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(July)

MATHEMATICS

(Honours)

(**Computer Programming in C and Computer-Oriented Numerical Analysis**)

(HOPT-62 : OP1)

Marks : 45

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. (a) What special rules that apply to integer constants? 2
- (b) What is an operator? Describe different types of operator that are included in C. 3
- (c) What is the purpose of the putchar function? How is it used within a C program? Compare it with the getchar function. 4

2. (a) What is the purpose of the do-while statement? How does it differ from the while statement? 3

- (b) Describe the output that will be generated by the following C program : 3

```
#include <stdio.h>
main ( )
{
    int i=0, x=0;
    while (i<20) {
        i++;
        if (i % 5==0) {
            x+=i;
            printf ("%d", x);
        }
    }
}
```

- (c) Write an interactive program that will read in a positive integer value and determine if the integer is a prime number. 3

UNIT—II

3. (a) What is a function? Are functions required when writing a C program? 3
- (b) What is recursion? What advantage is there in its use? 3

(3)

- (c) Describe the output generated by the following program : 3

```
# include <stdio.h>
int funct1 (int n);
main ( )
{
    int n=10;
    printf ("%d", funct1 (n));
}
int funct1 (int n)
{
    If (n>0) return (n+funct1 (n-1));
    else return (0);
}
```

4. (a) Describe the output generated by the following program : 4

```
# include <stdio.h>
int funct1 (int);
main ( )
{
    int a, count;
    for (count=1; count<=5; ++ count)
    {
        a=funct1 (count);
        printf ("%d", a);
    }
}
int funct1 (int x)
{
    int y=0;
    y+=x;
    return (y);
}
```

(4)

- (b) Name the four storage-class specifications included in C. 3
- (c) What is the purpose of an automatic variable? What is its scope? 2

UNIT—III

5. (a) In what way does an array differ from an ordinary variable? Summarize the rules for writing a one-dimensional array definition. 1+2=3
- (b) Describe the array that is defined in each of the following statements. Indicate what values are assigned to the individual array elements : 1×3=3
- (i) float c[8]={2., 5., 3., -4., 12., 12., 0., 8.};
- (ii) float c[8]={2., 5., 3., -4.};
- (iii) int z[12]={0, 0, 8, 0, 0, 6};
- (c) When passing an array to a function, how must the array argument be written? How is the corresponding formal argument written? 3
6. (a) What kinds of object can be associated with pointer variables? 2
- (b) How is a pointer variable declared? What is the purpose of the data type included in the declaration? 3

(5)

- (c) Explain the meaning of each of the following declarations : $1 \times 4 = 4$
- (i) `double *funct (double *a, double *b, int *c);`
- (ii) `int *px;`
- (iii) `float a, b; float *pa, *pb;`
- (iv) `char *a[12];`

UNIT—IV

7. (a) Using Newton's backward interpolation, compute $y(17)$ from the following data : 5
- | | | | | | | |
|-----|------|----|------|----|------|------|
| x | : 8 | 10 | 12 | 14 | 16 | 18 |
| y | : 10 | 19 | 32.5 | 54 | 89.5 | 15.4 |
- (b) Use trapezoidal rule to evaluate $\int_0^1 \frac{\sin x}{(1-x)} dx$, by taking $n = 4$. 4
8. (a) Construct the divided difference table for the data :
- | | | | | | | |
|--------|---------|-------|------|-------|---------|-------|
| x | : 0.5 | 1.5 | 3.0 | 5.0 | 6.5 | 8.0 |
| $f(x)$ | : 1.625 | 5.875 | 31.0 | 131.0 | 282.125 | 521.0 |
- Hence, find the interpolating polynomial and an approximation to the value of $f(7)$. 5

(6)

- (b) Describe the floating-point representation of numbers. Give examples to explain the arithmetic operations with normalized floating-point number. $2+2=4$

UNIT—V

9. (a) Use secant method to find the root of the equation $f(x) = 3x \sin x - e^x = 0$ to five decimal places. Use $x_0 = 0$ and $x_1 = 1$. Perform 3 iterations. $4\frac{1}{2}$
- (b) Solve the ordinary differential equation $3 \frac{dy}{dx} - xy^2 = \sin x$, $y(0) = 5$ by any Runge-Kutta 2nd-order method. $4\frac{1}{2}$
10. (a) Given $\frac{dy}{dx} = \frac{y}{x} - \frac{x}{y}$ with initial condition $y = 1$ at $x = 0$, find y for $x = 0.1$ by Euler's method. Take $h = 0.05$. $4\frac{1}{2}$
- (b) Find a positive root of $x^4 - x = 10$ using Newton-Raphson method. $4\frac{1}{2}$

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