IN PBS-17, UNDER THE FEDERAL GOVERNMENT, 2003

STATISTICS

TIME ALLOWED: THREE HOURS **MAXIMUM MARKS: 100**

NOTE: Attempt **FIVE** questions in all, including **QUESTION NO. 1** which is **COMPULSORY**. All questions carry **EQUAL** marks. Statistical tables will be provided if required.

COMPULSORY QUESTION

Q. 1. Write only the correct answer in the Answer Book. Do not reproduce the question. Cutting or overwriting is not allowed.

1. If $P(A)=0.2$, $P(B)=0.3$ and $P(A \cap B)=0.06$ then
   a) A and B are mutually exclusive events.
   b) A and B are exhaustive events.
   c) $P(A \cap B)$ represents the probability that either event A or B will occur.
   d) $P(A \cap B)$ represents the joint probability that both events A and B will occur.

2. Which one of the following statements is incorrect?
   a) If two events A and B are statistically independent, then $P(A \cap B)=P(A)P(B)$.
   b) If $P(A \cap B)=P(A)P(B)$, then events A and B are statistically independent.
   c) If A and B are statistically independent then $P(B/A)=P(B)$.
   d) If A and B are statistically independent, then $P(B/A)=P(A/B)$.

3. The relative frequency of Mathematics majors at a university with 8000 students is 0.015. The frequency or the total number of Mathematics majors in the university is
   a) 150 b) 9 c) 15 d) 120

4. A manufacturing process produces 10% defective articles. If 2 articles are drawn from this process, the probability that they will both be good is:
   a) 0.01 b) 0.81 c) 0.81 d) 0.18

5. According to Chebysev's Inequality, at least _____ percent of the probability distribution is included within two standard deviations from the mean:
   a) 75 b) 25 c) 89 d) 11

6. Which of the following values cannot be the probability of an event:
   a) 0.78 b) 0.00 c) 1.25 d) 1.00

7. A normal probability distribution is symmetric around the value 3, which of the following statements is false?
   a) The expected value of that distribution is 3.
   b) The standard deviation of that distribution can also be 3.
   c) Both of the above are true.
   d) None of the above is true.

8. Which of the following events can't occur?
   a) A poisson random variable takes on the value 0.
   b) A binomial random variable takes on the value –1.
   c) A normal random variable takes on the value 0.
   d) All of the above.

9. In which one of the situations below are statistics useless?
   a) Predicting an unborn baby's height.
   b) Helping the President prepare the budget.
   c) Determining whether there are human beings in another solar system.
   d) Deciding which medicine is better for AIDS patients.

10. The bias of non responses in an interview survey may be corrected by:
    a) More accurate measurements. b) Improved interviewing techniques.
    c) Either of the above. d) None of the above.

11. Random sampling is preferable to judgment sampling because:
    a) Measures of precision of estimates of population values can be derived in random sampling.
    b) Random sampling costs less.
    c) A random sample is easy to obtain.
    d) None of the above.

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12. A sample observation can contain _____
    a) Systematic error b) Random error
    c) Both of the above d) None of the above

13. The basic concept in confidence interval estimation is
    a) the standard score b) the sampling distribution
    c) the number of degrees of freedom d) the finite population correction

14. Which of the following statements is false for the normal distribution?
    a) the sample mean is an unbiased estimator of the μ.
    b) the sample mean is an efficient estimator of the μ.
    c) the sample mean is a consistent estimator of the μ.
    d) at least one of the above is false.

15. The coefficient of determination r^2 is equal to 1 minus the ratio of _____
    a) the standard error of estimate to the standard deviation of y.
    b) unexplained variation to total variation.
    c) explained variation to total variation.
    d) Variation around the mean of Y to variation around the regression line.

16. A coefficient of correlation of r=-1.5 indicates that _____
    a) the regression line passes through the origin of the scatter diagram.
    b) there is a strong inverse relationship between y and x.
    c) the regression line slopes from upper left to down right on the scatter diagram.
    d) an error has been made.

17. Which of the following is referred to as homoscedasticity?
    a) Population variations of y values for all x values are equal.
    b) y is normally distributed.
    c) the y values are independent of one another.
    d) y values given x are normally distributed.

18. Positive auto correlation leads to _____
    a) low values of R^2. b) strong multicolinearity.
    c) low observed values of the Durbin – Watson statistics. d) none of the above.

19. The test to use in evaluating the overall significance of a fitted regression model is the _____
    a) t test b) chi-square test
    c) test for auto correlation d) F test

20. Which of the following statements is true?
    a) A price index can be used as an inflation barometer.
    b) An un-weighted average of relatives index uses quantity data.
    c) Values can never be appropriate weights.
    d) All of the above.

Q.2. a) A police department in a small city consists of 10 officers. If the department policy is to have 5 of the officers patrolling the streets, 2 of the officers working full time at the station and 3 of the officers on reserve at the station, how many different divisions of the 10 officers into the 3 groups are possible.

b) A retail establishment accepts either the American Express or the VISA credit card. A total of 24 percent of its customers carry an American Express card, 61 percent carry a VISA card, and 11 percent carry both. What percentage of its customers carry a credit card that the establishment will accept?

c) At a certain stage of a criminal investigation the inspector in charge is 60 percent convinced of the guilt of a certain suspect. Suppose now that a new piece of evidence that shows that the criminal has a certain characteristics is uncovered. If 20 percent of the population possesses this characteristics, how certain the guilt of the suspect should the inspector now be if it turns out that the suspect has this characteristics?

Q.3. a) Show that hyper geometric probabilities add up to unity.

b) Show that the binomial distribution expressed in standard measure tends to the standard normal distribution for n tendency to infinity.

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a) Write short notes on the following:
   i) Multinomial distribution
   ii) Random variable and its expectations

b) According to a survey of Association of women head basketball coaches conducted by an organization the mean base salary of these coaches is $44961. Assume that the current base salary of all these coaches have an approximately normal distribution with a mean of $44961 and a standard deviation of $6255.
   i) What is the prob. That the base salary of a randomly selected women's head is between $34000 and $50000.
   ii) What is the prob. that the base salary of a randomly selected women's heads is $42000 and lower.
   iii) What is the prob. that the base salary of a randomly selected women's heads is $39000 and higher.
   iv) The lowest paid 5% of women head earn what salary?

c) An athlete finds that in a high jump he can clear a height of 1.68m in once in five attempts and a height of 1.52 m nine times out of ten attempts. Assuming the heights he can clear in various jumps form a normal distribution, estimate the mean and standard deviation of the distribution.

Q.5. a) A random sample of eight auto drivers insured with a company and having similar auto insurance policies was selected. The following table lists their driving experience (in years) and the monthly auto insurance premium (in dollars) paid by them:

Driving Experience (yrs)	5	2	12	9	15	6	25	16
Monthly Insurance Premium ($)	64	87	50	71	44	56	42	60

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   i) Do you think experience depends on the monthly insurance or the monthly insurance depends on experience?
   ii) With experience as an independent variable and the insurance premium sold as a dependent variable, what is your hypothesis about the sign of B in the regression model?
   iii) Construct a scatter diagram for these data. Does the scatter diagram exhibit a liner relationship between the two variables?
   iv) Find the least squares regression line. Is the sign of b the same as the one you hypothesized for B in part b?
   v) Give a brief interpretation of the values of the y-intercept and slope calculated in above.
   vi) Computer r and r^2 and explain what they mean.
   vii) Predict the insurance premium for 11 years of experience.
   viii) Compute the standard deviation of errors.

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Q.6. a) Distinguish between the stratified and cluster sampling by giving at least one example.

b) What role does statistics play in the economics and social problems solving.

Q.7. a) If (X,Y) has a bivariate normal distributions then find the marginal distribution of Y.

b) The two random variables have the join p.d.f.

$f(x,y)=24y(1-x) \quad 0 \le x \le 1$

find $E(x/y=y)$ $E(y/x=x)$. $0 \le y \le x$

Var (x/y=y) and correlation coefficient between x and y.

c) Define lognormal distribution and explain its connection with normal distribution. Find its mean.

Q.8. Write short notes on the following:
   a) Axiomatic approach to probability.
   b) Factorial moments and factorial moment generating function.
   c) Multiple and partial correlation.
   d) Maximum likelihood estimator.
   e) Analysis of variance and its assumptions.

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