KATHMANDU UNIVERSITY
End Semester Examination [C]
November/December, 2023

Marks Scored:

Level : B.Sc.
Year : II

Course : MATH 206
Semester : I

Exam Roll No.: Time: 30 mins. F. M. : 20

Registration No.: Date 07 DEC 2023

SECTION "A"
[10Q. × 1 = 10 marks]

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

1. What type of sampling scheme is suitable for measuring proportion of children receiving the two vaccines of COVID-19 in a particular district _____?

2. An airline claims that only 6% of all lost luggage is never found. If, in a random sample 17 of 200 pieces of lost luggage are not found, then the null hypothesis to this problem is _____ against the alternative hypothesis _____.

3. If the null hypothesis is that a Mathematical Model is credible, the results of Type I error is _____

4. The mathematical model $y = ae^{bx}$ is called _____model.

5. The lowest value that a quality characteristic can take before the process becomes out-of-control, is called _____

6. If a process has its operation with _____ causes of variation, it is said to be an out-of-control process.

7. In ANOVA the random variance within the treatments is measured by _____

8. In ANOVA if the true means of k populations are equal, then the calculated value of F is close to _____

9. A researcher reports an F-ratio with df = 5, 27 for an independent-measures ANOVA experiment. How many treatment conditions were compared in this experiment? _____

10. _____ statistical procedures are particularly useful when the experimental observations are based on qualitative attributes.

SECTION "B"
[10Q. × 1 = 10 marks]

Encircle the most appropriate answer among the given options.

11. What type of sampling scheme for the students is suitable for assessing the quality of services offered to the students, by the library of a university?
    a. Simple Random Sampling
    b. Stratified Sampling
    c. Cluster Sampling
    d. Systematic Sampling

12. Which of the following are types of correlation?
    a. Positive and Negative
    b. Simple, Partial and Multiple
    c. Linear and Nonlinear
    d. All of the above

13. The following are data pertain to the demand for a product (in thousands of units) and its price (in Rupees) charged in five different market areas:

Market area	Price (X)	Demand (Y)
1	20	22
2	16	41
3	10	120
4	11	89
5	14	56

What types of Regression existing between the variables of Price (X) and Demand(Y)?
a. linear b. exponential c. quadratic d. cubic

14. What symbol represents the test statistic for the Kuskal Wallis test?
a. W b. T c. U d. H

15. Run test is used to analyze _____
a. Scores b. Ranks c. Frequencies d. Randomness

16. Using a goodness-of-fit test, we can assess whether a set of obtained frequencies differ from a set of _____ frequencies
a. Mean b. Actual c. Predicted d. Expected

17. Control of the process for fraction defective level is usually done with the _____ control chart.
    a. X bar control chart
    b. c control chart
    c. R chart
    d. P chart

18. If a process is said to be out of control, what can we say about the variation?
a. Random b. Normal c. Attribute d. Assignable

19. When k population means are approximately similar to each other, it is likely that average error deviation _____.
    a. is relatively small as compared to average treatment deviation
    b. is equal to average treatment deviation
    c. is relatively large as compared to average treatment deviation
    d. none of the above

20. Twenty-five individuals were sampled as to whether they liked or did not like a product (indicated by Y and N respectively). The resulting sample is shown by the following sequence: Y Y N N N N Y Y Y N Y N N Y N N N N N Y Y Y Y N N. Then the number of runs is _____.
a. 10 b. 9 c. 11 d. 8

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0.1 DEC 2023

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

Course : MATH 206
Semester : I
F. M. : 55

SECTION "C"
[3Q. × 9 = 27 marks]

1. An experiment was conducted to determine if weight of an animal can be predicted after a given period of time on the basis of initial weight of the animal and the amount of feed that was eaten. The following data, measured in kilograms, were recorded: [4+3]

Final weight (y)	Initial weight (x_1)	Feed weight (x_2)
100	1.5	4.0
112	2.2	3.0
69	1.0	1.6
90	2.0	1.2
123	0.8	3.4
186	1.6	4.8

a. Fit a multiple regression of the form, $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2$. Interpret the line of regression.

b. Predict the final weight of an animal having an initial weight of 3.5 kg that is fed 3.2 kg of feed.

2. What is Chi square test? A study was recently conducted by manufacturing company to address the question, "Whether or not new serum helps to cure the disease?". To test this, two groups, A and B, consist of 100 people each who have a disease were selected as a sample. A serum is given to group A but not to group B (which is called the control); otherwise, the two groups are treated identically. It is found that in group A and B, 75 and 65 people, respectively, recover from the disease. The research results are summarized in the accompanying contingency table:

	Recover	Do not recover
Group A	75	25
Group B	65	35

From the contingency table, the researcher concluded that recovery is independent of the use of the serum. Do you agree with the conclusion of researcher? Use $\alpha = 0.05$.

3. What is non linear regression? [2+3.5+3.5]

a. The pressure and volume of gas are related by the equation $pv^{\lambda} = k$ (here λ *and* k are constants)
Fit an equation to the following data.

p	0.5	1.0	1.5	2.0	2.5	3.0
v	1.62	1.00	0.75	0.62	0.52	0.46

b. Two quantities x and y are measured and corresponding values are given in the following table.

x	20	40	60	80	100	120
y	5.5	9.1	14.9	22.8	33.3	46

Find a second degree parabola to the data.

SECTION "D"

[4Q. × 7 = 28 marks]

4. As part of an industrial training program, some trainees are instructed by Method A, which is straight computer based instruction, and some are instructed by Method B, which also involves the personal attention of an instructor. If random samples of size 10 are taken from large groups of trainees instructed by each of these two methods, and the scores which they obtained in an appropriate achievements test are-

   Method A: 71 75 65 69 73 66 68 71 74 68

   Method B: 72 77 84 78 69 70 77 73 65 75

   Use the 0.02 level of significance to test the assumption that the two populations have equal variances.

OR

The following data come from a study in which random samples of the employees of three government agencies were asked questions about their pension plan:

	Agency I	Agency II	Agency III
For the pension plan	67	84	109
Against the pension plan	33	66	41

Use the 0.01 level of significance to test the null hypothesis that the actual proportions of employees favoring the pension plan are the same.

5. What are non-parametric tests? [2+5]

The following data represents the number of hours that a rechargeable ledge trimmer operates before recharge is required:

1.5 2.2 0.9 1.3 2.0 1.6 1.8 1.5 2.6 1.2 1.7

Use the sign test to test the hypothesis that this trimmer operates on average 1.8 hours before requiring a recharge.

6. A filler machine in a food processing plants is set so that the mean fill is 16 ounces. When the process is in control, the actual load per can should vary about this mean in a random manner with a variance that remains stable over time. Suppose a process that has been operating for a period of time shows the following readings:

   15.87, 16.14, 15.98, 16.03, 16.05, 16.01, 16.08, 15.94

   Do the data suggest that the process is behaving in a non-random manner?

   Test the randomness of the sequence at the 0.05 significance level.

7. a. If the average fraction defective of a large sample of a product is 0.1537, calculate the control limits of np chart. It is given that the sub group size is 2000 [2]

   b. The following data gives the number of defectives in 10 independent samples of size 2000 each from a production process. Draw the control chart for fraction defectives and comment on it. [5]

Sample No.	1	2	3	4	5	6	7	8	9	10
No. of defectives	425	430	216	341	225	322	280	306	337	305