



Name :

Roll No. :

Invigilator's Signature :

**CS/MBIN/SEM-3/MBIN-302/2009-10
2009**

**C. PROGRAMMING & NUMERICAL METHODS &
STOCHASTIC MODELS**

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

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

Answer all questions.

GROUP – A

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) The statement 'continue' in C causes
 - a) an immediate jump out of the loop containing it
 - b) nothing, it is used when no executive statement is needed but the syntax demands one
 - c) an immediate jump out of all the nested loops
 - d) an immediate stop of the present cycle of the loop and continuation for the next cycle of the loop.
- ii) Which one of the following is not a valid variable name ?
 - a) raw_input
 - b) la
 - c) al
 - d) Typedef.



- iii) A static variable declared inside a function is
- a) accessible in the function only but alive throughout the program
 - b) accessible in the file containing the function but alive only during the function call
 - c) accessible only in the function and alive only during function call.
 - d) accessible anywhere in the program but its value one assigned cannot be changed.
- iv) `int *x; float *y; int u; float v;` then
- a) `sizeof (y) > sizeof (x)`
 - b) `sizeof (x) = sizeof (u)`
 - c) `sizeof (y) = sizeof (v)`
 - d) `sizeof (u) = sizeof (v)`.
- v) `char s[] = "Molecular Biology"`
- then `printf (“ %9s”, s)` will print
- a) Molecular
 - b) r Biology
 - c) run-time error
 - d) Molecular Biology.



- vi) Add a statement in the function cphandle () such that the address of x gets stored in i

```
#include <stdio.h>

void cphandle ( int ** );

void main ( )
{
    int *i;

    cphandle ( &i );
}

void cphandle ( int **k )
{
    int a = 10;

    /* add statement here */
}
```

- a) *k = &a;
 - b) *k = a;
 - c) k = **a;
 - d) k = &&a;
- vii) In a statement p + fopen (" data", " r"); p is
- a) an integer variable
 - b) a character variable
 - c) a file pointer
 - d) an integer pointer.



- viii) In order to use the function `rand ()` one must include
- a) `stdio.h`
 - b) `stdrandom.h`
 - c) `stdlib.h`
 - d) `stdsys.h`
- ix) In order to solve a system of inhomogeneous linear equations a Gaussian elimination method
- a) is prone to large truncation error
 - b) gives low round off error if maximal pivoting is adopted
 - c) gives low round off error if partial pivoting is adopted
 - d) is not applicable.
- x) If the initial guess values for the roots of the function $x^2 - 1$ by bisection method is -1.5 and 0 then the root obtained is
- a) 1
 - b) -1
 - c) 0
 - d) roots are not bracketed.
- xi) A function's value is known at some given sampling points but the closed form expression is not available. Which one of the following methods would you choose to integrate the function over the sampling range ?
- a) Simpson's one-third rule
 - b) Monte Carlo method
 - c) Trapezoidal method with Romberg correction
 - d) Trapezoidal method.



- xii) The order of the error, in integration per step (size h) by 4th order Runge-Kutta method of ordinary differential equation, is
- equal to h^4
 - less than h^4
 - greater than h^4
 - $4h$.
- xiii) If a non-singular matrix is brought to an upper triangular form by Naïve Gaussian elimination then the determinant of the matrix after triangulation is
- same as that of the original matrix
 - $(-1)^{2n}$ times that of the original matrix, where n = number of rows of the matrix.
 - $(-1)^n$ times that of the original matrix, where n = number of rows of the matrix.
 - is less than that of the original matrix.

GROUP – B

2. Answer any *one* of the following questions : $1 \times 10 = 10$
- Derive the Composite formula of Simpson's 1/3 rule of numerical integration.
 - Explain the algorithm of Monte Carlo integration.
 - Explain why pivoting is necessary in Gauss Jordan Elimination. Differentiate between maximal pivoting and partial pivoting. Site two specific applications of these two techniques.



3. Find out the error in any *two* of the following programs :

$$2 \times 10 = 20$$

- a) The following program is intended to read a float matrix (elements are less than 1.0), find the largest element in the matrix and to bring back this element to the first column of the first row by row exchange and then by column exchange.

However, the program does not work because of two syntax errors and one logical error. Find the errors.

```
#include <stdio.h>
#include <stdlib.h>
void main ( )
{
    int n = 3, i, j;
    float a [ 3 ] [ 3 ];
    void pivot ( float [ ] [ ],int );
    for ( i = 0;i<3; i++ )
    {
        for ( j=0;j<3; j++ )
        {
            scanf(“ %f”, a[i] [j]);
        }
    }
    for ( i=0;i<3; i++ )
    {
        printf(“\n”);
        for (j=0;j<3; j++)
        {
            printf(“%f\t”,a[i] [j]);
        }
    }
}
```



```
pivot (a,n);
for (i=0;i<3; i++)
{
    printf("\n");
    for (j=0;j<3; j++ )
    {
        printf("%f\t",a[i] [j]);
    }
}

void pivot ( float a [ ] [3],int n)
{
    inti,j, im=0, jm=0;
    float maxval=100.;
    float temp;
    for (i=0;i<n; i++)
        for (j=0;j<n; j++)
        {
            if (a[i] [j] > maxval)
            {
                maxval=a[i] [j];
                im=i;
                jm=j;
            }
        }
}

printf("im=%d\t,jm=%d\t,maxval=%f\n",im,jm, maxval);
for (j=0;j<n; j++)
```



```

{
    temp=a[0] [j];
    a[0] [j]=l[im] [j];
    a[im] [j]=temp;
}
for (i=0;i<n; i++)
{
    temp=a[i] [0];
    a[i] [0]=l[i] [jm];
    a[i] [jm]=temp;
}
}

```

- b) The following program is intended to read numbers from stdin and store them in an array and then display and sum them using explicit pointer notation. However, there are one run time error, two logical errors and one syntax error in the program.

```

#include <stdio.h>
main ( )
{
    int *p, sum, i,jp
    char ans;
    i=0;
    printf (" enter any integer number\n" );
    do
    {
        scanf ("%d",p);
        i++; p++;
        printf("do you want to add more numbers ? y/n\n");
        scanf ( "%c", & ans );
    }
}

```



```

} while ( ans='y' );
sum = 0;
p=p-i;
for (j=0; j <=i; j++)
{
    printf ("%d-th element of the array is %d",j,p);
    sum=sum+p;
    p++;
}
printf ("sum=%d", sum);
}

```

- c) This program implements the string method strip () of python in c. It reads a string and removes extra white spaces between the words and at the tail of the line.

However there are three syntax errors and one logical error.

```

#include <stdio.h>
#include <string.h>
void main ( )
{
    char x[100];
    printf("\n enter a string : ");
    gets(x);
    strip(x);
    printf("%s",x);
}
void strip ( char a )

```



```
{
    int i,n,j;
    n=strlen(a);
    for (i=0; i<n; i++ )
    {
        if (a[i] == ' ' && a[i+1] == ' ' | | a[i+1]=='\0')
        {
            for (j=i;j<n; j++)
            {
                a[j]=a[j+1];
            }
        }
    }
}
```

GROUP – C

4. Write any *three* of the following program in C : $3 \times 10 = 30$
- Write a function which accepts a float array and finds the value and the location of the highest element of the array. Write a main () which reads some floating point numbers from a file till the end of file and stores them in an array. Call function *max*. Use *max* in main () to implement selection sort of this array.
 - Write a program which a reads numbers from a file till the end of the file. Assume that the file contains a few numbers each repeating several times. Output the number of occurrence of each distinct value and hence the mode of the numbers.



- c) Implement scant method of root searching of an algebraic equation.
- d) Write a function which accepts an array and calculates the differentiation of this array by central differentiation rule. Write a main () which reads some floating point numbers from a file till the end of file and stores them in an array. Call the first function from the main () to calculate the 2nd derivative of the array. You may assume periodic boundary conditions both for the array and its derivative.
- e) Implement Euler's method of solving ordinary differential equation of a single variable with trapezoidal correction.
- f) Write a program which accepts two strings of equal length. Implement a crossover between these two strings about a randomly selected location.

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