# Week 11 : Assignment 11

***1 )***

Interpolation provides a mean for estimating functions

a) At the beginning points

b) At the ending points

c) At the intermediate points

d) None of the mentioned

a) Option (a)
b) Option (b)
c) Option (c)
d) Option (d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
*c) Option (c)*

***2)***

To solve a differential equation using Runge-Kutta method, necessary inputs from user to the algorithm is/are

a) the differential equation dy/dx in the form x and y

b) the step size based on which the iterations are executed.

c) the initial value of y.

d) all the above

a) Option (a)
b) Option (b)
c) Option (c)
d) Option (d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
*d) Option (d)*

***3)***

A Lagrange polynomial passes through three data points as given below

| $x$ | 5 | 10 | 15 |
|---|---|---|---|
| $f(x)$ | 15.35 | 9.63 | 3.74 |

The polynomial is determined as $f(x) = L_0(x).(15.35) + L_1(x).(9.63) + L_2(x).(3.74)$

The value of $f(x)$ at $x = 7$ is

a) 12.78
b) 13.08

c) 14.12
d) 11.36

Yes, the answer is correct.
Score: 1

Accepted Answers:
*b) 13.08*

***4)***

The value of $\int_0^{3.2} xe^x dx$ by using one segment trapezoidal rule is
a) 172.7
b) 125.6
c) 136.2
d) 142.8

a) Option (a)
b) Option (b)
c) Option (c)
d) Option (d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
*b) Option (b)*

***5)***

Accuracy of the trapezoidal rule increases when
a) integration is carried out for sufficiently large range
b) instead of trapezoid, we take rectangular approximation function
c) number of segments are increased
d) integration is performedfor only integer range

a) Option (a)
b) Option (b)
c) Option (c)
d) Option (d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
*c) Option (c)*

***6)***

Solve the ordinary differential equation below using Runge-Kutta4th order method. Step size h=0.2.

$$5\frac{dy}{dx} + xy^3 = \cos(x), y(0) = 3$$

The value of y(0.2) is (upto two decimal points)

a) 2.86
b) 2.93

c) 3.13
d) 3.08

No, the answer is incorrect.
Score: 0

Accepted Answers:
*b) 2.93*

***7)***

Match the following

| | |
|---|---|
| A. Newton Method | 1. Integration |
| B. Lagrange Polynomial | 2. Root finding |
| C. Trapezoidal Method | 3. Differential Equation |
| D. RungeKutta Method | 4. Interpolation |

a) A-2, B-4, C-1, D-3
b) A-3, B-1, C-2, D-4
c) A-1, B-4, C-3, D-2
d) A-2, B-3, C-4, D-1

a) Option (a)
b) Option (b)
c) Option (c)
d) Option (d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
*a) Option (a)*

***8)***

The value of $\int_1^3 e^x(\ln x)\, dx$ calculated using the Trapezoidal rule with five subintervals is (* range is given in output rather than single value to avoid approximation error)

a) 12.56 to 12.92
b) 13.12 to 13.66
c) 14.24 to 14.58
d) 15.13 to 15.45

a) Option (a)
b) Option (b)
c) Option (c)
d) Option (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
*c) Option (c)*

***9)***

Consider the same recursive C function that takes two arguments

```
unsignedintfunc(unsigned int n, unsigned int r)
{
 if (n  > 0) return (n%r +  func (n/r, r ));
 else return 0;
}
```

What is the return value of the function foo when it is called as func(513, 2)?

a) 9
b) 8
c) 5
d) 2

Yes, the answer is correct.
Score: 1

Accepted Answers:
*d) 2*

***10)***

What is the output?

```
#include <stdio.h>
int fun(int n)
{
if (n == 4)
return n;
else return 2*fun(n+1);
}
int main()
{
printf("%d ", fun(2));
return 0;
}
```

a) 4
b) 8
c) 16
d) Error

Yes, the answer is correct.
Score: 1

Accepted Answers:
*c) 16*

# Week 11 : Programming Assignment 1

The velocity of a car at different time instant is given as

| Time (t) | 10 | 15 | 18 | 22 | 30 |
|---|---|---|---|---|---|
| Velocity $v(t)$ | 22 | 26 | 35 | 48 | 68 |

A linear Lagrange interpolant is found using these data points. Write a C program to find the velocity of the car at different time instants. (Taken from test cases)

| Private Test cases used for evaluation | Input | Expected Output | Actual Output | Status |
|---|---|---|---|---|
| Test Case 1 | 20 | The respective value of the variable v is: 41.62 | The respective value of the variable v is: 41.62 | Passed |

**Assignment submitted on 2023-10-04, 12:53 IST**

Your last recorded submission was :

```c
#include<stdio.h>
int main()
{
  float t[100]={10,15,18,22,30}, v[100]={22,26,35,48,68};
  float a; //Value of the t to find the respective value of v(t)
  scanf("%f", &a);  // This will be taken from test cases
double k = 0.0;


    for (int i = 0; i < 5; i++) {
        double term = v[i];
        for (int j = 0; j < 5; j++) {
            if (j != i) {
                term *= (a - t[j]) / (t[i] - t[j]);
            }
        }
        k += term;
    }

printf("The respective value of the variable v is: %.2f", k);
  return 0;
}
```

# Week 11 : Programming Assignment 3

Write a C program to solve the following differential equation using Runge-Kutta method. Step size h=0.3

$$10\frac{dy}{dx} + 3y^3 = x(x+1), y(0.3) = 5$$

Find $y(x)$ for different values of $x$ as given in the test cases.

| | Input | Output |
|---|---|---|
| Test Case 1 | 0.6 | y=3.231255 |
| Test Case 2 | 1 | y=1.468128 |
| Test Case 3 | 0.9 | y=1.777165 |
| Test Case 4 | 1.2 | y=1.468128 |

```c
#include<stdio.h>
float func(float x,float y);
int main()
{
    float m1,m2,m3,m4,m,h=0.3;
    float x0 = 0.3, y0 = 5, xn;
    scanf("%f",&xn); //xn will be taken from test cases


//Use the printf statement as: printf("y=%f",y);
while(x0<xn)
    {
        m1=func(x0,y0);
        m2=func((x0+h/2.0),(y0+m1*h/2));
        m3=func((x0+h/2.0),(y0+m2*h/2));
        m4=func((x0+h),(y0+m3*h));
        m=((m1+2*m2+2*m3+m4)/6);
        y0=y0+m*h;
        x0=x0+h;
    }
    printf("y=%f",y0);  // Final output
    return 0;
}
float func(float x,float y)
{
    float m;
    m=(x*(x+1)-3*y*y*y)/10;
    return m;
}
```

# Week 11 : Programming Assignment 4

Write a C program to check whether the given input number is Prime number or not using recursion. So, the input is an integer and output should print whether the integer is prime or not.

Note that you have to use recursion.

Sample Test Cases

| | Input | Output |
|---|---|---|
| Test Case 1 | 51 | 51 is not a prime number |
| Test Case 2 | 29 | 29 is a prime number |
| Test Case 3 | 13 | 13 is a prime number |
| Test Case 4 | 40 | 40 is not a prime number |

```c
#include <stdio.h>
int checkPrime(int, int); //Function to check prime or not

int main()
{
    int num, check;
    scanf("%d", &num); //The number is taken from test case data
    check = checkPrime(num, num/2);
    if (check == 1)
    {
        printf("%d is a prime number\n", num);
    }
    else
    {
        printf("%d is not a prime number\n", num);
    }
    return 0;
}
int checkPrime(int num, int i)
{
    if (i == 1)
    {
        return 1;
    }
    else
    {
       if (num % i == 0)
       {
         return 0;
       }
       else
       {
         return checkPrime(num, i - 1);
       }
    }
}
```