

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS
EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN
ACTUARIAL SCIENCE

ACMT 413: RISK MODELLING

STREAMS: BSC

TIME: 2 HOURS

DAY/DATE: TUESDAY 17/12/2024

2.30 P.M. –4.30 P.M.

Question one (30 marks)

- A. Credibility is an example of a statistical estimate. Explain what is meant by a statistical estimate and elaborate two major statistical paradigms associated with credibility. (5 marks)
- B. Explain the three attributes of short term insurance contract. (6 marks)
- C. A compound distribution S is such that $P(N=0)=0.6$, $P(N=1)=0.3$ and $P(N=2)=0.1$. Claim amounts are either 1 unit or 2 units each with probability 0.5. Derive the distribution function of S . (4 marks)
- D. If X has a Pareto distribution with parameters $\lambda = 400$ and $\alpha = 3$, and N has a Poisson (50) distribution. Find the expected value of S . (4 Marks)
- E. The probability of a claim arising on any given policy in a portfolio of 1,000 one year term assurance policies is 0.004. Claim amounts have a Gamma (5, 0.002) distribution. Find the mean and variance of the aggregate claim. (6 marks)
- F. Explain three approaches to credibility theory (5 marks)

Question two (20 marks)

- A. Describe three situations, mentioning particular types of insurance, where an insurer might determine a premium rate by combining direct data for a risk with collateral data. (6 marks)
- B. State the posterior distribution for a normal normal model. (4 marks)
- C. State and explain the similarities and differences between the Bayesian models and the EBCT Models. (6 marks)

- D. Write down the MGF(Moment Generating function) of a Compound Poisson distribution with individual claim size distribution Gamma(α/β) and poisson parameter λ (4 marks)

Question three (20 marks)

- A. The aggregate claims for a risk have a compound poisson distribution with parameter λ . Individual claims (in kshs) have a Pareto distribution with parameters $\lambda = 1000$ and $\alpha = 3$. The insurer of the risk calculates the premium using a premium loading factor of 0.2. The insurer is considering effecting excess of loss reinsurance with retention limit of kshs 1000. The reinsurance premium would be calculated using a premium loading factor of 0.3. The insurer profit is defined to be a premium charged by the insurer less the reinsurance premium and less the claims paid by the insurer, net of reinsurance.
- Show that the insurer's expected profit before reinsurance is 100. (4 marks)
 - Calculate the insurer expected profit after effecting the reinsurance and hence find the percentage reduction in the insurer expected profit. (3 marks)
 - Calculate the percentage reduction in the standard deviation of the insurers profit as a result of effecting reinsurance. (3 marks)
- B. List and explain five steps involved in Bayesian approach to credibility. (10 marks)

Question four (20 marks)

- A. EBCT model 1 can be regarded as a generalization normal/normal model. State five points where EBCT mode differs from normal / normal model (10 marks)
- B. The table below shows the aggregate amounts (in kshs m) for a local insurer. Five portfolio for a five year period, together with summary statistics. Fill in the missing entries and calculate $E(m(\Theta))$, $E S^2(\Theta)$ and $Var(m(\Theta))$ using EBCT model 1

Total claim

	Year J					\bar{x}_j	\sum	$\frac{1}{4}$
<i>Type equation here.</i>								
Country (i)	1	2	3	4	5			
1	48	53	42	50	59	50.4	?	
2		64	71	64	73	70?		?
3		85	54	76	65	90	?	?
4		44	52	69	55	71		?

(10 marks)

Question Five (20 marks)

- A. Elaborate the five assumptions of the EBCT Model Z. (10 MARKS)
- B. What are the five criteria for risk events need to meet for them to be insurable? (10 marks)