SPC 02

Diploma in Statistical Process Control and Operations Research (DSPCOR) Examination, August 2009
ELEMENTS OF PROBABILITY AND STATISTICAL METHODS

Time : 3 Hours   Max. Marks : 90

SECTION – I

Answer **any 2** questions.   **(2×15=30)**

1. a) Define probability and write down its axioms.

   b) Explain equally likely outcomes and probabilities in the case of equally likely outcomes.

   c) An urn has 10 balls of which 5 are red, 3 are black and 2 are white. A ball is picked from the urn. Write the sample space. Find :
      i) the probability that the ball chosen is black and
      ii) the probability that the ball chosen is either white or black.

2. a) Define Bernoulli distribution, find its mean and variance.

   b) Toss three fair coins and let X denote the number of heads obtained.
      i) Identify the sample points associated with this experiment and assign a value of X to each sample point.
      ii) Calculate p(x) for each value of X.
      iii) Calculate mean and variance.

3. a) The number of mistakes counted in one hundred pages of a typist revealed that he made 2.8 mistakes on an average per page. Find the probability that in a page typed by him
      i) There is no mistake   ii) There are exactly two mistakes.

   b) In a sample of 120 workers in a factory the mean and the S.D of wages were Rs. 11.35 and Rs. 3.03 respectively. Find the percentage of workers getting wages between Rs. 9.00 and Rs. 17.00 in the factory assuming the wages are normally distributed.

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4. a) Suppose that 100 tires of a certain brand lasted on the average 21431 miles with a standard deviation of 1295 miles. Using $\alpha = 0.05$, test the null hypothesis $\mu = 22000$ miles against the alternative hypothesis $\mu < 22000$ [Table value $z_{0.05} = -1.645$].

   b) A disease attacked twenty people and only 18 survived, will you reject the hypothesis that the survived rate, if contracted by this diseases, is 85% in favour of the hypothesis that it is more at 5% level.

SECTION – II

Answer **any 4** questions.   **(4×10=40)**

5. Explain the terms with an examples each :
   i) Non deterministic experiments
   ii) Random experiment
   iii) Trials and outcomes
   iv) Sample space
   v) Complimentary event.

6. a) From a pack of cards, a card is picked at random. Given that the card picked is queen i) find the probability that it is spade.

   b) Let A and B be events such that

   $P(A/B) = 0.2$, $P(B/A) = 0.5$, $P(B) = 0.25$, find $P(A)$.

7. Write down the probability mass function of a binomial random variable. Determine the mean and standard deviation of a binomial random variable.

8. State any three properties of normal distribution. In a competitive examination of 5000 students, the marks of the examinees in mathematics were found to be distributed normally with mean 45 and S.D 14. Find the number of examinees whose marks out of 100 were more than 40, given that $P(0 < Z < 0.36) = 0.14058$.

9. Explain, briefly, the sampling distributions chi-square and student's t-distribution and state any 3 properties of each.

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10. What are null and alternative hypotheses ? Explain the terms simple and composite hypothesis with examples.

11. Describe the one way ANOVA procedure in detail.

12. What are confidence interval and confidence level. In a library number of books used per year follows a normal distribution. On the basis of past data the library section has computed the variance to be 2.25 $(books)^2$, A study on a random sample of 9 members the following data as the number of references used in the previous year. Compute 95% confidence interval for the average number of book used per year. [Given for 95% confidence level $Z_c = 1.96$].

SECTION – III

Answer **any 4** questions.   **(4×5=20)**

13. Show that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.

14. State and prove Bayes' theorem.

15. The average number of plants affected by a disease at a place is 2. Find the probability that atleast one plant gets affected by the disease.

16. In an aptitude test administered to 900 college students, the mean is 50 and S.D. is 20. Find the number of students exceeding the score of 65.

17. List out the advantages of sample survey over census.

18. What are the basic steps in performing a test of statistical hypothesis ?

19. What is the large sample test for testing significance of population proportion ?

20. What is meant by 95% confidence interval for the proportion mean ? State the assumptions involved.

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