TM244203M

Reg. No :.....

Name :.....

MASTER'S DEGREE (C.S.S) EXAMINATION, MARCH 2024

2022 ADMISSIONS REGULAR

SEMESTER IV - CORE COURSE Applied Statistics and Data Analytics

ST4C17TM - Statistical Computing II

**Time : 3 Hours** **Maximum Weight : 30**

## Part A

**I. Answer any Five questions. Each question carries 6 weight** **(5x6=30)**

1. a) A public opinion poll surveyed a simple random sample of 1000 voters. Respondents were classified by gender (male or female) and by voting preference (Republican, Democrat, or Independent). Results are shown in the contingency table below.

| Gender | Voting Preferences | | |
|---|---|---|---|
| | Republican | Democrat | Independent |
| Male | 200 | 150 | 50 |
| Female | 250 | 300 | 50 |



Test whether the voting preferences are depending on gender or not?

(b) A sample of size 64 is taken from a population with sample mean 26 and sample variance 49. Another sample of size 36 with sample mean 31 and sample variance 169 is taken from another population. Test the equality of mean of these two populations.

2. Test equality of population means for the following data assuming equal variance using any nonparametric test

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample 1** | 36 | 53 | 23 | 56 | 41 | 15 | 25 | 32 | 42 | 32 | 52 | 38 | 41 | 30 |
| | 47 | 49 | 19 | 51 | 42 | 20 | 19 | 55 | 43 | 51 | 47 | 23 | 25 | 56 |
| **Sample 2** | 43 | 46 | 48 | 43 | 45 | 56 | 54 | 12 | 35 | 51 | 53 | 30 | 36 | 46 |
| | 40 | 50 | 13 | 48 | 39 | 46 | 52 | 41 | 30 | 14 | 53 | 56 | 53 | 45 |

3. Given that $Y_i$, i = 1,2,3,4,5,6 are independent and have a commomn variance $\sigma^2$. Given that $E(Y_1) = E(Y_2) = \theta_1$, $E(Y_3) = E(Y_4) = \theta_2$ and $E(Y_5) = E(Y_6) = \theta_1 + \theta_2$. Obtain the BLUE of $\theta_1$ and $\theta_2$ and an unbiased estimator for $\sigma^2$.

4. Three sides of an equilateral triangle were measured by 5 pupils with the following results. Are there any significance difference between (a) Pupils and (b) the sides of tyriangles

| | Pupils | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | E |

| | | | | | | |
|---|---|---|---|---|---|---|
| Sides | (a) | 5.44 | 5.41 | 5.43 | 5.42 | 5.43 |
| | (b) | 5.43 | 5.41 | 5.42 | 5.43 | 5.44 |
| | (c) | 5.45 | 5.42 | 5.43 | 5.43 | 5.44 |

5. Following average daily gains of 3 lots of animals receiving different rations, the animals are divided in to 8 outcome groups. One animal from each outccome group was randomly assignwed to each ration. Analyse the data.

| Ration | Outcome Groups | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.79 | 1.72 | 1.47 | 1.26 | 1.28 | 1.34 | 1.55 | 1.40 |
| 2 | 1.30 | 1.21 | 1.08 | 1.42 | .95 | 1.26 | 1.14 | 1.31 |
| 3 | 1.47 | 1.37 | 1.15 | 1.22 | 1.48 | 1.31 | 1.27 | 1.40 |

6. Two samples of sizes 15 and 25 from two normal populations $N(\mu_1, \Sigma)$ and $N(\mu_2, \Sigma)$ respectively gave the following.

$\bar{x}_1 = \begin{pmatrix} 16.43 & 12.56 & 14.89 & 9.56 \end{pmatrix}'$ and $\bar{x}_2 = \begin{pmatrix} 14.41 & 10.51 & 13.12 & 8.11 \end{pmatrix}'$

Sum of squares and sum of products

$$\begin{pmatrix} 57.375 & 47.940 & 36.414 & 17.230 \\ & 69.003 & 37.638 & 13.005 \\ & & 59.925 & 13.311 \\ & & & 29.580 \end{pmatrix}$$

(a) Construct the best linear discriminant function.

(b) Classify the observation $\begin{pmatrix} 15.24 & 11.83 & 14.25 & 9.01 \end{pmatrix}$

(c) Test whether only $X_1$ and $X_2$ are sufficient for the purpose of discrimination ($\alpha = 0.05$)

7. The mean vectors and pooled dispersion matrix of two independent random samples each of size 20 taken from two trivariate normal populations are as follows:

$\bar{X}_1$ = (7.9, 5.24, 1.87)', $\bar{X}_2$ = (6.25, 6.13, 2.02)' and $S^2 = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$

If $\mu_0$ = (7, 8.15,9.5)', be the hypothetical mean value, setup the discriminant function and then classify to one of the two populations.

8. Calculate 3 years and 4 years moving average for the following and comment on the trend estimates.

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| No.of students | 15 | 18 | 14 | 20 | 23 | 25 | 29 | 33 | 36 | 40 |

9. Use Beale's method to solve the following QPP.

Max $Z = 2X_1 + 3X_2 - 2X_1^2$

s.t.c., $X_1 + 4X_2 \leq 4$

$X_1 + X_2 \leq 2$

$X_1, X_2 \geq 0$