

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



B.Sc. DEGREE EXAMINATION – STATISTICS

FOURTH SEMESTER – APRIL 2022

UST 4601 – ACTUARIAL STATISTICS

Date: 23-06-2022

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

PART – A

(10x 2 = 20 Marks)

Q. No

Answer ALL Questions

- 1 Find the present value of Rs. 1000 receivable at the end of 50 years the rate of interest being 5% p.a.
- 2 Find the accumulated value of the principal of Rs. 20000 invested for 25 years at compound interest of 8% p.a.
- 3 Differentiate between uniform annuity and variable annuity.
- 4 What is the effective rate p.a. corresponding to a nominal rate of 8 % p.a. convertible monthly?
- 5 Give the formula for present value of increasing annuity
- 6 Evaluate $(1 + i)^{12} a_{16} @ 9\%$
- 7 What is office premium?
- 8 A sum of money is invested at 4% p.a. effective. How long will it take to double itself?
- 9 Define stochastic interest rates
- 10 What is fixed rate of interest?

PART – B

(5 x 8 = 40 Marks)

Answer any FIVE Questions

- 11 a) The amounts for a certain sum with compound interest at a certain rate in two years and in three years are Rs. 8820 and Rs. 9261 respectively. Find the rate and sum.
b) A has taken a loan of Rs. 2000 at a rate of interest 4% p.a. payable half-yearly. He repaid Rs. 400 after 2 years, Rs. 600 after a further 2 years and cleared all outstanding dues at the end of 7 years from the commencement of the transaction. What is the final payment made by him?
- 12 Calculate the present value of a deferred annuity payable for 10 years certain, the first payment falling due at the end of 6 years from the present time. The annuity is payable at the rate of Rs. 100 p.a. for the first 5 years and Rs.200 p.a. thereafter. Given ($a_5 = 4.3295$, $a_{10} = 7.7217$, $a_{15} = 10.3797$)
- 13 In lieu of a single payment of Rs. 1000 at the present moment a person agrees to receive three equal payments at the end of 3 years, 6 years and 10 years respectively. Assuming a rate of interest of 6% p.a., what should be the value of each of the three payments?
- 14 Explain the various types of life annuities.
- 15 Calculate office annual premium for an Endowment Assurance for Rs. 15,000/- to a person aged 35 for 25 years. Provide for first year expenses at 50% of premium and 15% sum assured; and renewal expense of 5% of premium and 6% sum assured: LIC (1970 -73) ultimate Table and 6% interest.
- 16 Calculate office annual premium for a with profit Whole Life Assurance for Rs. 20000/- to a person aged 40. Provide for first year expenses at 55% of premium and 17% sum assured; renewal expense of 5% of premium and 6% sum assured; and a bonus loading of Rs 25% per annum: LIC (1970 -73) ultimate Table and 6% interest.
- 17 Calculate the expected accumulated value and variance of the accumulated value, at the end of 5 years of an initial investment of Rs. 50,000 if the returns from the investment are assumed to conform to the fixed interest rate model with the distribution of the following interest rates.

$$i_k = \begin{cases} 0.06 & \text{with probability } 0.2 \\ 0.08 & \text{with probability } 0.7 \\ 0.10 & \text{with probability } 0.1 \end{cases}$$

Where $K = 1, 2, 3$ and 4

- 18 Calculate mean and variance of the accumulated values of an initial investment of Rs. 40, 000/- at the end of 25 years if the annual rates of return are assumed to conform the varying interest rate model and follow Gamma (16, 200) distribution.

PART – C

(2 x 20 = 40 Marks)

Answer any TWO Questions

- 19 a) An annuity is payable for 35 years certain, the first payment falling due at the end of first year. The annuity payable at the rate of Rs. 1000 p.a. during the first 28 years and at Rs.800 p.a. during the remaining 7 years. Calculate the present value of the annuity on the basis of interest at 8% p.a. (10 Marks)
- b) A bond of Rs.1000 redeemable at par 10 years hence carry interest at rate of interest 9% p.a. payable half yearly (i)Find the price which purchaser of the bond must offer if he wishes to realize 10% p.a. on his investment. (ii)If the holder of single bond invests the sums of interest on the bond as they are received at a rate of 10% p.a. find the total amount at the end of 10 years. (10 Marks)
- 20 a) Derive the expression to convert effective rate of discount to nominal rate of discount and Vice – Versa. (10 Marks)
- b) Derive an expression to find the present value for the following variable annuities:
(i) Increasing annuity
(ii) Immediate Increasing Perpetuity
(iii)Increasing annuity due
(iv)Increasing Perpetuity due (10 Marks)
- 21 a) A loan of Rs. 10,000/- is to be repaid with interest at 6% p.a. by means of an immediate annuity for 5 years. Find the level payment. What will be the principal and interest contained in each of the 5 installments? (10 Marks)
- b) Calculate office annual premium for an Endowment Assurance for Rs. 15.000/- to a person aged 40 for 15 years. Provide initial expenses at 55% sum assured, other expenses at 8% of all premium and constant of 3% of sum assured: LIC (1970 -73) ultimate Table and 6% interest. (10 Marks)
- 22 Explain S_n and A_n in the context of stochastic interest rates and derive mean and variance of S_n and A_n .

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