বিদ্যাসাগর বিশ্ববিদ্যালয়

VIDYASAGAR UNIVERSITY

Question Paper

B.Sc. Honours Examinations 2022

(Under CBCS Pattern)

Semester - VI

Subject : STATISTICS

Paper : DSE 3-T

Full Marks : 40

Time : 2 Hours

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

[ACTUARIAL STATISTICS : THEORY]

Answer any ***two*** questions : 10×2=20

1. Describe the excess of loss reinsurance arrangement method in the context of insurance applications. Obtain the distributions of the Insurer's and Reinsurer's payments, and write the expressions of their means. 2+(3+3)+(1+1)

2. Confirm that each of the following functions can serve as a force of mortality. Obtain the corresponding survival functions. In each case, $x \geq 0$.

   (a) $Bc^{x}, B > 0, c > 1$

   (b) $a(b+x)^{-1},\ a > 0,\ b > 0.$ (3+3)+(2+2)

3. Suppose the force mortality follows Gompertz's law given by $\mu_x = BC^x$. Find the formulae for actuarial present values of init benefit to be paid at the moment of death for an *n* year term life insurance and whole life insurance. 10

4. (i) The p.d.f. of future life time, *T*, for *t* is assumed to be $f_T(t) = \frac{1}{80}, 0 \le t \le 80$. At a force of interest, calculate for *Z*, the present value random variable for a whole life insurance of unit issued to *t*

   (a) The actuarial present value

   (b) The variance

   (ii) Show that principle of zero utility is consistent and it satisfies the non-negative loading and no-ripoff properties. 5+5

Answer any *four* questions : 5×4=20

5. Let the amount of a claim of an insured party, denoted by *X*, have a log-normal distribution with mean 100 and variance 30000. Also, let *M* be the retention level. Calculate the expected payment to be made by the re-insurer. 5

6. Obtain the distribution of the curate future life-time and find its variance. 2+3

7. Let us define $T(x)$ as

$$T(x) = K(x) + Z(x),$$

where $T(x)$ and $K(x)$ have their usual meaning, and $Z(x)$ is the random variable representing the fractional part of a year lived in the year of death. Under the UDD assumption, are the variables $K(x)$ and $Z(x)$ independent ? 5

8. A decision maker's utility function is given by $u(x) = -e^{-5x}, x \ge 0$. The decision maker has two random prospects available. The outcome of the first denoted by *X*, is distributed as $N(5, 2)$. The second prospect, denoted by *Y*, is distributed as $N(6, 2.5)$. Which prospect will be preferred ? 5

9. Let the loss random variable *X* have a pdf given by $f(x) = 0.1e^{-0.1x}, x \ge 0$. If *P*=5 is to be spent for insurance to be purchased by the payment of the pure premium, show that $I(x) = \frac{x}{2}$ is feasible insurance policy with pure premium *p*=5 5

10. Define individual risk model for total risk of an insurance company. How collective risk model differs from individual risk model.

Or,

[FINANCIAL STATISTICS]

1. Answer any ***four*** questions : 5×4=20

 (a) What do you mean by stochastic models in finance ? Give examples.

 (b) What is the relationship between strike price and option price ?

 (c) Point out the difference between delta and gamma hedging ?

 (d) Name the tools needed for option pricing.

 (e) What is the relationship between spot price and future price ?

 (f) Discuss some properties of Brownian motion.

2. Answer any ***two*** questions : 10×2=20

 (a) What is geometric random walk ? Where do you start the geometric random walk ? How do you calculate the probability of a random walk ?

 (b) How do you solve stochastic integrals ? How do you find a stochastic differential equation ?

 (c) (i) In a sample of 1000 people in West Bengl, 540 are rice eaters and the rest are wheat eaters. Can we assume that both rice and wheat are equally popular in this state at 1% level of significance ? [Critical value of Z at 1% is 2.58]

 (ii) The second moments about the mean of two distributions are 9 and 16, while the third moments about the mean are –8.1 and –12.8 respectively. Which distribution is more skewed to the left ? Give reasons. 5+5

 (d) (i) Can two events be mutually exclusive as well as mutually independent ? Explain.

 (ii) Three lots contain respectively 10%, 20% and 25% defective articles. One article is drawn at random from each lot. What is the probability that among them there is exactly one defective and at least one defective ? 4+3+3