KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2023

Marks Scored:

Level : B.Pharm.
Year : I

Course : MATH 102
Semester : II

Exam Roll No.:

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 27 July-023

SECTION "A"
[10 Q. × 1 = 10 marks]

Fill in the blank space (s) by most appropriate word (s) or symbol (s).

1. If $a \leq r \leq b$ indicates the range of correlation coefficients, then the values of $a$ and $b$ are _____.

2. If two dice are rolled simultaneously, then the probability of getting the values whose sum is 12 is _____.

3. If $X$ is a continuous random variable and $f(x)$ is a pdf of $X$, then expected value of $X$ is equal to _____.

4. If $X \sim N(5, 4)$, then $2X \sim$ _____.

5. If $n$ samples are drawn from a population $N(\mu, \sigma^2)$, then the variance of sample means is _____.

6. Suppose that we have a large $(n \geq 30)$ random samples from a population with unknown variance $\sigma^2$. Then $100(1-\alpha)\%$ confidence interval for the population mean is _____.

7. The error obtained by accepting a false hypothesis is called _____ error.

8. The first moment about the mean is always _____.

9. If $X \sim B(n; p)$ then standard deviation of $X$ is _____.

10. If $P(A|B) = P(A)$, then two events $A$ and $B$ are _____ events.

SECTION "B"
[10Q. × 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 expected value of a constant 'a' is _____.
[0; $a$; $\frac{a}{2}$; 1]

12. Let $F(x)$ be a cumulative distribution function for the continuous random variable $X$ defined over the set of real numbers, then which of the following is not true?_____

[$0 \leq F(x) \leq 1$; $\lim_{x \to -\infty} F(x) = 0$;
$\lim_{x \to +\infty} F(x) = 1$; $F(x) = \int_x^{\infty} f(t)dt$ ]

13. Total number of ways of selecting a sample of $n$ units from a population of size $N$ by simple random sampling without replacement is_____.

[$N^n$; $C(N,n)$; $C(n,N)$; $n^N$ ]

14. _____ distribution function has only one parameter.

[Binomial; Hypergeometric; Poisson; Normal]

15. If the random variable takes only positive values, then the probability of negative values will have_____.

[Positive values; Negative Values; Zero value; Difficult to tell]

16. If $X \sim N(\mu, \sigma^2)$ and $Y = \frac{X-\mu}{\sigma}$ then _____.

[$Y \sim N(0, \sigma)$; $Y \sim N(0, 1)$; $Y \sim N(\mu, 1)$; $Y \sim N(0, \sigma^2)$]

17. Which of the following expressions give right sided confidence interval for population mean when population variance is unknown?

_____

[$P\left(\mu \geq \bar{X} - Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}\right) = 1 - \alpha$; $P\left(\mu \geq \bar{X} + t_{\frac{\alpha}{2}, n-1} \frac{S}{\sqrt{n}}\right) = 1 - \alpha$;
$P\left(\mu \geq \bar{X} - t_{\frac{\alpha}{2}, n-1} \frac{S}{\sqrt{n}}\right) = 1 - \alpha$; $P\left(\mu \leq \bar{X} + t_{\frac{\alpha}{2}, n-1} \frac{S}{\sqrt{n}}\right) = 1 - \alpha$]

18. In regression analysis, the Y-variables are also called _____.

[independent variables; explanatory variable;
regressor variables; regressive variables;]

19. An unfit player is selected in national team, it is an example of_____.

[type-I error; type-II error; correct decision; sampling error]

20. The normal equations for a straight line $y = ax + b$ are

_____

[$\Sigma y = a\Sigma x + nb$ and $\Sigma xy = a\Sigma x^2 + b\Sigma x$;
$\Sigma xy = a\Sigma x + nb$ and $\Sigma y = a\Sigma x^2 + b\Sigma x$;
$\Sigma y = a\Sigma x + nb$ and $\Sigma xy = a\Sigma x^2 + b\Sigma xy$;
$\Sigma y = a\Sigma x + nb$ and $x^2 y = a\Sigma x^2 + b\Sigma x$ ]

9. Suppose 30% of the women in a class received an A on the test and 25% of the men received an A. The class has 60% women. Given that a person chosen at random received an A, what is the probability this person is women? [4]

**OR**

An allergist claims that 45% of the patients she tests are allergic to some type of weed. What is the probability

a. that exactly 4 of her next 5 patients are allergic to weeds?
b. none of her next 5 patients is allergic to weeds?

SECTION "E"

[5Q × 2 = 10 marks]

10. A simple random sample of size 6 is drawn without replacement from a finite population of size 10. If the variance of population is 9, find the S.E. of the sample mean.

11. Under what circumstances is t-statistic preferred over Z-statistic for inference on mean of normal population?

12. Define binomial probability distribution function. Under which condition Poisson distribution is preferred over binomial distribution?

13. If $y = a + bx$ is the least square approximation of $n$ pair of points, then write down the normal equations.

14. The probability that a boy will get scholarship is 0.75 and that a girl will get independent of boy is 0.72. What is the probability that at least one of them will get scholarship?

KATHMANDU UNIVERSITY
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27 July - 023

Level : B.Pharm.
Year : I
Time : 2 hrs. 30 mins.

Course : MATH 102
Semester : II
F. M. : 55

SECTION "C"
[3Q. × 7 = 21 marks]

1. The following data which specifies the "life" of 40 similar car batteries recorded to the nearest tenth of a year. [3+3+1]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.2 | 4.1 | 3.5 | 4.5 | 3.2 | 3.7 | 3.0 | 2.6 |
| 3.4 | 1.6 | 3.1 | 3.3 | 3.8 | 3.1 | 4.7 | 3.7 |
| 2.5 | 4.3 | 3.4 | 3.6 | 2.9 | 3.3 | 3.9 | 3.1 |
| 3.3 | 3.1 | 3.7 | 4.4 | 3.2 | 4.1 | 1.9 | 3.4 |
| 4.7 | 3.8 | 3.2 | 2.6 | 3.9 | 3.0 | 4.2 | 3.5 |

a. Construct a double-stem-and-leaf plot for the battery life span of the fruit using the stems $0^-, 0^+, 1^-, 1, 2^-, 2^+, 3^-, 3^+\ 4^-$, and $4^+$ such that stems coded by the symbol $-$ and $+$ are associated leaves 0 through 4 and 5 through 9 respectively.
b. Construct a relative frequency histogram and discuss the mode of the distribution.
c. Find the median of life of batteries.

2. In a certain type of metal test specimen, the normal stress on a specimen is known to be functionally related to the shear resistance. The following is a set of coded experimental data on the two variables: [4+1+2]

| **Normal Stress, x** | **Shear Resistance, *y*** |
|---|---|
| 26.8 | 26.5 |
| 25.4 | 27.3 |
| 28.9 | 24.2 |
| 23.6 | 27.1 |
| 27.7 | 23.6 |
| 23.9 | 25.9 |
| 24.7 | 26.3 |
| 28.1 | 22.5 |
| 26.9 | 21.7 |
| 27.4 | 21.4 |
| 22.6 | 25.8 |
| 25.6 | 24.9 |

a. Estimate the regression line $y = \alpha + \beta x$
b. Estimate the shear resistance for a normal stress of 24.5.
c. Find the amount of variation $\boldsymbol{y}$ due to the variation in $\boldsymbol{x}$.

3. Data on number of work hours lost per day on a construction project due to weather related conditions over 11 working days are recorded as 8.8, 8.8, 12.5, 12.2, 5.4, 13.3, 12.8, 6.9, 9.1, 2.2, 14.7. Assuming that the work hours are normally distributed, is there any evidence to conclude at 1% level of significance that the mean number of work hours lost per day is smaller than 11 hours? Also, construct 99% confidence interval for actual work hours lost.

**OR**

Following are the number of sales which a sample of 9 salespersons of industrial chemicals in California and a sample of 6 salespersons of industrial chemicals in Oregon made over a certain fixed period of time

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| California: | 59 | 68 | 44 | 71 | 63 | 46 | 69 | 54 | 48 |
| Oregon: | 50 | 36 | 62 | 52 | 70 | 41 | | | |

Assuming that populations sampled are normally distributed with unknown means $\mu_1$ and $\mu_2$ but having common variance, construct 95% confidence interval for difference of means of sales in two cities. Also, test whether the mean sales in California is significantly greater than in Oregon at 5% level of significance. [4+3]

SECTION "D"

[6Q × 4 = 24 marks]

4. A continuous random variable $X$ has the following pdf

$$f(x) = \begin{cases} kx(1+x) & \text{for } 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$

a. Evaluate the value of $k$.
b. Find the cumulative probability distribution function of $X$.

5. An analysis of monthly wages paid to the workers of two firms A and B belonging to the same industry gives the following results: [2+2]
a. Which firm has larger wage bill?
b. Which firm has greater variability in individual wages?

6. The following are the numbers of minutes that a person had to wait for a bus to work on 15 working days: $10, 1, 13, 9, 5, 9, 2, 10, 3, 8, 6, 17, 2, 10, 15$. Find mean, median and draw a box plot.

7. The number of bacteria in a liquid is a random variable with mean number of bacteria per millilitre of a liquid is known to be 6. Find the probability that in 1 ml of the liquid, there will be:
i) zero bacteria
ii) Less than 5 bacteria.

8. A study of the career paths of hotel general managers sent questionnaires to a simple random sampling of 160 hotels belonging to major Nepal hotel chains. There were 114 responses. The average time these 114 general managers had spent with their current company was 11.78 years. Give a 90% confidence interval for the mean number of years general managers of major-chain hotels have spent with their current company. Take it as known that the standard deviation of time with the current company for all general managers is 3.2 years. [4]