

KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

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

0 2 AUG 2024

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

SECTION "C"

[3 Q. × 9 = 27 marks]

1. In what circumstances is the technique of analysis of variance preferred to the usual z or t test for testing the significance of the difference between means? Discuss one way analysis of variance (ANOVA). [4+5]

To find the best arrangement of equipment at the rear of a fire truck, 3 different arrangements were tested by simulating a fire condition and observing the reaction time required to extinguish the fire. The reaction time (in seconds) of 24 firefighters (randomly assigned to the different arrangements) were as follows:

| | | | | | | | | | | |
|----------------|----|----|----|----|----|----|----|----|----|----|
| Arrangement 1: | 40 | 35 | 30 | 32 | 34 | 29 | 36 | | | |
| Arrangement 2: | 34 | 30 | 28 | 35 | 39 | 28 | 39 | 42 | 38 | 27 |
| Arrangement 3: | 28 | 35 | 39 | 26 | 31 | 30 | 28 | | | |

Test at the level of significance $\alpha = 0.05$ whether we can reject the null hypothesis that the differences among the arrangements have no effect.

2. What do you understand by parametric and nonparametric test? With the help of examples, explain where would you use parametric and nonparametric test of statistical significance. [4+5]

Comparing two types of automobile engines, a consumer testing service obtained the following pickup (0 – 100 kmph) times (rounded to the nearest tenth of a second):

Engine A: 13.3, 12.1, 14.6, 8.9, 9.5, 12.4, 13.2, 13.5, 13.9, 12.9
Engine B: 12.6, 13.1, 9.8, 10.4, 12.5, 13.6, 13.0, 12.2, 9.9, 11.5

Use the U test at the 0.05 level of significance to check whether it is reasonable to say that the population of pickup times of the two engines is identical.

3. The following data pertain to the growth of a colony of bacteria in a culture medium: [4+5]

| Days since inoculation (X) | Count ('000) (Y) |
|-------------------------------|---------------------|
| 3 | 115 |
| 6 | 147 |
| 9 | 239 |
| 12 | 356 |
| 15 | 579 |
| 18 | 864 |

- a. Plot $\log Y_i$ versus X_i to verify that it is reasonable to fit an exponential curve.
b. Fit an exponential curve to the given data.

P.T.O.

SECTION "D"

[4 Q. \times 7 = 28 marks]

4. The lapping process which is used to grind certain silicon wafers to the proper thickness is acceptable only if σ , the population standard deviation of the thickness of dice cut from the wafers, is at most 0.50 mil. Use the 0.05 level of significance to test the null hypothesis $\sigma = 0.50$ against the alternative hypothesis $\sigma > 0.50$, if the thicknesses of 15 dice cut from such wafers have a standard deviation of 0.64 mil
5. If $x = 36$ of $n = 100$ persons interviewed are familiar with the tax incentives for installing certain energy-saving devices, construct a 95% confidence interval for the corresponding true proportion.

OR

In a random sample of 400 industrial accidents, it was found that 231 were due at least partially to unsafe working conditions. Construct a 99% confidence interval for the corresponding true proportion.

6. A large electronics firm that hires many workers with disabilities wants to determine whether their disabilities affect such workers' performance. Use the level of significance $\alpha = 0.05$ to decide on the basis of the sample data shown in the following table whether it is reasonable to maintain that the disabilities have no effect on the workers' performance:

| | Performance | | |
|---------------|---------------|---------|---------------|
| | Below average | Average | Above average |
| Disability | 21 | 64 | 17 |
| No Disability | 29 | 93 | 28 |

7. Write short notes on: any two of the following
 - a. Goodness of Fit
 - b. Linear regression
 - c. Experimental Design

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Date :

02 AUG 2024

SECTION "A"

[10 Q. × 1 = 10 marks]

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

1. If the independent random samples of size n_1 and n_2 are taken from normal populations having the same variance, then the test statistic for testing the null hypothesis $\sigma_1^2 = \sigma_2^2$ against the alternative hypothesis $\sigma_1^2 \neq \sigma_2^2$ is _____
2. Besides of sample variance, the population variance is estimated in terms of the _____
3. _____ is the proportion of the time that the event actually occurs.
4. The chi-square statistic should be used when on or more the expected frequencies is more than _____
5. Tables in which data are tallied into a two way classification having r rows and c columns is referred to as _____.
6. If the exact inferences can be made when the assumptions underlying the so-called standard method met, then we would prefer as _____.
7. An alternative to two independent sample t-test is _____
8. If n_1 , and n_2 are sequence of symbols of one kind and of another kind, then formula for standard deviation of test of randomness is _____
9. In the statistical analysis of the _____ can be apply for comparing means when there are more than two levels of single factor or treatment.
10. In usual notation, the relationship between SST, SS(Tr), and SSE in one way analysis of variance, SST is _____

SECTION "B"

[10 Q. \times 1 = 10 marks]

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

11. If the independent random samples of size n_1 and n_2 are taken from normal populations having the same variance, then the critical region for testing the null hypothesis $\sigma_1^2 = \sigma_2^2$ against the alternative hypothesis $\sigma_1^2 < \sigma_2^2$ is _____
 [$F > F_\alpha(n_1 - 1, n_2 - 1)$ $F > F_\alpha(n_2 - 1, n_1 - 1)$,
 $F < F_\alpha(n_2 - 1, n_1 - 1)$, $F < F_\alpha(n_2 - 1, n_1 - 1)$]
12. To determine whether two samples drawn from two independent normal populations have the unequal variance, we use _____
 [χ^2 - distribution t - distribution F - distribution Z - distribution]
13. The Mean of Mann-Whitney U test with 5 observations from first sample and 8 observations from second sample is _____
 [40 20 13 -3]
14. A sample of the following indicates the arrangement of defective, D and non-defective, N, produced in the given order by certain machine: NNNDDDDNNNDNDNNDNNDNND NNDD. The total number of runs are _____
 [11 12 13 24]
15. If the fitted multiple regression model is $\hat{Y} = 18.5 + 2.31X_1 - 45.3X_2 + 18.23X_3$ then the slope of regression coefficient of Y on X_1 is _____
 [18.5 2.31 -45.3 18.23]
16. In a 5×5 contingency table, the degrees of freedom is _____
 [25 24 16 4]
17. The control line for the fraction-defectives control chart is _____
 [$3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$ $3\sqrt{\frac{\bar{c}(1-\bar{c})}{n}}$ \bar{p} \bar{c}]
18. Control chart based on _____
 [1 sigma limits 2 sigma limits 3 sigma limits 4 sigma limits]
19. The negative coefficient of multiple correlation ranges from _____
 [0 to 1 -1 to 0 -1 to 1 greater than 0]
20. In the usual notation for the coefficient of correlation between X_2 and X_3 keeping X_1 and X_4 constant _____
 [$r_{2.314}$ $r_{23.14}$ $r_{1.423}$ $r_{14.23}$]