2020

STATISTICS — HONOURS

Paper : CC-7

(Statistical Computing and Numerical Analysis using C Programming)

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Group - A

1. Answer ***any ten*** from the following : 1×10

(a) Give one real life use of linear interpolation.

(b) Give two C keywords.

(c) Give an example of a transcendental equation.

(d) If $f(x) = 0,\ 1 < x < 3$ has a root $x_0 = 1{\cdot}5$, sketch a graph of $y = f(x)$.

(e) Give an example of a transcendental equation having infinite number of roots.

(f) What is error tolerance in the context of iterative solution of equations?

(g) "Number of iterations increases with the increase in error tolerance in the context of iterative solution of equations"— True or False?

(h) For which type of the function f, you can not apply Newton-Raphson method to solve $f(x) = 0$.

(i) Give an example of a transcendental equation with exactly two roots.

(j) Justify or correct the statement : "C is a machine language".

(k) If π is approximated by 3.1416, find the percentage error.

(l) Give the structure of any binary operator in C.

(m) Which of the following are valid identifiers : (i) sol_p (ii) #sol.pt (iii) sol.p.?

(n) If a number x is rounded to five decimal points giving percentage error of .021%, what is the absolute error?

(o) Give an example of an exit-controlled loop and give the structure.

Group - B

Answer ***any four*** the questions. 5×4

2. What output is obtained, when you execute the following C program block?

```
x = 577.299;
x = x - 1000;
printf ("%6.1f",x);
```

Justify the output and suggest modifications if you expect erorrs.

3. Prove that $f(4)$ can be expressed as $f(3) + \Delta f(2) + \Delta^2 f(1) + \Delta^3 f(1)$.

4. If an operator is defined as $\mu f(x) = \dfrac{\left\{f\left(x-\frac{h}{2}\right)+f\left(x+\frac{h}{2}\right)\right\}}{2}$, h being the interval of differencing, show that the operator is a linear operator.

5. If the first derivative at a point x_k, is approximated by $f(x_k) = [f(x_k + h) - f(x_k - h)]/(2h)$, find the error term up to first order.

6. Given that $f(0) = 1, f(1) = 3, f(3) = 55$, find the Lagrange polynomial of appropriate degree, which fits the given data.

7. Write a program in C to compute the proportion of even numbers among the first 60 natural intergers.

Group - C

Answer ***any two*** questions.

8. (a) Write a program in C to find the proportion of the students with marks in the interval [50, 70], when the marks of 20 students in a class are provided.

(b) Assuming interval of differencing as unity, prove that $(-1)^m B(m + 1, n) = \Delta^m\left(\dfrac{1}{n}\right)$, where m is an integer, $B(.,.)$ is the Beta function with integer arguments. 5+5

9. (a) Write a C program to find the median of any given set of 15 numbers using a function with the data array as argument.

(b) Find the iterative methods based on the Newton-Raphson method for finding e^N, where N is a positive real number. 6+4

10. (a) Write a C function to calculate the mean of n (>100) numbers used for looping structure, where n is not specified.

(b) Describe how Lagrange's interpolation formula can be used to find the approximate root of a given equation. 6+4
