2008 XE

EE24BTECH11020 - Ellanti Rohith

1) The solution of the first-order differential equation $(0 \leq x < 1)$

$$\frac{dy}{dx} - y^2 = 0, \;\; y(0) = 1 \text{ is:}$$

[GATE 2008]

a) $\frac{1}{1+x}$ b) $\frac{1}{1-x}$ c) $\frac{2}{2+x}$ d) $\frac{x^3}{3} + 1$

2) For the initial value problem

$$\frac{dy}{dx} + y = 0, \;\; y(0) = 1,$$

y_1 is the computed value of y at $x = 0.2$ obtained by using Euler's method with step size $h = 0.1$. Then, [GATE 2008]

a) $y_1 < e^{-0.2}$
b) $e^{-0.2} < y_1 < 1$
c) $1 < y_1$
d) $y_1 = e^{-0.2}$

3) Consider the initial value problem

$$\frac{dy}{dx} = y + x, \;\; y(0) = 2 \;.$$

The value of y_1 obtained using the fourth order Runge-Kutta method with step size $h = 0.1$ is[GATE 2008]

a) 2.20000   b) 2.21500   c) 2.21551   d) 2.21576

4) The following table gives a function $f(x)$ vs x:

x	0	1	2	3	4
$f(x)$	1.0	3.7	6.5	9.3	12.1

The best fit of a straight line for the above data points, using a least square error method is: [GATE 2008]

a) $2.75x + 0.55$ b) $2.80x + 0.80$ c) $3.10x + 0.85$ d) $2.78x + 0.96$

5) Consider the following part of a Fortran 90 function:

```
INTEGER FUNCTION RESULT(X)
    INTEGER:: X
    VALUE = 1
    DO
        IF (X == 0) EXIT
        TERM = MOD (X,10)
        VALUE = VALUE*TERM
        X = X/10
    END DO
```

```
    RESULT = VALUE
END FUNCTION RESULT
```

If the above function is called with an integer X = 123, the value returned by the function will be: [GATE 2008]

a) 0 b) 6 c) 9 d) 321

6) A portion of a Fortran 90 program is reproduced below:

```
PROGRAM CHECK_CYCLE
    DO I = 1, 10, 2
        IF (MOD(I, 3) == 0) CYCLE
        PRINT *, I
    END DO
END PROGRAM CHECK_CYCLE
```

The result displayed by the program is: [GATE 2008]

a) 1
5
7

b) 1
3
5

c) 1
3
7

d) 3
5
7

7) (P), (Q), (R) and (S) are separate segments of Fortran 90 code.

```
(P) IF (A > B) P = Q

(Q) SUBROUTINE SWAP(A, B)
    INTEGER, INTENT(IN) :: A, B
    TEMP = A
    A = B
    B = TEMP
    END SUBROUTINE SWAP

(R) IF (A /= B) X = Y - Z
    ELSE
    X = Y + Z
    ENDIF

(S) DO I = 1, N, 3
    C(I) = A(I) + B(I)
    END DO
```

Which segments have syntax errors? [GATE 2008]

a) P, Q b) Q, R c) R, S d) P, S

8) A Fortran-90 subroutine for the Gauss-Seidel Method to solve a set of N simultaneous equations $[A][X] = [C]$ is given below:

```
SUBROUTINE SIEDEL(A, C, X, N, IMAX)
REAL :: SUM
REAL, DIMENSION(N,N) :: A
REAL, DIMENSION(N) :: C, X
DO K = 1, IMAX
```

```
        DO I = 1, N
            SUM = 0.0
            DO J = 1, N
                IF (I /= J) THEN
                    SUM = SUM + A(I,J)*X(J)
                ENDIF
            ENDDO
            ******
        ENDDO
    ENDDO
    END SUBROUTINE SIEDEL
```

The missing statement in the program, indicated by ‘******‘, is: [GATE 2008]

a) $X(I) = C(I) + SUM$ b) $X(I) = C(I) + SUM$ c) $X(I) = \frac{C(I)+SUM}{A(I,I)}$ d) $X(I) = \frac{C(I)-SUM}{A(I,I)}$

9) What is the result of the following C program?

```
int main()
{
    int  i, sum=0;
    for (i = 0; i < 25; i++) {
        if (i > 10) continue;
        sum += i;
    }
    printf("%d\n",sum);
    return 1;
}
```

[GATE 2008]

a) 25 b) 45 c) 55 d) 325

10) Consider the following C code:

```
int x = 1, y = 5, z;
z = x++<<--y;
```

The values of x, y, and z after the execution are: [GATE 2008]

a) $2, 4, 16$ b) $2, 4, 32$ c) $2, 4, 64$ d) $1, 5, 32$

11) A two-dimensional array is declared as `int num[3][3]`. Then the result of the expression `*(num+1)` is: [GATE 2008]

a) The value of `num[1][0]`
b) The value of `num[0][1]`
c) The address of `num[1][0]`
d) The address of `num[0][1]`

12) A C function named `func` is defined as follows:

```
int func(int a, int b)  {
    if (  (a == 1)||(b == 0)||(a == b) ) return 1;
    return func(a-1,b) + func(a-1,b-1);
}
```

What is the result of `func(4, 2)`? [GATE 2008]

a) 12 b) 6 c) 3 d) 1

Common Data for Questions 29 and 30 The following table gives the values of a function $f(x)$ at three discrete points.

x	0.5	0.6	0.7
$f(x)$	0.4794	0.5646	0.6442

[GATE 2008]

13) The value of $f'(x)$ at $x = 0.5$ accurate up to two decimal places, is

a) 0.82 b) 0.85 c) 0.88 d) 0.91

14) The value of $f(x)$ at $x = 0.55$ obtained using Newton's interpolation formula, is

a) 0.5626 b) 0.5227 c) 0.4847 d) 0.4749

Linked Answer Questions: Q.31 to Q.34 carry two marks each.
A modified Newton-Raphson method is used to find the roots of an equation $f(x) = 0$ which has multiple zeros at some point $x = p$ in the interval $[a, b]$. If the multiplicity M of the root is known in advance, an iterative procedure for determining p_{k+1} is given by

$$p_{k+1} = p_k - M\frac{f(p_k)}{f'(p_k)} \quad \text{for} \quad k = 0, 1, 2, \ldots$$

[GATE 2008]

15) The equation $f(x) = x^3 - 1.8x^2 - 1.35x + 2.7 = 0$ is known to have a multiple root in the interval $[1, 2]$. Starting with an initial guess $x_0 = 1.0$ in the modified Newton-Raphson method, the root, correct up to three decimal places, is

a) 1.500 b) 1.200 c) 1.578 d) 1.495

16) The root of the derivative of $f(x)$ in the same interval is

a) 1.500 b) 1.200 c) 1.578 d) 1.495

Statement for Linked Answer Questions 33 and 34:
The values of a function $f(x)$ at four discrete points are as follows:

x	0	1	3	4
$f(x)$	-12	0	6	12

17) The function may be represented by a polynomial $P(x) = (x - a)R(x)$, where $R(x)$ is a polynomial of degree 2, obtained by Lagrange's interpolation and a is a real constant. The polynomial $R(x)$ is

a) $x^2 + 6x + 12$ b) $x^2 + 6x - 12$ c) $x^2 - 6x - 12$ d) $x^2 - 6x + 12$