

P. G. D. A. S. (Sem.-2) Examination
AS 201

Actuarial Statistics-2

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

Q. 1(A) Attempt any TWO:

14

- (1) A sample of 400 articles from a big lot gave 40 defective articles. Find 99.73% confidence limits of the percentage of defective articles in the entire lot.
- (2) A random sample from an exponential distribution with parameter ' λ ' is given below:
14.84, 0.19, 11.75, 1.18, 2.44, 0.53
Calculate the estimate of ' λ ' by method of moments.
- (3) Find MLEs of ' μ ' and ' σ ' for a sample of size ' n ' from the normal distribution $N(\mu, \sigma^2)$ where the observations are iid.

Q. 1(B) Answer in short: (Any THREE)

03

- (1) Define Parameter.
- (2) Define Estimator.
- (3) Define Critical Region.
- (4) Define Standard Error.

Q. 2(A) Attempt any TWO:

14

- (1) Test the hypothesis that attributes A and B are independent for the following table:

	B	Not B	Total
A	1	6	7
Not A	9	6	15
Total	10	12	22

- (2) The mean of random sample of 1000 units is 17.6. The mean of another random sample of 800 units is 18. Can it be concluded that both the samples come from the same population with standard deviation 2.6?
- (3) In an experiment of tossing a coin, ' p ' denotes the probability of getting head. In order to test the hypothesis $H_0 : p = \frac{1}{2}$ against $H_1 : p = \frac{3}{4}$, the coin is tossed 5 times. If more than 3 heads appear, then H_0 is rejected. Find the probabilities of Type-I and Type-II errors. Also find the power of the test.

Q. 2(B) Answer in short: (Any FOUR)

04

- (1) Define Level of Significance.
- (2) Define Hypothesis.
- (3) Define Unbiasedness.
- (4) Define consistency of an estimator.
- (5) State the table values of Z for two tailed test at 1%, 5% and 10%.

Q. 3(A) Attempt any TWO:

14

- (1) What is correlation? Explain in detail.

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(2) A sample of 15 observations are given below:

X	25	30	19	20	80	70	65	28	42	39	12	55	13	45	22
Y	2	2	8	6	5	6	4	2	3	3	2	5	7	2	9

Calculate S_{XX} , S_{XY} and S_{YY} . Find residual. Find R^2 and explain its meaning.

(3) A sample of 11 claims (in '000) and their corresponding payments on settlements (in '000) for household polices is taken from the business of an insurance company. The amounts are as follows

X	4.1	6.5	12.6	25.5	29.8	38.6	46	52.8	59.6	66.3	74.7
Y	2.2	4.5	10.4	23.1	27.9	36.8	44.3	50.7	57.5	64.1	72.6

Calculate S_{XX} , S_{XY} and S_{YY} . Calculate r . Check $H_0: \rho = 0$ vs $H_1: \rho \neq 0$ with $\alpha = 5\%$.

Q. 3(B) Chose the appropriate answer for the following questions: (Any THREE) 03

- (1) What do residuals represent?
 - a) The difference between the actual Y values and the mean of Y.
 - b) The difference between the actual Y values and the predicted Y values.
 - c) The square root of the slope.
 - d) The predicted value of Y for the average X value.
- (2) How can the strength of the linear relationship between two numerical variables be measured?
 - a) By a scatter diagram.
 - b) By the correlation coefficient.
 - c) By determining the slope.
 - d) By determining the Y intercept.
- (3) Assuming a linear relationship between X and Y, which of the following is true if the coefficient of correlation (r) equals -0.30?
 - a) There is no correlation.
 - b) The slope (b_1) is negative.
 - c) Variable X is larger than variable Y.
 - d) The variance of X is negative.
- (4) What does the standard error of the estimate measure?
 - a) The total variation of the Y variable.
 - b) The variation around the regression line.
 - c) The explained variation.
 - d) The variation of the X variable.

Q. 4(A) Attempt any TWO:

14

(1) There are sample of stress level of workers in three shift as follows:

Midnight	Morning	Evening
6	5	6
3	4	5
5	3	4
7	2	2
2	7	1
1		3

Check whether the population mean of three shifts are same or not with 5% level of significance.

- (2) Suppose we suspected an unusual distribution of blood groups in patients undergoing one type of surgical procedure. We know that the expected distribution for the population served by the hospital which performs this surgery is 44% group O, 45% group A, 8% group B and 3% group AB. Check whether there are significant difference between expected value and observed value. Results for 187 consecutive patients:

Blood Group:	O	67
	A	83
	B	29
	AB	08

- (3) Consider a car owner who has a 40% chance of no accidents in a year, a 60% chance of being in a single accident in a year, and no chance of being in more than one accident in a year. For simplicity, assume that there is a 29% probability that after the accident the car will need repairs costing 500, a 19% probability that the repairs will cost 1000, a 39% probability that the repairs will cost 5000 and a 13% probability that the car will need to be replaced, which will cost 15,000. Find the distribution function for repairing cost, expected repairing cost and variability of repairing cost.

Q. 4(B) Chose the appropriate answer for the following questions: (Any FOUR)

04

- (1) What type of data do you need for a chi-square test?
 - a) Categorical
 - b) Ratio
 - c) Scales
 - d) Ordinal
- (2) How can you deal with low expected values?
 - a) You can increase your sample size or combine categories
 - b) You can exclude outliers
 - c) You have to redo your experiment
 - d) You can transform your data
- (3) By which other name is the chi-square goodness of fit test known?
 - a) One-sample chi-square
 - b) Chi-square Anova
 - c) Wilcoxon
 - d) None of these
- (4) Analysis of variance is a statistical method of comparing the _____ of several populations.
 - a) means
 - b) standard deviations
 - c) proportions
 - d) none of the above
- (5) The _____ sum of squares measures the variability of the observed values around their respective treatment means.
 - a) Error
 - b) Treatment
 - c) Interaction
 - d) Total

— X —

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Candidate's Seat No : _____

P. G. D. A. S. (Sem.-2) Examination

AS 202

Actuarial Mathematics-2

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Q. 1 (a) (i) For a whole life assurance with sum assured 1 payable to the life aged x, deferred for n years. Define present value random variable, obtain its mean and variance. [7 Mark]

(ii) Let X: represent the value of whole life assurance and [7 Marks]

Y: present value of a temporary assurance with term n years.

Both for sum assured 1 payable at the end of the year of death of aged x then obtain the expression $Var(X - Y) = {}_n^2 A_x - ({}_n A_x)^2 - {}^2 A_{x:n}^1$.

OR

(a) (i). Obtain present value, its mean and variance for the whole life annuity payable annually in advance. [7 Marks]

(ii) Under the assumption of a constant force of mortality μ and of a constant force of interest δ , evaluate [7 Marks]

(1). $\bar{a}_x = E(\bar{a}_{\bar{n}|})$

(2). $Var(\bar{a}_{\bar{n}|})$

(b). Attempt any four [4 Marks]

(1). Define assurance

(2). Define Annuity

(3). Define endowment assurance.

(4). Define ${}_t p_x$

(5). Define $\bar{a}_{x:n|}$

Q. 2(a). Discuss Healthy Sick Dead model with probabilities associated with it and describe multiple decrement model. [14 marks]

OR

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M1020-2

(a) (i) Obtain mean and variance of present value of the joint life and last survivor assurance with sum assured payable at the end of the year of death. [7 Marks]

(ii). A life insurance company issues a joint life annuity to male aged 68 and a female aged 65. The annuity of 10000 per annum is payable annually in arrear and continuous until both lives have died. [7 Marks]

- Write expression for the present value of this annuity. Derive the expression for variance of this annuity in terms of appropriate single and joint life assurance function.
- If the company charges a premium of 150000 for this policy calculate the probability that it makes a profit on this contract.

(b). Attempt any **four** [4 Marks]

(1) Define joint life status.

(2) When do you say that status is failed

(3) Define T_{xy} .

(4) Define ${}_t p_{xy}$

(5) Define $(aq)_x^d$.

(6) Define ${}_t q_x'$

Q. 3(a) (i). Discuss net premium for various insurance contracts. [7 Marks]

(ii). Derive a formula for the variance of the profit earned by an insurance company offering an n year endowment assurance policy to lives aged x . Assume that premiums are payable annually in advance and death benefits are payable at the end of the year of death. [7 Marks]

OR

(a) (i). Discuss retrospective and prospective accumulations. [7 Marks]

(ii). For retrospective reserve show that [7 Marks]

$${}_t V_x = P_x \ddot{S}_{x:t} - \frac{(1+i)^t}{P_x} A_{x:t}^1$$

M1020-3

(b). Attempt any **three**.

[3 Marks]

- (1) Which is bigger ${}_5P_{40}$ or ${}_{10}P_{40}$?
- (2) Define net future random loss
- (3) What is reserve?
- (4) Define prospective reserve.
- (5) Write the equation of equilibrium for a whole life assurance.

Q. 4 (a). (i). Verify the equation of equilibrium for endowment assurance

$${}_tV_{x:\overline{n}|} = v(g_{x+t} + p_{x+t} {}_{t+1}V_{x:\overline{n}|}) - P_{x:\overline{n}|} \quad [7 \text{ Marks}]$$

Also write the equation of equilibrium for term assurance and pure endowment assurance contracts.

(ii). A person aged 60 is applying to buy a whole life immediate annuity from an insurance company with his life savings of 200000. Obtain expression for largest amount of level annuity payable annually in arrear that the insurer could pay if it requires a probability of loss from the contract of no more than 0.10. Interest is 5% per annum and expenses of 1% of each annuity payments. [7 Marks]

OR

(a) (i). Discuss Death strain at risk and define expected death strain at risk and actual death strain. [7 Marks]

(ii). Discuss conventional with profit contract. Also define accumulating with profits contract. [7 Marks]

(b). Attempt any **three**

[3 Marks]

- (1). Define net premium reserve.
- (2). Define gross premium
- (3). Define gross premium reserve
- (4). Define Mortality profit.
- (5). Explain expenses.

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P. G. D. A. S. (Sem.-2) Examination

AS 203

Principles of Economics and Finance of Acturics-2

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

- Q.1 (A) Explain Instruments of Fiscal Policy. (07)
OR
 (A) Explain Assumptions of Classical Model. (07)
 (B) Explain Objectives of Monetary Policy. (07)
OR
 (B) What is Fiscal Policy? Explain Objectives of Fiscal Policy. (07)
 (C) Answer the following questions: (Any Four) (04)
 (1) Explain formula of Aggregate Demand.
 (2) Explain any two limitations of Monetary Policy.
 (3) Explain the effect of monetary policy on Indian economy.
 (4) What is CRR?
 (5) What is SLR?
 (6) What is Repo-Rate?
- Q.2 (A) Write a note on: Globalization. (07)
OR
 (A) Write a note on: International Trade (07)
 (B) Explain Balance of Payment & Exchange Rate Theories. (07)
OR
 (B) Write a note on: International Economics. (07)
 (C) Answer the following questions: (Any Three) (03)
 (1) What is Bond?
 (2) What is Debenture?
 (3) What is GDR?
 (4) What is trade deficit ?
 (5) Difference between Domestic trade & International Trade.
- Q.3 (A) Explain Benefits of Demerger. (07)
OR
 (A) What is a merger? Explain different types of mergers. (07)
 (B) XYZ Ltd. is considering merger with ABC Ltd. XYZ Ltd.'s shares are currently traded at Rs. 20. It has 5,00,000 shares outstanding and its earnings after taxes amount to Rs. 10,00,000. ABC Ltd. has 2,50,000 shares outstanding, its current market price is Rs. 10 and its EAT are Rs. 2,50,000. The merger will be effected by means of a stock swap (exchange). ABC Ltd., has agreed to a plan under which XYZ will offer the current market value of ABC's shares. (07)
 (1) What is the pre-merger EPS and PE ratios of both the companies.
 (2) If ABC's PE ratio is 6.40, what is its current market price? What is the exchange ratio? What will XYZ's post-merger EPS be?
 (3) What should be the exchange ratio; if XYZ's pre-merger and post-merger EPS are to be the same?

OR

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- (B) Explain five conditions of Merger. (07)
 (C) Explain the following terms: (Any Four) (04)
 (1) Acquisition (2) Buy-back of shares (3) Spin-off
 (4) Equity carve-outs (5) Joint Venture (6) Capital Reduction

Q.4 (A) What is corporate valuation? What are the different methods of corporate valuation? (14)

OR

- (A) X. Corporation is expected to grow at a higher rate of 4 years; thereafter the growth rate will fall and stabilise at a lower level. The following information has been assembled: (14)

Base Year (Year 0) Information

Revenues	Rs. 300 million
EBIT	Rs. 50 million
Capital expenditure	Rs. 35 million
Depreciation	Rs. 25 million
Working capital as a percentage of revenues	25%
Corporate tax rate (for all time)	30%
Paid-up equity capital (Rs.10 par)	Rs. 40 million
Market Value of Debt	Rs. 120 million

Inputs for the High Growth Phase

Length of high growth phase	4 years
Growth rate in revenues, depreciation, EBIT and capital expenditure	20%
Working capital as a percentage of revenues	25%
Cost of debt (pre-tax)	13%
Debt-equity ratio	1:1
Risk-free rate	11%
Market risk premium	7%
Equity Beta	1.129

Inputs for the Stable Growth Period

Expected growth rate in revenues and EBIT	10%
Capital expenditure are offset by depreciation	
Working capital as a percentage of revenues	25%
Cost of debt (pre-tax)	12.14%
Risk-free rate	10%
Market risk premium	6%
Equity Beta	1.00
Debt-equity ratio	2:3

- (1) What is the WACC for the high growth phase and the stable growth phase?
 (2) What is the value of the firm?

(B) Answer the following questions: (Any Three) (03)

- (1) What is replacement value?
 (2) Define liquidation value.
 (3) What is book value?
 (4) What do you mean by intrinsic value?
 (5) What is Going concern value?

P.G.D.A.S. (Sem.-2) Examination

AS 204

Introduction to Mathematical and Statistical theories of Valuation

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

- Q. 1) Attempt any TWO:** [14]
- Explain Efficient Market and its hypothesis.
 - Explain VaR.
 - Explain difference between Prospect theory and Utility theory with an example.
- Q. 2) Attempt any TWO:** [14]
- Explain the Brownian Motion and state its application.
 - Explain CAPM.
 - Explain Kahneman and Tversky's Prospect Theory
- Q. 3) Attempt any TWO:** [14]
- Explain the main difference between a deterministic process and a stochastic process giving a suitable example.
 - Write the definition of martingale. Explain gambling problem.
 - Explain the difference between equity premium puzzle and risk free rate puzzle.
- Q. 4) Attempt any TWO:** [14]
- We have a stock presently priced at \$150. In exactly one year the stock price will be either \$180 or \$120. The current interest rate is 6% and strike price is \$160. Using both Game theory method as well as Expected value approach, find the fair price of the option.
 - State the Black-Scholes formula. Using following data, compute the price of the associated European call option by Black-Scholes formula.
 $S_0 = 1500$, $X = 1650$, $r = 0.065$, $T = 6$ month, $\sigma = 0.30$.
 - Find the value of European call option for the following data by using two-step binomial option pricing model.
 $S_0 = 50$, $X = 55$, $u = 1.5$, $d = 1.1$, $r = 0.065$, $T = 0.5$.
- Q. 5) Attempt any TWO:** [14]
- Define Option. State the factors which affect the Option Pricing and explain it in brief?
 - What is PUT-CALL Parity? Explain with an example.
 Given that the price of European call option with a strike price of Rs. 100 is Rs. 50. The underlying stock price is Rs. 140, risk-free interest continuously compounded is 10% and expiration date is 1 year. Find the value (price) of put option?
 - What is derivative market? Explain Call option and Put option with an example.

