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| Image result for adamas university logo | **ADAMAS UNIVERSITY**  **END SEMESTER EXAMINATION**  (Academic Session: 2020 – 21) | | |
| **Name of the Program:** | M.Tech CE(Construction Engineering and Management) | **Semester:** | I |
| **Paper Title:** | Probability theory and statistical techniques | **Paper Code:** | SMA61105 |
| **Maximum Marks:** | 50 | **Time Duration:** | 3 Hrs |
| **Total No. of Questions:** | 17 | **Total No of Pages:** | 3 |
| *(Any other information for the student may be mentioned here)* | 1. At top sheet, clearly mention Name, Univ. Roll No., Enrolment No., Paper Name & Code, Date of Exam. 2. All parts of a Question should be answered consecutively. Each Answer should start from a fresh page. 3. Assumptions made if any, should be stated clearly at the beginning of your answer. | | |

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| **Group A**  **Answer All the Questions (5 x 1 = 5)** | | | |
| 1 | **What** is a sample space. Give an example of a sample space. | **R** | **CO1** |
| 2 | **What** is an uniform distribution? | **R** | **CO2** |
| 3 | **What** is correlation coefficient between two variables and taking values and | **R** | **CO3** |
| 4 | **Explain** the concept of population and sample. | **U** | **CO4** |
| 5 | **What** is a sufficient estimator for a population parameter? | **R** | **CO5** |
| **Group B**  **Answer All the Questions (5 x 2 = 10)** | | | |
| 6 a) | 1. **What** is an event? Give examples. 2. Let two coins are tossed together and let denotes the “number of heads.” **What** is the probability distribution of the random variable ? | **R**  **R** | **CO1** |
| **(OR)** | | | |
| 6 b) | 1. Let be a sample space and be the probability function. Let be an event. **Show** that . Here denotes the complement of the event . 2. Let two dice are thrown together and let denotes the “maximum of the two numbers.” **What** is the probability distribution of the random variable ? | **U**  **R** | **CO1** |
| 7 a) | **What** is a continuous random variable? Provide the two properties of probability density function. | **R** | **CO2** |
| **(OR)** | | | |
| 7 b) | **What** is a geometric distribution? Provide example. | **R** | **CO2** |
| 8 a) | Let and be two variables taking values and respectively. **When** we use regression line of on and regression line of on ? | **R** | **CO3** |
| **(OR)** | | | |
| 8 b) | **Show** that the product of the regression coefficient of on () and the regression coefficient of on ( is equal to the square of the correlation coefficient between and . | **U** | **CO3** |
| 9 a) | **Explain** the term statistic. | **U** | **CO4** |
| **(OR)** | | | |
| 9 b) | **Explain** the term standard error. | **U** | **CO4** |
| 10 a) | **What** is confidence interval and confidence limits? | **R** | **CO5** |
| **(OR)** | | | |
| 10 b) | **What** is sampling distribution of sample mean? | **R** | **CO5** |
| **Group C**  **Answer All the Questions (7 x 5 = 35)** | | | |
| 11 a) | Let three coins are tossed together and X denotes “the number of tails”. **Find** the variance of X, i.e, Var(X). | **R** | **CO1** |
| **(OR)** | | | |
| 11 b) | Let be defined by if and otherwise. **Find** the value of such that the function is a probability density function for a random variable X. Also find the expectation of X (E(X)) and variance of X (Var(X)). | **R** | **CO1** |
| 12 a) | **Find** the mean and variance of the geometric distribution. | **R** | **CO2** |
| **(OR)** | | | |
| 12 b) | Suppose the probability of a rocket hitting a target is and a rocket is repeatedly fired until the target is hit. Then   1. **Find** the expected number of rockets which will be fired. 2. **Find** theprobability that 3 or more rockets will be needed to finally hit the target. | **R** | **CO2** |
| 13 a) | **Explain** the notion of poisson distribution. Also, show that the sum of the poisson probability is 1. | **U** | **CO2** |
| **(OR)** | | | |
| 13 b) | 1. **Explain** the condition under which the Bionomial probability is approximated by poisson probability. 2. Suppose 2% of the items produced by a factory are defective. **Find** the probability that there are 3 defective items in a sample of 100 items. | **U**  **R** | **CO2** |
| 14 a) | **Explain** different types of scatter diagrams. | **U** | **CO3** |
| **(OR)** | | | |
| 14 b) | With the help of a suitable regression line, **determine** the estimated value of x when y=22 by using the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 4 | 5 | 8 | 9 | 11 | 12 | 14 | | y | 16 | 10 | 8 | 7 | 6 | 5 | 4 | | **E** | **CO3** |
| 15 a) | Let the regression line of on is and the regression line of on is . **Find** the correlation coefficient between and . Also, find the ratio of the standard deviations of and . | **R** | **CO3** |
| **(OR)** | | | |
| 15 b) | In a contest, two judges ranked seven candidates in order of their preference as in the following table. Find the rank correlation coefficient.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Candidates | A | B | C | D | E | F | G | | Ranks by Judge I | 2 | 1 | 4 | 5 | 3 | 7 | 6 | | Ranks by Judge II | 3 | 4 | 2 | 5 | 1 | 6 | 7 | |  | **CO3** |
| 16 a) | **Show** that the sample mean based on a simple random sample with replacement (SRSWR) is an unbiased estimator of the population mean. | **U** | **CO4** |
| **(OR)** | | | |
| 16 b) | The safety limit of a crane is known to be 32 tons. The mean weight and the standard deviation of a large number of iron rods are 0.3 ton and 0.2 ton respectively. 100 rods are lifted at a time. **Find** the probability of an accident. (The area under the standard normal curve to the right of the ordinate is 0.1587) | **R** | **CO4** |
| 17 a) | **Find** the maximum likelihood estimator of the parameter of a poisson distribution on the basis of a random sample. | **R** | **CO5** |
| **(OR)** | | | |
| 17 b) | A sample of 600 screws is taken from a large consignment and 75 are found to be defective. **Estimate** the percentage of defectives in the consignment and assign limits within which the percentage lies. | **E** | **CO5** |