# GUJARAT TECHNOLOGICAL UNIVERSITY <br> BE - SEMESTER-IV (NEW) EXAMINATION - WINTER 2018 

Subject Code:2141703
Date:22/11/2018
Subject Name:Numerical Techniques \& Statistical Methods
Time: 02:30 PM TO 05:30 PM
Total Marks: 70

## Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
Q. 1 (a) If 0.333 is the approximate value of $1 / 3$, compute the absolute, relative and percentage errors.
(b) Calculate the mean and mode from the following frequency distribution:

| Marks | $0-10$ | $10-20$ | $20-30$ | $30-40$ | $40-50$ | $50-60$ |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| No. of <br> students | 12 | 18 | 27 | 20 | 17 | 6 |

(c) Compute the following system of equations by using Gauss-Sedial method correct up to 4 decimal place.

$$
\begin{align*}
& 10 x_{1}+x_{2}+2 x_{3}=44 \\
& 2 x_{1}+10 x_{2}+x_{3}=51 \\
& x_{1}+2 x_{2}+10 x_{3}=61 \tag{07}
\end{align*}
$$

Q. 2 (a) Use Langrange's formula of interpolation and find $y(9.5)$
given $\mathrm{y}(7)=3, \mathrm{y}(8)=1, \mathrm{y}(9)=1, \mathrm{y}(10)=9$
(b) Evaluate the integral $\int_{0}^{1} \frac{d x}{1+x^{2}}$ by using Trapezoidal rule with $\mathrm{h}=0.2$. Hence obtain an approximate value of Compare the result with the exact value obtained by a formula known from calculus.
(c) Apply Runge-Kutta fourth order method to find an approximate value of $y$ for $x=0.2$ and $x=0.4$ if $\frac{d y}{d x}=\frac{y^{2}-x^{2}}{x^{2}+y^{2}}$, given that where $y(0)=1$

## OR

(c) Using Milne's Predictor-Corrector method to solve the equation $\frac{d y}{d x}=x^{2}+y^{2}$ at $x=0.3$, given that $y(0)=1$.
Q. 3 (a) Find a root of the following equations correct to three decimal places using the method of False position method $x \log _{10} x-1.2=0$
(b) Using Newton's interpolation formula, find the values of $f$ (82) from the following data.

| $x$ | 80 | 85 | 90 | 95 | 100 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $f(x)$ | 5026 | 5674 | 6362 | 7088 | 7854 |



$$
\begin{align*}
& x-y+3 z-3 w=3 \\
& 2 x-3 y+z-11 w=1 \\
& 5 x-2 y+5 z-4 w=5 \\
& 3 x+4 y-7 z+2 w=7 \tag{07}
\end{align*}
$$

## OR

Q. 3 (a) Compute $f(9.2)$ from the given values using Newton's divided difference interpolation formula.

| $\boldsymbol{x}$ | 8.0 | 9.0 | 9.5 | 11.0 |
| :---: | :---: | :---: | :---: | :---: |
| $\boldsymbol{f}(\boldsymbol{x})=\boldsymbol{\operatorname { l o g } \boldsymbol { x }}$ | 2.079442 | 2.197225 | 2.251292 | 2.397895 |

(b) Apply modified Euler's method to the solve initial value problem, y ' $=1-\mathrm{y}$ with $\mathrm{y}(0)=0$. Find $\mathrm{y}(0.2)$ choosing $\mathrm{h}=0.1$
(c) Use Simpson's $1 / 3$ and $3 / 8$ rule to evaluate the following integral $\int_{4}^{5.2} \log _{e} x d x$ and after finding the true value of the integral compare errors in the two cases.
Q. 4 (a) Mathematics problem is given to three student s $\mathrm{A}_{1}, \mathrm{~A}_{2}$ and $\mathrm{A}_{3}$, whose chances of solving it are $1 / 3,2 / 5$ and $3 / 7$. What is the probability that the problem will be solved.
(b) In a normal distribution 31\% of the items are under 45 and $8 \%$ are over 64. Find the parameters of the distribution. $f(t)=\int_{0}^{t} e^{-x^{2} / 2} d x$ then $\mathrm{f}(0.5)=0.19$ and $f(1.4)=0.42$.
(c) Verify whether Poisson distribution can be assumed from the data given:

| No. appeared on <br> dice | Frequencies |
| :--- | :--- |
| 0 | 6 |
| 1 | 13 |
| 2 | 13 |
| 3 | 8 |
| 4 | 4 |
| 5 | 3 |

Using $\chi^{2}-$ test at $5 \%$ level of significance.

| d.f | 1 | 2 | 3 | 4 | 5 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\chi_{0.05}^{2}$ | 3.841 | 5.991 | 7.815 | 9.488 | 11.070 |

## OR

Q. 4 (a) Intelligence tests were given to two groups of boys and girls

|  | Mean | Standard Deviation | Size |
| :---: | :---: | :---: | :---: |
| Girls | 75 | 8 | 60 |
| Boys | 73 | 10 | 100 |

Examine if the difference between mean scores is significant at $5 \%$ level of significance.
(b) Razor blades are supplied by a manufacturing company in packets of 10. There is a probability of 1 in 500 blades to be defective. Using Poisson distribution to

blade, and two defective blade in a consignment of 10,000 packets.
(c) Fit a Binomial distribution for the given data

| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| f | 6 | 20 | 28 | 12 | 8 | 6 | 0 | 0 | 0 | 0 |

Q. 5 (a) A sample of 20 items has mean 42 units and standard deviation 5 units. Test the hypothesis that it is a random sample from a normal population with mean 45 units using t-test at $5 \%$ level of significance.

| d.f | 17 | 18 | 19 | 20 | 21 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $t_{0.05}$ | 2.110 | 2.101 | 2.093 | 2.086 | 2.080 |

(b) The theory predicts the proportion of beans in the four groups $\left(G_{1}, G_{2}, G_{3}\right.$ and $\left.G_{4}\right)$ should be in the ratio 9:3:3:1. In an experiment with 1600 beans the number in the four groups was $882,313,287$ and 118. Dose the experiment result support the theory at $5 \%$ level of significance using $\chi^{2}-$ test .

| d. f | 1 | 2 | 3 | 4 | 5 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\chi_{0.05}^{2}$ | 3.841 | 5.991 | 7.815 | 9.488 | 11.070 |

(c) A project schedule has the following characteristics

| Activity | Time(days) |
| :--- | :--- |
| $1-2$ | 4 |
| $1-3$ | 1 |
| $2-4$ | 1 |
| $3-4$ | 1 |
| $3-5$ | 6 |
| $4-9$ | 5 |
| $5-6$ | 4 |
| $5-7$ | 8 |
| $6-8$ | 1 |
| $7-8$ | 2 |
| $8-10$ | 5 |
| $9-10$ | 7 |

(1) Construct a network diagram.
(2) Determine the critical path and total project duration.
(3) Compute total float and free float for each activity.

## OR

Q. 5 (a) Before an increase in excise duty on tea, 800 persons out of a sample 1000 persons were found to be tea drinkers. After an increase in duty, 800 people were tea drinkers in sample 1200 using standard error of proportion, state whether there is a significant decrease in the consumption of tea after the increase in excise duty. $\quad\left(Z_{0.05}=1.96\right)$
 and those of nine randomly chosen boys $61,62,65,66,69,70,71,72$ and 73 inches. Test whether the girls are taller than boys at $5 \%$ level of significance.

| d. f | 11 | 12 | 13 | 14 | 15 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $t_{0.05}$ | 1.796 | 1.782 | 1.77 | 1.761 | 1.753 |

(c) A project has following time estimates:

| Activity | Estimated durations (days) |  |  |
| :--- | :---: | :---: | :---: |
|  | Optimistic <br> $\left(t_{o}\right)$ | Most likely <br> $\left(t_{m}\right)$ | Pessimistic <br> $\left(t_{p}\right)$ |
| $(1,2)$ | 1 | 1 | 7 |
| $(1,3)$ | 1 | 4 | 7 |
| $(1,4)$ | 2 | 2 | 1 |
| $(2,5)$ | 1 | 1 | 1 |
| $(3,5)$ | 2 | 5 | 14 |
| $(4,6)$ | 2 | 5 | 8 |
| $(5,6)$ | 3 | 6 | 15 |

(a) Draw the project network.
(b) Find the critical path and project duration.
(c) What is the probability that the project will be completed 4 days earlier than expected? $(P(Z=1.33)=0.4082)$

