KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.Sc.
Year : II

Course : MATH 208
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 17 DEC 2024

SECTION "A"
[10 Q. × 1 = 10 marks]

Fill in the blank space(s) by most appropriate words or symbol(s):

1. The ratio of standard deviation of a data set to its mean expressed as percentage is called _____.

2. The probability of an event when the outcome of another event dependent on it is known is called _____.

3. The probability that the last digit of the phone number that will be received next on your cell phone will be 5 is _____.

4. If $V(X) = 7$, then $V(2X + 3) =$ _____.

5. The variance of $Poisson(2.4)$ distribution is equal to _____.

6. The mode of a continuous random variable with probability density function $f(x)$ is obtained by solving equation _____.

7. _____ distribution is used to make inference on mean of a normal population when population variance is unknown and sample is large.

8. _____ hypothesis is the complementary statement that is accepted if the null hypothesis is observed to be false.

9. Faults in equipment in a manufacturing process produce variation due to _____ _____ cause in the products.

10. The study of inter-relationship between two variables by observing data on them is called _____.

SECTION "B"

[10 Q. × 1 = 10 marks]

Fill in the blank space(s), ***DO NOT TICK,*** *by selecting the most appropriate answers from among the given ones.*

11. The equation $P(A \cap B) = P(A).P(B|A)$ represents _____ law.

[addition law multiplication law total probability law Bayes' law]

12. If two events A and B are such that $P(A \cap B) = P(A).P(B)$, they are said to be _____

[independent events dependent events
mutually exclusive events equally likely events]

13. For a discrete random variable X, $E(X) = \sum x.p(x)$, and $E(X^2) =$ _____

[$\sum(x.p(x))^2$ $\sum x^2.p(x)$ $\sum x.(p(x))^2$ $\sum x^2.p(x^2)$]

14. The binomial distribution $B(n, p)$ is converted into _____ distribution when $n \to \infty$, $p \to 0$ and the product np is finite.

[Poisson normal chi-square t]

15. The two points of inflections of $X \sim N(52, 144)$ distribution lie at 40 and at _____.

[52 12 64 196]

16. The expression gives _____ of population mean.

$$\left(\frac{\sigma Z_{\frac{\alpha}{2}}}{E_{Max}}\right)^2$$

[error in estimation sample size required for estimation
confidence interval of population mean confidence interval of population variance]

17. The statistics _____ is an unbiased estimate of population variance (σ^2).

[$\frac{1}{n}\sum_i X_i$ $\frac{1}{n}\sum_i (X_i - \bar{X})^2$ $\frac{1}{n-1}\sum_i (X_i - \bar{X})^2$ $\frac{1}{n+1}\sum_i (X_i - \bar{X})^2$]

18. The major purpose of a test of hypothesis procedure is to

_____

[make a decision about the sample, using the statistic
make a decision about the observed statistic
make a decision about the population, using the statistic
forecast values]

19. The lower control line of an R-chart, when process standard deviation is not known is given by: $LCL =$ _____

[$LCL = D_3 \bar{R}$ $LCL = B_3 \bar{R}$ $LCL = D_4 \bar{R}$ $LCL = B_4 \bar{R}$]

20. The objective of regression analysis is no to _____

_____

[observe of change in one variable with respect to another
develop model describing relation between two or more variables
predict unknown/ future values
detect normality of variables]

KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Level : B.Sc.
Year : II
Time : 2 hrs. 30mins.

17 DEC 2024

Course : MATH 208
Semester : I
F. M. : 55

SECTION "C"
[3 Q. × 9 = 27 marks]

1.

a. In a call center, the number of phone calls received each by each of the 12 receptionists is normally distributed with 63 calls on average on each day. If probability of daily phone calls numbering between 60 and 66 is found to be 0.6827, find the standard deviation and then find probability that on a particular day the number of phone calls received by the receptionists is more than 70. [4]

b. Chief of Army assumes that height of soldiers is normally distributed with mean 68.22 inches with a variance 10.8 inches. If a regiment is to form with 1000 soldiers, how many soldiers in a regiment would he expect to be over six feet tall? [3]

2. It is intended to test whether alloying reduces the resistance of electric wire significantly. Observation of 9 pieces of unalloyed wire are observed to have following resistances (in Ohm) – 17.40, 10.79, 24.19, 8.94, 13.25, 15.67, 19.36, 9.93, 14.44. Next, the observation of 7 pieces of alloyed wire are found to have resistances (in Ohm) as- 13.59, 15.60, 9.45, 6.22, 11.26, 13.79, 12.20. First esablish the fact, that the variances of two samples are not significantly different at 2% level of significance. Next, test whether alloying wire decreases resistance significantly, on average at 5% level of significance.

OR

10 cars were equipped with radial tires and driven over a test course. Then the same 10 cars (with the same drivers) were equipped with regular belted tires and driven over the same course. After each run, the cars' fuel economy (in km/l) was measured. The results are presented below-

Radial tire	4.2	4.7	6.6	7.0	6.8	4.5	5.7	6.0	7.4	4.9
Belted tire	4.1	4.9	6.2	6.9	6.8	4.4	5.7	5.8	6.9	4.7

Is there evidence that radial tires produce better fuel economy? (Assume normality of data, and use paired t-test at $\alpha = 0.05$.) Also, find a 95% confidence interval for the mean difference in fuel economy between radial tires and belted tires.

P.T.O.

3. A survey was conducted to relate the time required to deliver a proper presentation on a topic, to the performance of the student with the scores he/she receives. Following table shows the matched data:

Hours (x)	Score(y)
0.5	57
0.75	64
1.00	59
1.25	68
1.50	74
1.75	76
2.00	79
2.25	83
2.50	85
2.75	86
3.00	88

a. Draw a scatterplot to show that performance score is linearly related to the time required for presentation. [1]
b. Find the linear regression equation that will predict a student's score if we know how many hours the student studied. [5]
c. If a student had studied 0.85 hours, what is the student's predicted score? [1]

SECTION "D"

[6 Q. × 4 = 24 marks]

4. A consulting firm rents cars from three agencies, 20% from agency A, 20% from agency B and 60% from agency C. If 10% of the cars from A, 12% of the cars from B, and 14% of the cars from C have bad tires, what is the probability that a car with bad tires rented by the firm came from agency C?

5. If X is a continuous random variable with the probability density function $f(x) = k.e^{-3x}; x > 0$.

   Find k and $P\ (0.5 \leq x \leq 1)$.

6. The mean and standard deviation of binomial distribution are 4 and $\frac{2}{\sqrt{3}}$ respectively. Find the values of parameters n and of p of this distribution and then find $P[X \geq 1]$.

7. Telecom service provider claims that individual customers do not have to pay, on an average, more than 400 Rs. per month with standard deviation of 75 Rs. A random sample of 50 customers bills during a given month is taken with a mean of 420 and standard deviation of 15. Test the claim made by the service provider at 5% level?

8. The mean life of the tyres manufactured by a company follows normal distribution with standard deviation 3200 kms. A sample of 250 tyres is taken and it is found that the average life of the tyres is 50000 kms with a standard deviation of 3500 kms. Construct 95% confidence interval of the actual average life of the tyres manufactured by the company.

9. Thirty-five successive samples of size 100 castings each, taken from a production line, contained, respectively, 3, 3, 5, 3, 5, 0, 3, 2, 3, 5, 6, 5, 9, 1, 2, 4, 5, 2, 0, 10, 3, 6, 3, 2, 5, 6, 3, 3, 2, 5, 1, 0, 7, 4 and 3 defectives. Based on these data construct p-chart (control chart for fraction defectives) specifying clearly the control lines and interpret the chart.

SECTION "E"

[5 Q. × 2 = 10 marks]

10. If the values of the first quartile (Q_1) and the third quartile (Q_3) of a symmetric data are 3000 and 4000 respectively, then find median as well as coefficient of quartile deviation.

11. In a certain population, 30% of the persons smoke, and 8% have a certain type of heart disease. Moreover, 12% of the persons who smoke have the heart disease. What percentage of the population smokes and has the heart disease?

12. The number of customers arriving at a grocery store is a Poisson random variable. On average 10 customers arrive per hour. Let X be the number of customers arriving from 10 am to 11 am. Find $P(12 < X \leq 15)$.

13. Calculate sample size required to estimate mean of a normally distributed population known to have standard variance of 1.44 at 95% level if tolerable error in estimation is not to exceed 0.47.

14. Describe some applications of control charts in industrial processes.