KATHMANDU UNIVERSITY
End Semester Examination
September 2024

Marks Scored:

Level : B.Arch
Year : I

Course : MATH 106
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 13 SEP 2024

SECTION "A"
[10 Q. × 1 = 10 marks]

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

1. The school asks to rate a teacher's teaching as excellent, very good, good, and poor. This is an example of the _____ scale.

2. The example of a discrete data is _____

3. If X is the true value of the quantity and X_1 is the approximate value then the relative error is E_R = _____

4. If X is the true value and X_1 is the approximate value of the given quantity then its absolute error is E_A = _____

5. After rounding of the number 4.735 to three significant digits, we get the number _____

6. _____ random variable takes infinite number of possible values that are not countable.

7. The probability rolling three 6's in five rolls of a balanced die is _____

8. A graphical representation of groups of data through quartiles is called_____

9. The central difference operator is denoted by the symbol _____.

10. For the given distributed data the value of $\Delta^3 y_0$ is _____

x	3.60	3.65	3.70	3.75
y	36.598	38.475	40.447	42.521

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.

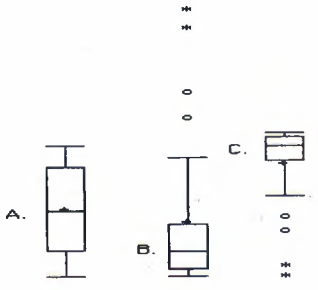
11. Errors may occur in performing numerical computation on the computer due to which of the following reasons?
[Operator fatigue Back substitution Rounding errors Power Fluctuation]

12. The Newton-Raphson method formula for finding the square root of a real number R from the equation $x^2 - R = 0$ is,

[$x_{i+1} = \frac{x_i}{2}$ $x_{i+1} = \frac{3x_i}{2}$ $x_{i+1} = \frac{1}{2}\left(x_i + \frac{R}{x_i}\right)$ $x_{i+1} = \frac{1}{2}\left(3x_i - \frac{R}{x_i}\right)$]

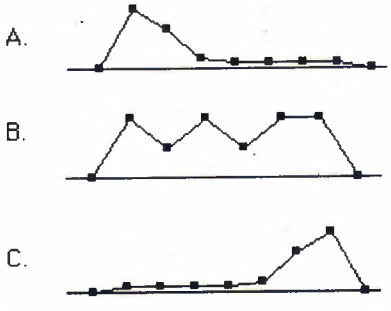
13. Box plots with a large positive skew is _____

[A B C None of these]



14. Frequency polygon with a large negative skew is _____

[A B C None of these]



15. True error is defined as _____
[Present Approximation – Previous Approximation
True value – Approximate value
abs(True value – Approximate value)
abs(Present Approximation – Previous Approximation)]

16. The shift operator is denoted by the symbol _____.
[Δ ∇ ∂ E]

17. Given $n+1$ data points $(x_0, y_0), (x_1, y_1), \ldots\ldots, (x_{n-1}, y_{n-1}), (x_n, y_n)$, assume you pass a function $f(x)$ through all the data points. If now the value of the function $f(x)$ is required to be found outside the range of the given x-data, the procedure is called
[Interpolation Extrapolation Iterative Polynomial equation]

18. The next iterative value of the root of $x^2 - 4 = 0$ using the Newton-Raphson method, if the initial guess is 3, is _____
[1.5 2.067 2.167 3.000]

19. Given three data points (1,6), (3,28), and (10, 231), it is found that the function $y = 2x^2 + 3x + 1$ passes through the three data points. Your estimate of y at $x = 2$ is most nearly _____
[6 15 17 28]

20. Which one of the following variables is not categorical? _____
[Age of a person.
Gender of a person: male or female.
Choice on a test item: true or false.
Marital status of a person (single, married, divorced, other)]

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Level : B.Arch
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13 SEP 2024

Course : MATH 106
Semester : II
F. M. : 55

SECTION "C"
[3Q. × 7 = 21 marks]

Attempt *All* questions.

1. Forty -five specimens of certain type of powder were analyzed for sulfur trioxide content. Following are the results, in percent. The list has been sorted into numerical order.

14.1, 14.4, 14.7, 14.8, 15.3, 15.6, 16.1, 16.6, 17.3, 14.2, 14.4, 15.7, 14.9, 15.3, 15.7, 16.2, 17.2, 17.3, 14.3, 14.4, 14.8, 15, 15.4, 15.7, 16.4, 17.2, 17.8, 14.3, 14.4, 14.8, 15.0, 15.4, 15.9, 16.4, 17.2, 21.9, 14.3, 14.6, 14.8, 15.2, 15.5, 15.9, 16.5, 17.2, 22.4

   a. Construct a stem – and – leaf plot for these data.
   b. Construct a box plot for these data and interpret it.
   c. Construct a histogram and a relative frequency for these data
   d. Compute the mean, standard deviation and coefficient of variation [2+2+2+1]

2.
   a. It is estimated that 50% of emails are spam emails. Some software has been applied to filter these spam emails before they reach your inbox. A certain brand of software claims that it can detect 99% of spam emails, and the probability for a false positive (anon-spam email detected as spam) is 5%. Now if an email is detected as spam, then what is the probability that it is in fact a non-spam email? [3 + 4]
   b. The temperature readings from a thermocouple in a furnace fluctuate according to a cumulative distribution function

$$F(x) = \begin{cases} 0, & x < 800^0C \\ 0.1x - 80, & 800^0C \le x < 810^0C \\ 1, & x > 810^0C \end{cases}$$

Determine the following:
   a. P(X < 805)
   b. P(800 < X ≤ 805)
   c. P(X > 808)
   d. If the specifications for the process require that the furnace temperature be between 802 and 808 ^{0}C, what is the probability that the furnace will operate outside of the specifications?

3. X is a discrete random variable with the probability mass function

$$f(x) = \frac{x}{10}, \quad for \ \ x = 1, 2, 3, 4$$

Find *a*) $P(\frac{1}{2} < X < \frac{5}{2})$ b) E(X) c) V(X) [3+2+2]

SECTION "D"
[6Q. × 4 = 24 marks]

4. Find the absolute error in the sum of the numbers 105.6, 27.28, 5.63, 0.1467, 0.000523, 208.5, 0.0235, 0.432 and 0.0467, where each number is correct to the digits given.

5. Find the absolute error in the product *uv* if u = 56.54±0.005 and v = 12.4±0.05

P.T.O.

6. The time to microwave a bag of popcorn using the automatic setting can be treated as a random variable having a normal distribution with standard deviation 10 seconds. If the probability is 0.8212 that the bag will take less than 282.5 seconds to pop, find the probability that [2.0 + 2.0]
   a. it will take longer than 258.3 seconds to pop, and
   b. it will take a value greater than 39.2 seconds.

7. A continuous random variable X has a probability density function $f(x) = 3x^2, 0 \leq x \leq 1$. Find a and b such that [2+2]
   a. $P(X \leq a) = 0.5$
   b. $P(X \geq b) = 0.05$

8. Indentify the type of data. Choose from nominal, ordinal, interval and ratio. [4]
   a. Anxiety rate on a scale of 1 to 5 where 1 equals not anxious, 3 equals moderately anxious and 5 equals highly anxious
   b. Gender
   c. Weight of an individual
   d. Number of adults (above 18 years) living in a family

9. Compute, to four decimal places, the root of the equation $e^x = 4x$ by Newton Raphson's Method till six iterations

SECTION "E"

[5 Q.× 2 = 10 marks]

10. Construct a difference table for the following data.

x	1	1.05	1.10	1.15	1.2	1.25
f(x)	0.682689	0.706282	0.728668	0.749856	0.769861	0.7887

11. A coin is tossed till a head or five tails appear. Write the sample space of this experiment.

12. In the experiment given in Question No. 11, let X be a random variable denoting the number of tosses needed to complete the experiment. Find E(X).

13. Prove that $\mu\delta = \frac{\Delta+\nabla}{2}$

14. Prove that $\Delta^2 = (1 + \Delta)\delta^2$