**Q1**(Compulsory) Define the following terms with suitable examples          [10]
(i) Relative error (ii) Significance Level (iii) Accuracy (iv) Inherent error
(v) Extrapolation.

**Q2** (Compulsory)          [10]
**(a)** Explain Newton Raphson method for finding root of f(x) = 0. Give its graphical representation also. Write the situations which lead to its divergence.
**(b)** The population of a certain town is shown as

| Year | 1961 | 1971 | 1981 | 1991 | 2001 |
|---|---|---|---|---|---|
| Population (in 1000's) | 19.96 | 39.65 | 58.81 | 77.21 | 94.61 |

Estimate the population in the year 1976 and 2003 using Interpolation techniques.

**Or**

**(b)** 1000 students at collage level were graded according to their I.Q. and economic conditions of their homes. Use chi square test to find out whether there is any association between economic condition at home and I.Q. at 5% significance level.

|  | High IQ | Low IQ |
|---|---|---|
| Rich | 460 | 140 |
| Poor | 240 | 160 |

**Q3(a)** Compute the following system of equations by using Gauss-Seidel method
$$10x + y + 2z = 44$$
$$2x + 10y + z = 51$$
$$x + 2y + 10z = 61$$

**(b)** Use Simpson's $\frac{3}{8}$th rule to evaluate $\int_{-0.6}^{0.3} f(x)dx$ from the table given below

| x | -0.6 | -0.5 | -0.4 | -0.3 | -0.2 | -0.1 | 0 | .1 | .2 | .3 |
|---|---|---|---|---|---|---|---|---|---|---|
| y | 4 | 2 | 5 | 3 | -2 | 1 | 6 | 4 | 2 | 8 |

**Or**          [10]

**Q3(a)** Solve the ordinary differential equation to find the approximate value of y(0.2) if $\frac{dy}{dx} = x + y^2, y(0) = 1$ with step size h=0.1 by Runge Kutta's 4th order method.

**(b)** Using False Position Method find the root of the equation $xe^x - 2 = 0$ correct to four decimal places

**Q4(a)** The following table gives the results of the measurement of train resistance; V is the velocity in miles per hour, R is the resistance in pounds per ton

| v | 20 | 40 | 60 | 80 | 100 | 120 |
|---|---|---|---|---|---|---|
| R | 5.5 | 9.1 | 14.9 | 22.8 | 33.3 | 46 |

If R is related to V by the relation $R = a + bv + cv^2$, find the values of a,b,c

**(b)** Apply Lagrange's method to find the value of x when f(x)=15 from the given data

| x | 5 | 6 | 9 | 11 |
|------|----|----|----|----|
| f(x) | 12 | 13 | 14 | 16 |

**Or** [10]

**Q4(a)** In the table given below ,the values of y are consecutive terms of a series of which 23.6 is the $6^{th}$ term. Find the first and the tenth term of the series.

| x | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|-----|-----|------|------|------|------|------|
| y | 4.8 | 8.4 | 14.5 | 23.6 | 36.2 | 52.8 | 73.9 |

**(b)** A set of 5 coins are tossed 3200 times and the number of heads appearing each time is noted .The results are given below:

| No of heads | 0 | 1 | 2 | 3 | 4 | 5 |
|-------------|----|-----|------|-----|-----|----|
| Frequency | 80 | 570 | 1100 | 900 | 500 | 50 |

Using Chi –square test at 5% level of significance, test the hypothesis that the coins are unbiased .

**Q5(a)** The following table gives the marks of a group of 80 students in an examination .Calculate the variance and the standard deviation

| Marks obtained | No. of students | Marks obtained | No. of students |
|----------------|-----------------|----------------|-----------------|
| 10-14 | 2 | 34-38 | 10 |
| 14-18 | 4 | 38-42 | 8 |
| 18-22 | 4 | 42-46 | 4 |
| 22-26 | 8 | 46-50 | 6 |
| 26-30 | 12 | 50-54 | 2 |
| 30-34 | 16 | 54-58 | 4 |

**(b)** Explain the procedure generally followed in testing of a hypothesis. Point out the difference between one tail and two-tail tests.

**Or** [10]

**Q5(a)** Of a large group of men 5 percent are under 60 inches in height and 40 percent are between 60 and 65 inches. Assuming a normal distribution, find the mean height and standard deviation.

**(b)** Assume that a factory has two machines. Past records show that machine 1 produces 30% of the items of output and machine 2 produces 70% of the items. Further 5% of the items produced by machine 1 were defective and only 1% produced by machine 2 were defective. If a defective item is drawn at random, what is the probability that the defective item was produced by machine 1 or machine 2?

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# Kadi Sarva Vishwavidyalaya, Gandhinagar
## MCA Sem-II External Examination, May 2014
## MC 12 – Computer Oriented Numerical and Statistical Methods

Date: 24·5·14      Time: 3 Hours      Total Marks: 50

1. (a) Define the following terms: [05]
   - i. Round-off error
   - ii. Truncation error
   - iii. Inherent error
   - iv. Absolute error
   - v. Relative error

   (b) Find a real root of an equation $f(x) = x^3 - 2x - 5 = 0$ using the method of *regula falsi* correct to four significant figures. [05]

2. (a) Fill in the blanks [06]
   - (i) _____ is the positional measure of central tendency. (Mean, Median, Mode)
   - (ii) The difference between the largest and the smallest data values is _____. (Range, Interquartile range)
   - (iii) $P(A|B) = $ _____, if events $A$ and $B$ are statistically independent. $(0, P(A))$
   - (iv) Standard error of point estimate of the population mean for infinite population is _____. $\left(\sigma, \frac{\sigma}{\sqrt{n}}\right)$
   - (v) A _____ is the set of all the elements of interest under study. (Population, Sample)
   - (vi) _____ occurs if the null hypothesis rejected when it is true. (Type I error, Type II error)

   (b) (i) For the following data, compute the interquartile range [02]

   | 99 | 75 | 84 | 61 | 33 | 45 | 66 | 97 | 69 | 55 |
   |----|----|----|----|----|----|----|----|----|----|

   (ii) Suppose that for the next month the Martin Clothing Store forecasts 1000 customers will enter the store. On the basis of past experience, the store manger estimates the probability that any customer who enters the store will make a purchase is 0.3. What is the expected number of customers who will make purchase? What is the standard deviation for the number of customers who will make a purchase? [02]

   **OR**

   (i) Explain the difference between one tailed test and two tailed test. [02]
   (ii) Explain the properties of t-distribution. [02]

3. (a) From the following table, find $P$ when $t = 142° C$ and $t = 175° C$, using appropriate Newton's interpolation formula. [05]

   | Temp $(t)°C$ | 140 | 150 | 160 | 170 | 180 |
   |--------------|-----|-----|-----|-----|-----|
   | Pressure $(P)$ | 3.685 | 4.854 | 6.302 | 8.076 | 10.225 |

   (b) The following table shows height *(h)* and weight *(w)* of eight persons. [05]

   | h(cm) | 175 | 165 | 160 | 180 | 150 | 170 | 155 | 185 |
   |-------|-----|-----|-----|-----|-----|-----|-----|-----|
   | W(kg) | 68 | 58 | 59 | 71 | 51 | 62 | 53 | 68 |

   Assuming the a linear relationship between the height and weight, find the regression line and estimate the weight of the person with the height 140 cm.

   **OR**

3. (a) Given the following set of data points, use the Lagrange's interpolation technique to estimate the value of $f(3.5)$. [05]

   | i | 0 | 1 | 2 | 3 |
   |---|---|---|---|---|
   | $x_i$ | 2.5 | 3.0 | 4.5 | 4.75 |
   | $f(x_i)$ | 8.85 | 11.45 | 20.66 | 22.85 |

   (b) Solve the following system of linear equations using Gauss elimination method [05]

$$5x_1 + 10x_2 + x_3 = 28$$
$$x_1 + x_2 + x_3 = 6$$
$$4x_1 + 8x_2 + 3x_3 = 29$$

4. (a) Use Gauss-Seidel method to compute the solution of the following system of linear equations [05] until the approximate relative error in the solution falls below the stopping criterion $e_r = 0.005$.

$$30x - 2y + 3z = 75$$
$$2x + 2y + 18z = 30$$
$$x + 17y - 2z = 48$$

(b) The following table gives the velocity of an object at various points in time [05]

| Time(Seconds) | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 |
|---|---|---|---|---|---|
| Velocity(m/sec) | 9.0 | 9.5 | 9.9 | 10.2 | 10.8 |

find the acceleration of the object at time $t = 1.0$ and $t = 1.8$.

OR

4. (a) Evaluate $\int_{0.2}^{1.0} (\sin x - \log x + e^x) dx$ with $h = 0.1$ using simpson's $\frac{1}{3}^{rd}$ rule. [05]

(b) Given the differential equation $\frac{dy}{dx} = \frac{1}{x^2} - \frac{y}{x}$, with $y(1) = 1$, compute $y(1.1), y(1.2)$ and $y(1.3)$ using Runge-Kutta second order method. [05]

5. (a) Compute variance & standard deviation from following data: [05]

| class | 25-34 | 35-44 | 45-54 | 55-64 | 65-74 | 75-84 |
|---|---|---|---|---|---|---|
| Frequency | 2 | 6 | 4 | 4 | 2 | 2 |

(b) Department of social Walfare has recently carried out a socio-economic survey of a village. [05] The information collected is related to the gender of the respondent and level of education (graduation) .1000 respondent were surveyed . The results are presented in the following table:

| Gender | Educational Qualification | | Total |
|---|---|---|---|
| | Undergraduate | Graduate | |
| Male | 150 | 450 | 600 |
| Female | 150 | 250 | 400 |
| Total | 300 | 700 | 1000 |

A respondent has been selected randomly, what are the chances that
   i. A randomly selected respondent will be under graduate?
   ii. A randomly selected respondent will be female?
   iii. A randomly selected the respondent will be Male- graduate?

OR

5. (a) Explain the general procedure of testing the hypothesis in brief. [05]

(b) Based on information on 1000 randomly selected fields about the tenancy status of the [05] cultivation of these fields and use of fertilizers, collected in an agro-economic survey, the following classification were noted :

| | Owned | Rented | Total |
|---|---|---|---|
| Using fertilizers | 416 | 184 | 600 |
| Not using fertilizers | 64 | 336 | 400 |
| Total | 480 | 520 | 1000 |

Would you conclude that owner cultivators are more inclined towards the use of fertilizers at 5% level? Carry out chi-square test for testing procedure.