

KATHMANDU UNIVERSITY  
End Semester Examination [C]  
June/July 2024

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

02 JUL 2024

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

SECTION "C"

[3Q. × 7 = 21 marks]

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.

[2+2+1.5+1.5=7]

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
  - c. Construct a relative frequency histogram these data
  - d. Compute the mean, standard deviation and coefficient of variation
2. Compare root finding process of Newton – Raphson and Iteration Method. Also find the root of the equation  $xe^x=1$ , using Newton Raphson and Iteration Method. Also compare the results. [2+4+1=7]
3. X is a discrete random variable with the probability mass function
- $$f(x) = \frac{x}{10}, \quad \text{for } x = 1, 2, 3, 4$$
- Find a)  $P(X = 1 \text{ or } 2)$     b)  $P\left(\frac{1}{2} < X < \frac{5}{2} \mid X > 1\right)$     c)  $E(X)$     d)  $V(X)$  [1+2+2+2=7]

SECTION "D"

[6Q. × 4 = 24 marks]

4. Let X denote the number of patients who suffer an infection within a floor of a hospital per month with the following probabilities:

Number of patients X	0	1	2	3	4	5
Probability P (X = x)	0.04	0.12	0.30	0.24	0.22	0.08

Determine the following probabilities:

- a. less than one infection
  - b. more than three infections
  - c. at least one infection
  - d. no infection
5. 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
- a. it will take longer than 258.3 seconds to pop, and
  - b. it will take a value greater than 39.2 seconds.

6. At a machine center there are four automatic screw machines. An analysis of past inspection of records yields the following data. [2+2=4]

Machine	Percent Production	Percent Defectives Produced
1	15	4
2	30	3
3	20	5
4	35	3

Machine 2 and 4 are newer and more production has been assigned to them than to machines 1 and 3. Assume that the current inventory mix reflects the production percentages indicated.

- If a screw is randomly picked from inventory, what is the probability that it will be defective?
- If a screw is picked and found to be defective, what is the probability that it was produced by machine 3?

7. The temperature readings from a thermocouple in a furnace fluctuate according to a cumulative distribution function

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

Determine the following:

- $P(X < 805)$
  - $P(800 < X \leq 805)$
  - $P(X > 808)$
8. 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.

9. Values of  $x$  (in degrees) and  $\sin x$  are given in the following table:

X (in degrees)	Sin x
15	0.2588190
20	0.3420201
25	0.4226183
30	0.5
35	0.5735764
40	0.6427876

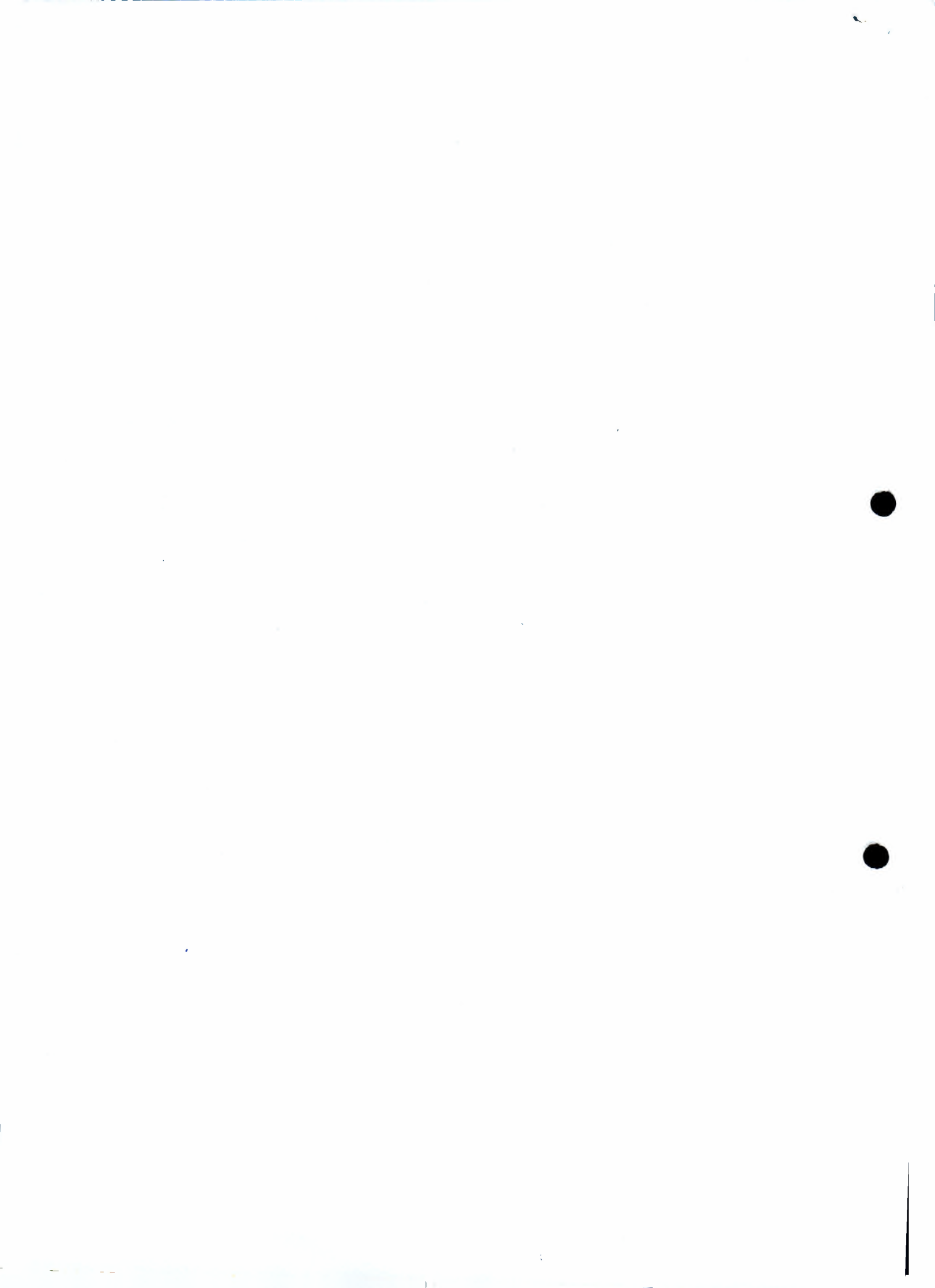
Determine the value of  $\sin 38^{\circ}$

### SECTION "E"

[5Q.  $\times$  2 = 10 marks]

- Evaluate  $\Delta^2 x^3$
- If  $p = 3c^6 - 6c^2$  find the percentage error in  $p$  at  $c=1$ , if the error in  $c$  is 0.05
- Find a real root of  $f(x) = x^3 + x^2 + x + 7$  correct to three decimal places using bisection method. Test till four iterations

13. Find  $x$  if  $x_0 = 0.6$ ,  $n = 2.6$  and  $h = 0.2$ .
14. If  $X$  follows a Poisson distribution such that  $P(X = 2) = 9 P(X = 4) + 90 P(X = 6)$ ,  
find the mean and variance of  $X$ .



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Marks Scored:

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Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 02 JUL 2024

SECTION "A"

[10Q.  $\times$  1 = 10 marks]

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

1. Marks obtained by students in an examination is an example of \_\_\_\_\_ scale.
2. How many scales of measurement exist? \_\_\_\_\_
3. If you are asked to rate the taste of a brand of cereal as excellent, very good, good, and poor. This is an example of the \_\_\_\_\_ scale.
4. Coefficient of variation of a random variable distributed as Binomial with parameter  $n$  and  $p$  is \_\_\_\_\_
5. A graphical representation of groups of data through quartiles is called \_\_\_\_\_
6. Every polynomial equation of the 4th degree has \_\_\_\_\_ roots.
7. If the parameter of a Poisson distribution is  $\lambda$ , then its mean and variance are \_\_\_\_\_ & \_\_\_\_\_
8. Let  $p(x) = cx$ ,  $x = 1, 2, 3, 4$   
where  $c$  is a constant. Then  $c =$  \_\_\_\_\_
9. In question number 8, the value of  $P(X = 2)$  \_\_\_\_\_
10. In question number 8, the value of  $E(X)$  \_\_\_\_\_

SECTION "B"

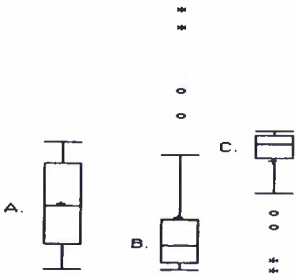
[10 Q.  $\times$  1 = 10 marks]

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

11. Number of adults (above 18 years) living in a family \_\_\_\_\_  
[ Nominal Data          Ordinal Data          Interval Data          Ratio Data ]

12. 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 ) ]
13. Which one is not an example of random experiment? \_\_\_\_\_  
 [ A coin is tossed and the outcome is either a head or a tail  
 A six-sided die is rolled  
 Some number of persons will be admitted to a hospital emergency room during any hour.  
 All medical insurance claims received by a company in a given year. ]
14. The relationship between E and delta is \_\_\_\_\_.  
 [  $E = 1 - \delta$        $E = 1 + \delta$        $E = \delta - 1$        $E = \delta$  ]
15. Iteration method is a \_\_\_\_\_ method  
 [ direct      indirect      self correcting      step by step ]
16. The forward difference operator is denoted by the symbol \_\_\_\_\_.  
 [  $\Delta$        $\nabla$        $\partial$        $\infty$  ]
17. 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

 [ 0.095      0.007      1.872      -5.993 ]
18. Box plots with a large positive skew is \_\_\_\_\_  
 [A      B      C      None of these ]
- 
19. A perfectly normal distribution : \_\_\_\_\_  
 [ Is bell shaped, symmetrical and has tails that cross the x-axis at infinity  
 Is only applicable for normal people  
 Has equal mean, median and modes  
 (a) and (c) above ]
20. If you had a z-score of 2.33 this would tell you that : \_\_\_\_\_  
 [ Your score was 2.33 standard deviations above the mean  
 Your score was 2.33 standard deviations below the mean  
 There was a probability of 2.33 of obtaining a score greater than your score  
 There was a probability of 2.33 of obtaining a score less than your score ]