POST-GRADUATE DIPLOMA IN APPLIED STATISTICS WITH SOFTWARE

Introduction:

Statistics has become a vital tool of data analysis and valid inference in almost all fields in the present era. Statistical techniques are applied in Finance, Insurance, Marketing, Manufacturing, Social Sciences, Health Sciences and Software Designing etc. A huge volume of data is generated in these fields every day. Processing and Management of this data has become a vital need of the hour. This necessitates a pertinent exposure to various Statistical Techniques to all the users.

Processing and management of this voluminous data using computerized Statistical packages has become essential in the current era.

Over the next three years industry sources expect the number of statistician in Private Sector to double. Demand for statistician is likely to intensify as new entrants in clinical trials and pharma industry look at india.

Fee Structure:

Rs. 40,000 per year *

Rs. 1,000 Examination fee per term.

Rs. 800 P.G. Registration Fee.

***Note**: If there is a change in the fees then the excess amount will be collected afterwards.

Scheme of Examination:

The evaluation of the performance of a student in each paper shall be based upon both internal and external examination. The external examination will be held only once at the end of an academic term. The external examination will consist of EIGHT papers each of THREE hours.

Subject	Title	Internal	External	Total
Paper I	Basic Statistics	40	60	**100**
Paper II	Marketing Research	40	60	**100**
Paper III	Regression and Linear Model	40	60	**100**
Paper IV	Decision Making and Forecasting	40	60	**100**
Paper V	Six sigma &Statistical Process Control	40	60	**100**
Paper VI	Medical Statistics	40	60	**100**
Paper VII	Multivariate Techniques	40	60	**100**
Paper VIII	Communication Skills , Accounting & Project	100	---	**100**

First term will consist of first four papers & Second term will consist of next four papers & project work. Internal Exam will be held only once in each term.

Detailed syllabus for the subject:

PAPER I: BASIC STATISTICS

1. Exploratory Data Analysis
2. Concepts of Probability
3. Concepts of Random Variable, Probability distribution, Distribution Function, Expected Value, Variance and Higher Moments.
4. Probability generating function, moment generating function, cumulate generating function and cumulant.
5. Basic discrete and continuous distributions.
6. Concepts of independence, jointly distributed random variables and conditional distributions, use of generating functions.
7. Central limit theorem and its application
8. Concepts of random sampling, statistical inference and sampling distribution.

9 Methods of estimation and properties of estimators.

10 Confidence intervals for unknown parameters.

11 Testing of hypothesis

12 Concepts of conditional expectation and compound distribution

13 Simulation

Reference Books:

1. Anderson David R., Sweeny Dewis J. and Williams Thomas A (2004): Statistics for business and economics.
2. Hogg, R., and A. Craig: Introduction to Mathematical Statistics, The Macmillan company, New York, 1959.
3. Levin Richard I and Rubin Deavid S (1994)Statistics for management.

Mathematical Statistics with application.

4. Rohatgi V. K. & A. K. MD. Ehsanes Saleh (2001): An Introduction to probability theory and Mathematical Statistics Second Edition.
5. Wackesly D.D,Mondonhall III, William and Scheffer R. L.(2002):Mathematical Statistics with applications
6. Mood Alexander M., Graybill Franklin A.:(1950) Introduction to the theory of StatisticsSecond Edition,McGraw –Hill Book Company Inc.

PAPER II: MARKETING RESEARCH

1. Definition of marketing research and market research, need for marketing research, requirement of good marketing research, manager researcher relationship, competitive and complex nature of Indian markets, role of research in new product development, packaging, branding, positioning, distribution and pricing, ethics in Business Research.

2. Steps in marketing Research.

3 Techniques for identifying management problem and research problem.

4. Meaning & types of research designs-exploratory, descriptive and casual.

5. Exploratory research designs, Sampling & data collection methods

6. Causal research designs: Data collection methods

7. Descriptive research design: Sampling methods, Types of scales, questionnaire design

8. Preparations research proposal

9. Objectives and data needs for consumer research.

10 Objectives and data needs for product research.

11. Objectives and data needs for pricing research

12. Objectives and data needs for advertising research.

13. Consumer segmentation techniques: Chi-square test of independence, Cluster analysis

14. Customer discriminating technique: Discriminant analysis

15. Product positioning techniques: Snake chart, Benefit structure analysis, Multi-dimensional scaling technique, Factor analysis

16. **CH**i-squared **A**utomatic **I**nteraction **D**etector (CHAID)

17. New product development technique: Conjoint analysis

18. Report writing

Reference Books:

1. Kinnear Thomas C and Taylor James R. (1995) Marketing Research : An applied Approach

2. Green Paul E., Tull Donalds, Albaum Gerald (1988): Research for Marketing Decision.

3. Nargundkar Rajendra(2003), Marketing Research Text & Cases.
4. David A. Aaker(2004) Marketing Research
5. Malhotra Naresh (2006) Marketing Research An applied orientation and SPSS 14.0 student CD.

6. Burns C. Alwin & Bush Ronald(2006): Marketing Research with SPSS 13.0
7. Boyd Harper W. Jr. Westfall Ralph, Stasch Stanley F. (1977) Marketing Research: Text & Cases

8. Harvard Business Review: Select Articles on Marketing Research.

PAPER III: REGRESSION AND LINEAR MODEL

1. Simple linear regression

2. Multiple linear regression

3. Regression diagnostics

4. Transformation of variable
5. Qualitative Variables as predictors
6. Analysis of collinear data
7. Logistic regression
8. Stepwise regression
9. ONE WAY ANOVA
10. TWO WAY ANOVA
11. Multiway ANOVA and Nested Analysis
12. Comparison of individual means
13. Analysis of covariance
14. One Way Random effect model
15. Two way Mixed Model

Reference Books:

1. Chatterjee Samprit, Hadi Ali S., Price Betram (2000): Regression Analysis by Example Third Edition A Wiley Interscience Publication John-Wiley and Sons
2. Draper Norman R., Smith Harry (2003): Applied Regression Analysis Third Edition
3. Kshirsagar Anant M. (1983): A course in Linear Models
4. Seber George A. F. (2003) Linear Regression Analysis
5. Dielman Terry E. (2004) Applied Regression analysis: A second course on Business and Economics Statistics.
6. Chatterjee Samprit, Handcock Marks, Simonoff Jeffrey (1994) A Caselook for a list course in Statistics and data Analysis.
7. Design and analysis of experiments(2010) 7^{th} ed. Douglas C. Montgomery, Wiley India Pvt Ltd.
8. Design and analysis of experiements classical and regression approach with SAS, Onyiah L.C. (2008) Chapman and Hall/CRC.

PAPER IV: DECISION MAKING AND FORECASTING

1. Basic concepts of Forecasting and Decision Making.
2. Quantitative techniques of Decision Making: Decision Tree, Break-even analysis, Investment appraisal, Critical Path analysis.
3. Qualitative techniques of Decision making : SWOT analysis, PESTEL analysis, Six Thinking Hats Technique, Human Mindset Affecting Implementation of Decision.
4. Statistical Rules of Decision Making, Bayesian approach
5. Step by step process of Decision Making.
6. Quantitative Causal Techniques of Forecasting: Regression Model, Econometric Model, Input Output Model, Leading Indicator Model, Logistic Regression model.
7. Quantitative Time Series Techniques of Forecasting: Trend Projection Models, Smoothing Techniques, Classical Decomposition Model, Box-Genkins Model
8. Selection of right forecasting method.
9. Qualitative Methods of Forecasting: Delphi Method, Subjective Probabilities Method, Market Research.
10. Decision Making under Uncertainty, Role of Probability Theory and Statistical Techniques, Forecasting-based Decision Making.
11. Characteristics of Decision: Unstructured or Non-Programmable Decisions, Structured or Programmable Decisions.
12. Quantitative Tools of Decision Making: Decision Tree, Break-even analysis, Investment appraisal, Critical Path Analysis
13. Qualitative Tools of Decision Making: Qualitative Factors Influencing Decision Making, SWOT Analysis, PESTEL Analysis, Six Thinking Hats Technique, Human Mindset Affecting Implementation of Decision
14. Statistical Rules of Decision Making: Maximin Criterion, Maximax Criterion, Minimax Regret Criterion, Laplace Criterion.
15. Bayesian Approach to Decision Making: Prior Analysis, Pre-posterior Analysis, Posterior Analysis, Sequential Analysis.

16 Step by Step Process of Decision Making.

17. Inventory management and introduction, inventory control, costs in inventory problems, Techniques of Inv. Control and with selective control (ABC analysis, Usage rate and criticality)

18. Techniques of inv. Control and with known demand and E.O.Q with uniform demand, prod. Runs of unequal length, with finite rate of replenishment, Problem of E.O.Q with shortage

19. Techniques inv. Control and with uncertain demand and buffer stock computation, stochastic problems and uniform demand.

20 Techniques inv. Control and with price discounts

21. Break even analysis, Marginal Costing

Reference Books:

1. Mayes Timothy R., Shack Todd. M(2006).: Financial Analysis with Microsoft Excel.
2. Martin Mindy C., Hansen Steven M., Klingher Beth,(1996): Mastering Excel 2000 Premium Edition.
3. Spyros G Makrindakis Steyan C. Wheelwright Rob J. Hyndman: Forecasting: Methods & Applications
4. Hanke,John E.,Reitsch Arthur G.,Wichern Dean W.: Business Forecasting 7th Edition

PAPER V: SIX SIGMA AND STATISTICAL PROCESS CONTROL.

1 7 QC tools, 7 New QC tools

2 Control Charts for variables

3 Six sigma , Lean Sigma

4 Process and measurement system capability analysis

5 Factorial and Fractional factorial experiments for process design and improvement

6 Response surface methods and designs

7 Taguchi techniques

8 Japanese System

9 ISO 9000

10 Project Planning

11 Statistics in software development process

Reference Books:

1. Montgomery Douglas C. (2004): Introduction to statistical quality control Fourth Edition.
2. Phadke Madhav S. (1989): Quality Engineering Using Robust Design
3. Kaoru Ishikawa(1986): Guide To Quality Control Second Edition.
4. Genichi Taguchi (1991): Introduction to Quality Engineering: Designing Quality into Products and Processes Second Edition.
5. Brassard Michael & Diane Riffer (1994): The Memory Jogger II
6. Harry Mikel & Schroeder Richard (1999): Six Sigma The Breakthrough Management.
7. Pande Peter S., Neuman Robert P. & Cavanagh Rolana R.(2002): (Six Sigma Way Team) An Implementation Guide for Process Improvement.

PAPER VI: MEDICAL STATISTICS

1 Phase I, II and III Clinical Trials

2 Randomization

3 Blinding and Placebos

4 Sample size calculation

5 Nonparametric Tests: Fisher's exact test, Wilcoxon Signed Rank test, Wilcoxon Rank Sum test, Mann-whitneyUtest, Kruskal-Wallis test.

6 Comparing more than two treatments.

7 Causality, Non-compliance and Intent-to-treat

8 Survival analysis in Phase III clinical trials

9 Early stopping of clinical trials

10 Multiplicity and interim analysis

11 Parallel and Crossover designs

12 Binary Response data, Categorical Data Analysis

13 Comparing Methods of measurements.

14 Meta analysis

15 Repeated measures analysis

Reference Books:

1. .Shoukri M. M., Pause C. A.(1999): Statistical Methods for Health Sciences Second Edition.
2. Davis Charles S.(2002): Statistical Methods for the Analysis of Repeated Measurements.
3. Finney D,J(1964): Statistical Method in Biological Assays.
4. Fleiss Joseph L.,Levin Bruce & Paik Myunghee Cho (2003): Statistical Methods for Rates and Proportions
5. Dr. Fieller Nick(2007): Medical Statistics: Clinical Trials
6. Zhang Daowen (2007): Statistical Principles of Clinical Trials

(Lecture Notes)

PAPER VII: MULTIVARIATE TECHNIQUES

1 The organization of Data

2 Applications of Multivariate Techniques.

3 Data Display and Pictorial Representation.

4 Assessing the Assumption on Normality

5 Detecting Outliers and Data Cleaning

6 Transformations to Near Normality

7 Hotelling's T^2 and Likelihood Ratio Tests

8 Confidence Regions and simultaneous Comparisons of Component Means.

9 Large Sample Inferences about a Population Mean Vector

10 The Classical Linear Regression Model.

11 Principal Components

12 Factor Analysis

13 Cluster Analysis

14 Discrimination and Classification

15 Multi Dimensional Scaling

Reference Books:

1. Johnson, Richard A. & Wichern, Dean W(2007).: Applied Multivariate Statistical Analysis.
2. Seber, G.A.F(1984).: Multivariate observations
3. Bishop Yuonne M. M., Fienbeng S. E.,Holland P. W.(1975): Discrete Multivariate Analysis Theory and Practice.

PAPER VIII Communication Skills, Accounting and Project Communication

Module I : COMMUNICATION SKILLS

1 Spoken & Written communication

2 Preparing and organizing a public speech: Topic selection, Research Methods, Overcoming anxiety, arranging main points, Constructing introductory and concluding remark; Development and delivering informative-style and persuasive-style, speeches; Debating: Fundamentals of debating, Premises and process of debate, Basic rules & language, Building & processing cases, Rebuttal arguments, Timing, Roles of the speakers, Judges & moderator; Debating style: Parliamentary, Academic, Cross- examination informal and impromptu speaking excercises.

3 Politics & governance, Business, Social, Morals & ethics, Culture & education, Law & order, Science & technology, Handling questions.

4 Personal communication, Business communication, Report Writing.

5 Fundamentals of Presentations: Effective presentation- understanding effective presentation, understanding different types of presentation; Planning presentations: Establishing objectives, Determining objectives, Making realistic objectives;

6 Analysing audience, Selecting supporting material, Understanding the types of supporting materials, Exploring retention & visual aids; Building presentation: Developing introduction, Capturing attention of audience, Organizing body of presentation, Creating conclusions, Closing

presentation; Presentation mechanism: Power point, Visual aids, Speaker notes & footnotes, Reviewing presentations.

Reference Books:

1. Bahl Sushil (1996): Business Communication Today
2. C. S. Rayadu: Media & Communication Management.
3. Thrill V. John, Bovee Courtland (2004): Excellence in Business Communication.
4. Nichols Ralph G., Leonard A. Stevens, Bartolome Fernando, Argyris Chris (1999): Harvard Business Review on Effective Communication.

Module II: Accounting

1. Introduction to Accounting – Basic Accounting Terms, Need and Importance of Book-keeping – Accounting
2. Conceptual Frame work of Accounting - Basic assumptions – Basic concepts –Accounting Standards
3. Double entry system – Account – Golden rules of accounting.
4. Basic Accounting Procedures – Journal, Ledger, Trial Balance
5. Final Accounts - Trading account – Profit and loss account – Balance sheet – Preparation of Final Accounts.vv

Reference Books:

1. Advanced Accounts – M.C. Shukla, T.S. Grewal
2. Book Keeping and Accountancy – Choudhari, Chopde.

Module III : PROJECT

Students should carry out the project on Statistical Application based on data

Note: All the course will be taught using Statistic Software such as

R/SAS/SPSS/MINITAB.

Standard of Passing:

1. A candidate securing a minimum of 200 out of 400 marks with a minimum of 40 marks in each of the four papers consisting of internal and external examination taken together will be declared to have passed in that examination.
2. If in a paper a candidate secures minimum of 50% marks consisting of internal and external examination taken together, will be exempted from that paper.
3. A candidate will be declared to have passed the examination if he/she passed in all papers including project.
4. A candidate will be awarded the following Grades on the basis of percentage of total marks obtained by the candidate in one or more attempt (s).

Percentage	Grade
50 below 60	C
60 below 70	B
70 below 80	A
80-100	A^+

5. A registration of the candidate is valid only for three years for the course. After the three years he/she will have to register again.

Fees:

The fees prescribed for the One year Post-Graduate Diploma in Applied Statistics with Software and Post Graduate Diploma in Actuarial Science is Rs.40,800 each. (If there is a change in the fees then the excess amount will be collected

afterwards.)

In case a student wants to withdraw his/her admission, he/she has to apply at least one week before the commencement of the course. In such a case, administrative charges to the extent of 25% will be deducted as cancellation charges. After the commencement of the course no fees shall be refunded.

Mode of Payment:

Fees should be paid only by demand draft in favour of “THE FINANCE AND ACCOUNTS OFFICER, UNIVERSITY OF MUMBAI” Payable at Mumbai.

HOW TO APPLY

Brochure and application forms can be collected from the office of the Department of Statistics, University of Mumbai, Vidyanagari Campus, Tilak Bhavan Building, 2nd Floor for Rs. 400 at the above address before the last date specified.

ENTRANCE TEST

Common Entrance test will be held for two courses.

Questions will be based on the following topics:

1. Limits
2. Derivatives
3. Integrals
4. Sequences and Series
5. Simple and Compound Interest
6. Permutation and Combination
7. Ratio and Proportions
8. Quadratic equations
9. Matrics and determinant
10. Descriptive statistics
11. Standard distributions
12. Probability

The question paper will contain objective questions and short type questions to be answered in 90 minutes.

IMPORTANT DATES TO BE REMEMBER

IMPORTANT DATES		
Sr. No	**Event**	**Date**
1	Last date of submission Test Form.	
2	Date of Entrance Test	
3	Announcement of Results	
4	Registration of candidates in Merit List-I	
5	Last date for submission of Registration form for merit list- I candidates	
6	Registration of candidates in Merit List –II (If seats are balance)	
7	Last date for submission of Registration form for merit list- II candidates (if any)	
8	Probable Date of Commencement of Course	

You can also refer the website for the above dates.

Entrance Test

Sample Question Paper: PGDASS and PGDAS

1. $x^y = e^{y-x}$ then find $\frac{dy}{dx}$

(a) $\frac{2-\log x}{(1-\log x)^2}$ (b) $\frac{\log x}{(1-\log x)}$

(c) $\frac{-\log x}{(1+\log x)^2}$ (d) $\frac{1}{(1-\log x)^2}$

2. If $x^4 y^6 = (x+y)^{10}$ then find $\frac{dy}{dx}$

(a) $\frac{y}{x}$ (b) $\frac{x}{y}$

(c)xy (d) $\frac{x}{10y}$

3. $\lim_{x\to 3} \frac{x^3 - 27}{-4+\sqrt{x^2+7}}$

(a) 36 (b) 0 (c) 63 (d) Limit does not exist

4. $\lim_{x\to 1} \frac{x + x\sqrt{x} - 2}{x^2 - 1}$

(a) ∞ (b) $\frac{4}{5}$ (c) $\frac{5}{4}$ (d) 0

5. If $y = x^e + e^x$ then find $\frac{dy}{dx}$

(a) $ex^{e-1} + xe^{x-1}$ (b) $x^e + e^x$ (c) $ex^{e-1} + e^x$ (d) $ex^{x-1} + \log x$

6. $\lim_{x\to 0} \frac{\log(1+5x)}{x}$

(a) e (b) 5 (c) ∞ (d) 2

7. $\lim_{x\to 0} \frac{6^x - 3^x}{4^x - 1}$

(a) 0 (b) 2 (c) 1 (d) $\frac{1}{2}$

8. If $y = x^x$, find $\frac{d^2y}{dx^2} - \frac{1}{y}\left(\frac{dy}{dx}\right)^2 - \frac{y}{x}$

(a) 1 (b) 2 (c) 0 (d) $\frac{1}{2}$

9. If X_1 and X_2 have independent Poisson distribution with parameters λ then X_1+X_2 is distributed as Poisson with parameters

(a) λ (b) $\lambda/2$ (c) 2λ (d) λ^2

10. If X has exponential distribution with mean $\frac{1}{m}$ then the

$\frac{P[X \geq x]}{P[X \geq 2x]}$ is equal to

(a) exp(-mx) (b) exp(-x) (c) exp $(-x/m)$ (d) exp (mx)

11. Suppose X has binomial with mean 3 and variance 2,then

(a) P[X=0]<P[X=9] (b) P[X=0]=P[X=9]
(c)P[X=0]>P[X=9] (d) P[X=0]=9P[X=9]

12. Match List I with List II and select the correct answer using the codes given below the lists

List I	List II
A. Uniform distribution (0,1)	1. Mean = Standard deviartion
B. Exponential distribution	2. Mean= Variance
C. Binomial distribution	3. (Variance/Mean) is less than 1’
D. Poisson distribution	4.6(variance/mean) =1

(a) (A,1), (B,4), (C,3), (D,2)
(b) (A,4), (B,1), (C,3), (D,2)
(c) (A,1), (B,4), (C,2), (D,3)
(d) (A,4), (B,1), (C,2), (D,3)

13. Let Z be a random variate having standard normal distribution and $P[Z > Z(\alpha)] = \alpha$, $0 < \alpha < 1$, then

(a) $Z(1-\alpha) = -Z(\alpha)$ (b) $Z(1-\alpha) = Z(\alpha)$
(c) $Z(1-\alpha) = 1 - Z(\alpha)$ (d) $Z(1-\alpha) = 2Z(\alpha)$

14. If X is distributed as Normal with mean μ and variance μ^2 then $E(X^2)$ is equal to

(a) $\mu^2 + \mu$ (b) $2\mu^2$ (c) $\mu^2 - \mu$ (d) μ^2

15. Match list I with list II and select correct answer using the codes given below the list

List I	List II
A. Geometric	1. Tossing of coin
B. Poisson	2. Tossing a die

C. Binomial
D. Uniform

3. Tossing of coin till head appears
4. Telephone calls arriving at single booth

a) (A,3), (B,4), (C,2), (D,1)
b) (A,4), (B,3), (C,2), (D,1)
c) (A,3), (B,4), (C,1), (D,2)
d) (A,4), (B,3), (C,1), (D,2)

16. You are given $P(A \cup B) = 0.7$ and $P(A \cup \overline{B}) = 0.9$. Determine P(A).

(a) 0.2 (b) 0.3 (c) 0.4 (d) 0.6

17. $\int_{-\infty}^{x} \frac{1}{\pi(1+t^2)}$ dt is

a) $\frac{1}{\pi}\tan^{-1} x$ b) $\frac{1}{2} + \frac{1}{\pi}\tan^{-1} x$

c) $\frac{1}{2} - \frac{1}{\pi}\tan^{-1} x$ d) $\frac{1}{\pi}\tan^{-1} x - \frac{1}{2}$

18. $\int_{a}^{b} \frac{e^{tx}}{b-a}\, dx$ *is*

a) $t(e^{tb} - e^{ta}) \big/ (b-a)$ b) $(e^{tb} - e^{ta}) \big/ [t(b-a)]$

c) $te^{t(b-a)}$ d) $e^{t(b-a)} \big/ t$

19. Which of the following matrices has rank two?

a) $\begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$ b) $\begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$ c) $\begin{pmatrix} 1 & -3 \\ -3 & 9 \end{pmatrix}$ d) $\begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$

20. A random sample of four policyholders is taken from a group of eight, comprising three men and five women. If the random variable X denotes the number of male policyholders in the sample then X can take values.

a) $\{1,2,3,4\}$ b) $\{0,1,2,3\}$ c) $\{0,1,2,3,4\}$ d) $\{1,2,3\}$

21. $\int_{0}^{\infty} e^{-x} x^4 dx$ is

a) 24 b) $\frac{1}{6}$ c) 6 d) $\frac{1}{24}$

22. IF A= $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$ then r(A)=

a) three b) two c) one d) zero

23. In a statistical experiment of tossing four coins simultaneously, if a random variable X represents number of heads appeared, then X has following distribution

a) Geometric b) Binomial $\left(16, \frac{1}{2}\right)$

c)Binomial $\left(4, \frac{1}{2}\right)$ d) Hypergeometric

24. A box contains 100 items out of which 20 are defective. If 4 items are picked at random from that box and X denotes number of defective items out of four then X has following distribution

a) Binomial b) poisson c) negative binomial d) hypergeometric

25. Let X_1 be b (2,p) and X_2 be b (4,p). If $\Pr[X_1 \geq 1] = \frac{5}{9}$,the $\Pr[X_2 \geq 1]$ is

a) $1-\left(\frac{3}{4}\right)^4$ b) $\left(\frac{3}{4}\right)^4$ c) 1-$\left(\frac{2}{3}\right)^4$ d) $\left(\frac{2}{3}\right)^4$

26. Random variable X follows binomial distribution with parameters n and p. If for the Binomial distribution E(X)=5 and Var(X)=4, then pair (n,p) is

a) $\left(25, \frac{1}{5}\right)$ b) $\left(25, \frac{4}{5}\right)$ c) $\left(16, \frac{1}{5}\right)$ d) $\left(16, \frac{4}{5}\right)$

27. $\int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi}} x^2 e^{-\frac{1}{2}x^2} dx$

a) -1 b) 1 c) $\frac{1}{2}$ d) $-\frac{1}{2}$

28. Summary of observed values of random variable X is as follows 3 times –g, 5 times g, 2 times 0
Average value of X is

a) .3g b) .5g c) -.2g d) .2g

29. A and B alternately toss a fair coin. The first one to throw a head wins. If A starts, probability that A wins is

a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{2}{3}$ d) $\frac{1}{6}$

30. The probabilities of solving a problem by three students A, B and C are respectively $\frac{3}{7}, \frac{3}{8}$ and $\frac{1}{3}$. If all of them try independently, probability that the problem will not be solved is

a) $\frac{5}{21}$ b) $\frac{3}{7}$ c) $\frac{2}{3}$ d) $\frac{3}{8}$

31. A small company paid each of its five clerks Rs. 22,000, each two stenos Rs. 50,000 each and the director Rs. 2,70,000 last year. The number of employees earning less than mean salary is

a) 0 b) 4 c) 5 d) 7

32. If P[X=2] =1, then $(E(X), V(X))$ is

a) (2,0) b) (2,2) c) (0,2) d) (2,1)

33. The mean and variance of -2,0,2 are respectively

a) (0,2) b) (2,8) c) $\left(0, \frac{8}{3}\right)$ d) (-2,2)

34. If Q_1 and Q_3 are first and third quartiles then

a) $Q_1 >$ median $> Q_3$ b) $Q_1 <$ median $< Q_3$

c) median $< Q_1 < Q_3$ d) median $> Q_3 > Q_1$.

35. A student randomly guesses at the two questions on a true or false quiz. Let X= number of correct guesses. The mean of X is.

a) 1 b) $\frac{1}{2}$ c) 2 d) 0

36. Mean and standard deviation of (5,5) is

a) 5,5 b) 10,5 c) 5,0 d) 0,5

37. If A and B are two nxn square matrices then determinant of AxB is equal to

a) Det A x det B b) det A + det B c) n. det A d) n.det B.

38. If X follows normal distribution with mean zero and variance 2. Then max f(x) is

a) $\frac{1}{\sqrt{2\pi}}$ b) $\frac{1}{2\sqrt{\pi}}$ c) $\frac{1}{2\pi}$ d) 1

39. The distribution of marks of a large group of high school students is normally distributed with $\mu = 60$ and $\sigma = 4$. The probability that a randomly selected student has marks more than 60 is

a) .25 b) .05 c) .5 d) .80

40. If X follows N(5, σ) which of the following is false?

a) Mean of X is five b) Median of X is five

c)Mode of X is five d) X is symmetric about zero