Total No. of Questions—**5**]   [Total No. of Printed Pages—**8**

Seat No.	

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F.Y. B.Sc. (Computer Science) EXAMINATION, 2017

STATISTICS

Paper-II

(Statistical Methods—II)

(2013 PATTERN)

Time : Three Hours   **Maximum Marks : 80**

N.B. :— (*i*) *All* questions are compulsory

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of non-programmable, scientific calculator and statistical tables is allowed.

(*iv*) Symbols have their usual meanings unless otherwise stated.

1. (A) Attempt each of the following :   [1 mark each]

(*i*) Every subset of a sample space is called as ....

(*ii*) If two events A and B are mutually exclusive, then P(A $\cap$ B) = ...

(*iii*) If random variable X follows uniform distribution in (*a*, *b*), then its mean is given by ....

(*iv*) Probability of rejecting H_0 when H_0 is true is called as ....

P.T.O.

(B) Attempt each of the following :   [1 mark each]

(*i*) Which of the following tests is not a non-parametric test ?

(*a*) Sign test

(*b*) Mann-Whitney U test

(*c*) Large sample test

(*d*) Run test

(*ii*) If A $\subset$ B, then P(A/B) =

(*a*) 1

(*b*) $\dfrac{P(A)}{P(B)}$

(*c*) $\dfrac{P(A \cap B)}{P(A)}, P(A) > 0$

(*d*) $\dfrac{P(A)}{P(B)}, P(B) > 0$

(*iii*) If event A denotes getting a multiple of 5 on a die, then A is :

(*a*) Sure event

(*b*) An impossible event

(*c*) An elementary event

(*d*) Disjoint event

(*iv*) A function of population values is known as :

(*a*) Statistic

(*b*) Level of significance

(*c*) Sample

(*d*) Parameter

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(C) Attempt each of the following : [2 marks each]

(i) A continuous random variable X has the p.d.f.

$$f(x) = \begin{cases} kx^3, & 0 \le x \le 1 \\ \\ 0, & \text{otherwise} \end{cases}$$

Find the value of k.

(ii) Define non-deterministic experiment with an example.

(iii) State lack of memory property of an exponential distribution.

(iv) State any *two* merits of simulation.

2. Attempt any *four* of the following : [4 marks each]

(a) Define each of the following with an example :

(i) Combination and

(ii) Permutation of objects when all are distinct.

(b) Two fair dice are thrown and the outcomes on the uppermost faces are noted. Find the probability that :

(i) The sum of the two numbers is even

(ii) The sum of the two numbers is at least 8.

(c) Define each of the following with an illustration :

(i) Sample space

(ii) Exhaustive events.

(d) In a random arrangement of the letters of the word "COMPUTER", find the probability that :

(i) All the vowels come together

(ii) The vowels occupy even places.

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(*e*) State axioms of probability. Also prove that "For any event A defined on Ω, $0 \leq P(A) \leq 1$".

(*f*) Three books are selected at random from a shelf containing 4 books on computers, 2 books of Mathematics and a dictionary. What is the probability that : (*i*) 2 books on computers and 1 book on Mathematics are selected, (*ii*) dictionary is not selected ?

3. Attempt any *four* of the following : [4 marks each]

(*a*) (*i*) Define independence of two events A and B defined on a sample space Ω.

    (*ii*) State Bayes' Theorem.

(*b*) The events A_1, A_2 and A_3 form a partition of sample space. If $3P(A_1) = 2P(A_2) = 3P(A_3)$, find $P(A_1 \cup A_2)$.

(*c*) Define each of the following :

    (*i*) Mutually exclusive events

    (*ii*) Complement of an event

    (*iii*) Union of two events

    (*iv*) Conditional probability.

(*d*) If mean and variance of U[a, b] distribution are 5 and 3 respectively, determine the values of a and b.

(*e*) Define each of the following :

    (*i*) Probability density function (p.d.f.) of a continuous random variable.

    (*ii*) Variance of a continuous random variable.

(*f*)   If X → N(1, 9) and Y → N(2, 16) are independent random variables, calculate :

(*i*)   P(5 ≤ X ≤ 7)

(*ii*) P(X + Y ≥ 5).

4.   Attempt any *two* of the following :   [8 marks each]

(A)   (*i*)   Define normal distribution. State normal approximation to binomial distribution.

(*ii*) The amount of time that a computer will work without having to be reset is a random variable having an exponential distribution with mean of 120 hours. Find the probability that such a computer will (1) have to be reset in less than 25 hours and (2) not have to be reset in at least 180 hours.

(B)   (*i*)   Define distribution function of a continuous random variable. State any *two* properties of the distribution function.

(*ii*) A driver buys petrol either at a petrol pump P or at petrol pump S and the following arrangement shows the order of the petrol pump from which he bought petrol over a certain period of time :

PPPSPSPSSPPSPSPSPSSPSS

Test the randomness of the above seqeunce at 5% level of significance (l.o.s.).

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(C) (*i*) Explain the method of drawing a model sample from an exponental distribution with mean θ.

(*ii*) A low-noise transistor for use in computing products is being developed. It is claimed that the mean noise level will be below 2.5 dB level of products currently in use. A sample of 16 transistors yields mean noise level 1.8 dB level with standard deviation 0.8 dB level. Test the claim at 5% level of significance.

(D) (*i*) Describe procedure of sign test.

(*ii*) If X is a random variable with probability density function :

$$f(x) = \begin{cases} \dfrac{x^2}{3}, & -1 \le x \le 2 \\ 0, & \text{otherwise} \end{cases}$$

If A = {x/x ≥ 0}, B = {x/ − $\dfrac{1}{2}$ ≤ x ≤ $\dfrac{1}{2}$}

Find P(A), P(B) and P(A ∩ B).

5. Attempt any *one* of the following :

(A) (*i*) Define each of the following : [4]

Population

Null hypothesis

Sampling distribution of a statistic

Critical region.

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(*ii*) A new computer network is being designed. The maker's claim that it is compatible with more than 99% of the equipment already in use. A sample of 300 programs is run and 298 of these run with no changes necessary that is, they are compatible with the new network. Test the maker's claim at 5% l.o.s. [4]

(*iii*) A bank utilizes four teller windows to render fast service to the customers. On a particular day 800 customers were observed. They were given service at the different windows as given below : [8]

Window Number	Number of Customers
1	150
2	250
3	170
4	230

Test whether the customers are uniformly distributed over the windows. Use 5% l.o.s.

(B) (*i*) Explain the large sample test for testing $H_0 : \mu_1 = \mu_2$ against $H_1 : \mu_1 \neq \mu_2$. [4]

(*ii*) In a radio listener's survey 120 persons were interviewed and their opinions about preference to Hindi or Marathi music were asked. The results are as follows : [4]

Type of Music	Opinion about Preference	
	Hindi	Marathi
I	13	45
II	39	23

Test whether the preference for music type is independent of language at 5% level of significance.

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(*iii*) Let X denote the number of lines of executable SAS code, and let Y denote the execution time in seconds. Use the following summary information : [8]

$n = 10$, $\Sigma_{i=1}^{10} \, x_i = 16.75$, $\Sigma_{i=1}^{10} \, y_i = 170$, $\Sigma_{i=1}^{10} \, x_i^2 = 28.64$,

$\Sigma_{i=1}^{10} \, y_i^2 = 2898$, $\Sigma_{i=1}^{10} \, x_i y_i = 285.625$

(1) Compute the value of regression coefficient of Y and X and

(2) Test the significance of regression coefficient of Y on X at 1% l.o.s.