KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2025

Marks Scored:

Level : B.Sc.
Year : II

Course : MATH 206
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 03 APR 2025

SECTION "A"
[10 Q. × 1 = 10 marks]

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

1. If a random samples of size n is taken from normal population having the standard deviation σ, then the test statistic for testing the null hypothesis $\sigma = \sigma_0$ against the alternative hypothesis $\sigma \neq \sigma_0$is _____.

2. The population Proportion is estimated in terms of the _____.

3. The test of Statistics for comparing the consumer response (percentage favorable and percentage unfavorable) to two or more than two different product _____.

4. We can apply for test concerning difference between two proportions _____ which, for large samples, is a random variable having approximately the standard normal distribution.

5. Tables in which data are arranged into a two way classification having number of rows and number of columns is referred to as_____.

6. The main advantage of these _____ is that exact inferences can be made when the assumptions underlying the so-called standard methods cannot be met.

7. An alternative to two or more than two independent sample test is _____.

8. If $n_1, and\ n_2$ are sequence of symbols of one kind and of another kind, then formula for mean of test of randomness is _____.

9. In the statistical analysis _____ can be apply for comparing means when there are classified according to one criterion of classification.

10. In usual notation, the relationship between SST, SS(Tr), and SSE in one way analysis of variance, SSE is _____.

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. If the independent random samples of size n_1 and n_2 and ($n_1 < n_2$)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 $\sigma_1^2 \neq \sigma_2^2$ is _____.

[$F < F_{\frac{\alpha}{2}}(n_1 - 1, n_2 - 1)$ $F > F_{\frac{\alpha}{2}}(n_2 - 1, n_1 - 1)$,

$F < F_2(n_1 - 1, n_2 - 1)$, $F < F_2(n_2 - 1, n_1 - 1)$]

12. To determine whether two samples drawn from two independent normal populations have the equal variance, we use _____.

[χ^2 – *distribution* t – *distribution* F – *distribution* Z – *distribution*]

13. The variance of Mann-Whitney U test with 5 observations from first sample and 6 observations from second sample is _____.

[5 6 11 30]

14. A sample of the following indicates the arrangement of defective, D and non-defective, N, produced in the given order by certain machine: NDNDNDDNNNDNDNNDNNDDNDND. The total number of runs are _____.

[11 13 18 24]

15. If the fitted multiple regression model is $\hat{Y} = 18.5 + 2.31X_1 - 45.3X_2 + 18.23X_3$then the intercept of regression coefficient of Y *on* X_1 *and* X_2 is _____.

[18.5 2.31 -45.3 18.23]

16. In a 5 × 6 contingency table, the degrees of freedom is _____.

[4 5 20 30]

17. The upper control line for the fraction-defectives control chart is _____.

[$\bar{p} + 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$ $\bar{p} - 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$ $\bar{p} + 3\sqrt{\frac{\bar{p}(1+\bar{p})}{n}}$ $\bar{p} - 3\sqrt{\frac{\bar{p}(1+\bar{p})}{n}}$]

18. When the variability present in a production process is confined to chance variation, the process is said to be in a state of _____.

[Statistical Control Process Control process capability Quality Control]

19. The positive 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_3 *and* X_2 *keeping* X_1 *and* X_4 constant _____.

[$r_{2.314}$ $r_{23.14}$ $r_{1.423}$ $r_{14.23}$]

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SECTION "C"
[3 Q. × 9 = 27 marks]

1. What do you understand by nonparametric test? With the help of examples, explain where you would nonparametric test of statistical significance.
A company that processes health claims maintains three centers. Software was installed so they could monitor non-business internet usage by their employees. Initially, six employees were randomly selected from each of three service centers and the number of hours of non-business internet usage recorded.

Service Center A	4.1,	10.4,	2.2,	5.7,	3.8,	12.3
Service Center B	7.9,	5.4,	13.1,	7.7,	8.3,	9.8
Service Center C	6.9,	9.3,	11.2,	1.9,	13.8,	7.3

Use the H test at the 0.05 level of significance to test the null hypothesis that the 3 samples come from identical populations

OR

What is Analysis of variance and where is it used? Carryout one-way Analysis of Variance
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 is multiple and partial correlation coefficient. Write down its main properties.

A compound is produced for a coating process. It is added to an otherwise fixed recipe and the coating process is completed. Adhesion is then measured. The following data concern the amount of adhesion and its relation to the amount of an additive and temperature of a reaction.

Additive X1	0	70	35	0	70
Temperature X2	100	100	140	180	180
Adhesion Y	10	48	41	40	39

a. Fit a multiple regression equation of the form $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2$.
b. Predict the amount of adhesion when the amount of additive is 40 and the temperature is 130.

P.T.O.

3. What is confidence interval? How will you construct a confidence interval for variance?

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.

SECTION "D"

[4 Q. × 7 = 28 marks]

4. To monitor complex chemical processes, chemical engineers will consider key process indicators, which may be just yield but most often depend on several quantities. Before trying to improve a process, n = 9 measurements were made on a key performance indicator.

123 106 114 128 113 109 120 102 111

Construct a 95% confidence interval for the variance of the population sampled.

5. A randomized-block experiment is run with three treatments and four blocks. The three-treatment means are $\overline{y_{1\bullet}} = 6, \overline{y_{2\bullet}} = 7, and\ \overline{y_{3\bullet}} = 11.$

The total (corrected) sum of squares is

$$220 = \sum_{i=1}^{3} \sum_{j=1}^{b} (y_{ij} - \overline{y_{\bullet\bullet}})^2$$

The analysis of variance (ANOVA) table takes the form

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Treatments Blocks Error		132		
Total	11	220		

a. Fill in all of the missing entries in the analysis table.
b. Conduct the F test for treatments and the F test for blocks. Use $\alpha = 0.05$.

6. Given that simple correlation between X_1 and X_2 is $r_{12} = 0.4$, that between X_1 and X_3 is $r_{13} = 0.6$, and between X_2 and X_3 is $r_{23} = 0.5$. Find

a. $R^2_{1.23}$ b. $r^2_{23.1}$

7. Write short notes on: any two of the following
a. Range chart
b. Test of Hypotheses Concerning Proportion
c. The Sign Test