JOMO KENYATTA UNIVERSITY
OF
AGRICULTURE AND TECHNOLOGY
University Examination 2018/2019
THIRD YEAR SECOND SEMESTER EXAMINATIONS FOR THE BACHELOR OF ACTUARIAL SCIENCE
STA 2391: RISK THEORY FOR ACTUARIAL SCIENCES

DATE: APRIL 2019   TIME: 2 HOURS

INSTRUCTION TO CANDIDATES

1. Answer question ONE and any other two questions.

2. Be neat and show all your workings.

3. All questions except question one carry equal marks.

4. No writing should be done on this question paper.

5. Any rough work should be done at the back of the booklet and cancelled.

QUESTION ONE (30 MARKS)

(a) Differentiate between the individual and aggregate claim cost models.   [2 marks]

(b) Explain in your own words why the normal approximation technique might not be suitable to approximate the total claim distribution function of S, the total individual claim amounts.   [2 marks]

(c) State the 3 properties of utility functions that are useful when pricing.   [3 marks]

(d) Show that the sum of n independent Bernoulli (θ) random variables are Binomial(n,θ).   [3 marks]

(e) Given that the total claim cost has an expected value of 10000, standard deviation of 1000 and skewness of 1. Using the normal power approximation technique, determine the amount of capital needed to cover the loss with a 95% probability.   [5 marks]

(f) Prove that the maximum and minimum premium for a risk X of a linear utility function is given by the net premium.   [5 marks]

(g) Consider a compound binomial distribution where r=14, p=0.7 and $Pr(X = 1, 2, 3) = \frac{1}{4}, \frac{1}{2}, \frac{1}{4}$. Use Panjer's recussion to find the cumulative distribution function of $S = X_1 + X_2 + X_3$.   [5 marks]

(h) An insurer knows from past experience that the number of claims received per month has a Poisson distribution with mean 15 and claim amounts have an exponential distribution with mean 500. The insurer uses a security loading of 30%. Calculate the insurer's adjustment coefficient and give an upper bound for the inurer's probability of ruin if the insurer sets aside an initial surplus of 1,000.   [5 marks]

QUESTION TWO (20 MARKS)

(a) Find the mean and variance of $S = X_1 + X_2 + X_3$ if   [10 marks]

$$f_1(x) = 0.3, 0.2, 0.4, 0.1 \quad \text{for} \quad x = 0, 1, 2, 3$$
$$f_2(x) = 0.4, 0.3, 0.1, 0.2 \quad \text{for} \quad x = 0, 1, 2, 3$$
$$f_3(x) = 0.1, 0.2, 0.3, 0.3, 0.1 \quad \text{for} \quad x = 0, 1, 2, 3, 4$$