825

Work Shown (3 points).

Answer is ()

2. (3+1=4 marks) Suppose you can earn 10% effective annual interest for the next 10 years and 6% interest convertible semiannually for the 10 years after that. What should be the required investment today to accumulate to \$1,000,000 in 20 years?

- a) 215,285
- b) 213,465
- c) 213,270
- d) 212,115
- e) 211,980

Work Shown (3 points) .

Answer is ()

3. (3+1=4 marks) The current price of the commodity actuarium is \$40 per pound. A mining company is considering hedging this price for a sale in 3 months. Two options are proposed.

Option A : Buy a 3-month European **put** with $K = 40$ for a price of 1.8355.

Option B : Buy two 3-month **puts** for 1.8355 each and sell one 3-month **put** with $K = 43.014$ for 3.671.

Which of the following is **true**?

- a) Option B is always has a higher profit because its cost is 0
- b) Option A is always more profitable.
- c) Option B is more profitable for values of actuarium less than 40 because its cost is 0, but it is less profitable for high prices of actuarium.
- d) Option B is less profitable for values of actuarium less than 40, but it is more profitable for high prices of actuarium.
- e) The company does not need to hedge

Work Shown (3 points)

Answer is ()

4. (3+1=4 marks) A stock has a current price of 40. The continuous annual risk free rate is 2%. An investor wishes to create a zero-cost collar using options with maturity $T = 0.25$. Which of the following strike prices cannot be used for the put in the collar ?

- a) 38.37
- b) 39.93
- c) 40.01
- d) 40.20
- e) 41

Work Shown (3 points)

Answer is ()

5. (4+1=5 marks) European puts and calls with a strike price of $K = 50$ are available for a stock with current price S_0 . The stock has an annual continuously compounded dividend rate of $\delta = 0.01$. The table below gives the call-put difference $C - P$ for expiration times 0.25 and 0.50

Time T	Difference $C - P$
0.25	0.125
0.5	0.248

The risk-free rate is less than 10%. Which of the following is closest to the risk free rate?

- a) 0.01
- b) 0.02
- c) 0.03
- d) 0.04
- e) 0.05

Work Shown (5 points).

Answer is ()

6. (4+1=5 marks) An interest rate swap is set up for the next two years with swap rate 6.48%. The one year spot rate is 6%. Find the second year forward rate $r_0(1, 2)$.

- a) 6.33%
- b) 6.49%
- c) 6.77%
- d) 6.85%
- e) 7.00%

Work Shown (4 points)

Answer is ()

7. (3+1=4 marks) A two-year bond level coupon of 4.2 and maturity value of 100 has price 101.291. The one-year spot rate is 0.045. What is the swap rate for a two year interest rate swap?

- a) 0.0352
- b) 0.0391
- c) 0.0433
- d) 0.0477
- e) 0.0498

Work Shown (3 points) .

. Answer is ()

8. (4+1=5 marks) In this problem, we will look at profit for a farmer who grows corn. The current (spot) rate for corn is 1.60 per bushel. The 6 month forward price is \$1.50 per bushel. The continuously compounded annual rate is $\delta = 0.04$. The farmer, has total fixed and variable costs of 1.45 per bushel, and plans to produce 100,000 bushel for \$145,000. A six month ($T = 0.5$) call with a strike price of 1.55 per bushel is available at a price of 0.10.

What are the minimum and maximum profits for the farmer in six months if he is hedged with a sale of this call?

- a) minimum = -134800, maximum = 28022
- b) minimum = -134800, maximum = 20202
- c) minimum = -134800, no maximum
- d) no minimum , maximum = 28022
- e) none of the above

Work Shown (4 points)

. Answer is ()

9. (4+1=5 marks) A new company expects the dividends on its common stock to be 1 the first year and increase by 1 each year until it reaches 10. Thereafter it expects the dividend to grow by 3% each year. Assume an annual interest rate of 5%.

Calculate the **price** of this stock using the dividend discount model.

- a) 334
- b) 351
- c) 356
- d) 365
- e) 372

Work Shown (4 points)

Answer is ()

END OF TEST PAPER