DIVISION / ROLL NO.: D2A/55

Vivekanand Education Society's Institute of Technology

(Academic Year 2020-2021)

Subject: Engineering Mathematics- II

Semester: II

TUTORIAL/SCILAB COVER PAGE

TUTORIAL /SCILAB NO :- 2

TUTORIAL TOPIC:- NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

DATE OF PERFORMANCE/SUBMISSION :- 05/07/2021

NAME OF THE STUDENT: - SHREYAS ARUN SAWANT

SIGNATURE OF TEACHER: - ______________________________

Division: D2A Roll No: 55

Name: Shreyas Arun Sawant

A.Y.: 2020-2021

SCI LAB PRACTICAL 1: MODIFIED EULER'S METHOD

QUESTION: Using suitable loop, write a sci-lab program to obtain approximate solution of y using Modified Euler's Method (Correct up to five decimal places).

6) $\frac{dy}{dx} = -xy^2; y(0) = 2 \; for \; x = 0.2 \; with \; h = 0.1$ *(Roll. No: 51-60)*

INPUT CODE:

```
clc;
deff('[d]=f(x,y)','d=-x*y^2');
x0=input("Enter intial value of x0: ")
y0=input("Enter intial value of y0: ")
h=input("Enter intial value of h: ")
xn=input("Enter intial value of xn: ")
n=input("Enter number of iterations for y: ")
for i=1:n
   disp('Step= ');disp(i);
   x(i)=x0+h;
   y(i)=y0+h*(f(x0,y0));
   disp('At x= ',x(i));
   disp('Euler solution y= ',y(i));
   disp('Modified solution y= ');

    for j=1:n;
       y(j)= y0+h/2*(f(x0,y0)+f(x(i),y(i)));
       disp(y(j));
       y(i)=y(j);
    end
   disp("________________________________________");
 if x(i)==xn then
 break;
 else x0 = x(i)
 y0 = y(i);
end
end
```

OUTPUT:

Enter intial value of x0: 0

Enter intial value of y0: 2

Enter intial value of h: 0.1

Enter intial value of xn: 0.2

Enter number of iterations for y: 5

"Step= "

1.

"At x= "

0.1

"Euler solution y= "

2.

"Modified solution y= "

1.98

1.980398

1.9803901

1.9803903

1.9803903

"____"

"Step= "

2.

"At x= "

0.2

"Euler solution y= "

1.9411708

"Modified solution y= "

1.9230991

1.9237974

1.9237706

1.9237716

1.9237716

"____"

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SCI LAB PRACTICAL 2: RUNGE-KUTTA METHOD OF FOURTH ORDER

QUESTION: Using suitable loop, write a sci-lab program to obtain approximate solution of y using Runge-Kutta method of order four Method (Correct up to five decimal places).

6) $\frac{dy}{dx} = 2 + \sqrt{xy}$ *; y(1) = 1 for x = 2 with h = 0.5* *(Roll. No: 51-60)*

INPUT CODE:

```
clc;
deff('g=f(x,y)','g=2+((x*y)^0.5)')
x0 = input("Enter x0 : ")
y0 = input("Enter y0 : ")
xn = input("Enter xn : ")
h = input("Enter h : ")

disp("x0 = ", x0)
disp("y0 = ", y0)
disp("xn = ", xn)
disp("h = ", h)
n = ((xn - x0)/h) y(1) = y0
x(1) = x0

i = 1
while i < (n+1)
disp("Iteration No. ", i)
k1 = h*f(x(i),y(i))
disp(" k1 = ", k1)
k2 = h*f(x(i)+(h/2),y(i)+ (k1/2)) disp(" k2 =
", k2)
k3 = h*f(x(i)+(h/2),y(i) + (k2/2)) disp(" k3 =
", k3)
k4 = h*f(x(i)+h,y(i)+k3)
disp(" k4 = ", k4)
y(i+1) = y(i)+(1/6)*(k1+2*k2+2*k3+k4)
x(i+1) = x(i)+h
disp(" y = ", y(i+1), " at x = ", x(i+1))

   i = i+1
end
```

OUTPUT:

```
"x0 = "

 1.

"y0 = "

 1.

"xn = "

 2.

"h = "

 0.5

"Iteration No. "

 1.

" k1 = "

 1.5

" k2 = "

 1.7395100

" k3 = "

 1.7643942

" k4 = "

 2.0181590

" y = "

 2.7543279

" at x = "

 1.5

"Iteration No. "

 2.
```

" k1 = "

2.0163036

" k2 = "

2.2829984

" k3 = "

2.3055360

" k4 = "

2.5905760

" y = "

5.0516526

" at x = "

2.

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SCI LAB PRACTICAL 3: SIMPSON'S 1/3rd METHOD

QUESTION: Using suitable loop, write a sci-lab program to obtain approximate value of integral using Simpson's 1/3rd rule(Correct up to five decimal places).

6) $\int_0^1 \frac{1}{1+5x} dx$ by dividing intervals into 8 subintervals. (Roll. No: 51-60)

INPUT CODE:

```
clc;
deff ("g=f(x,y)", "g=1/(1+(5*x))")
a = input("Enter lower limit : ")
b = input("Enter upper limit : ")
n = input("Enter number of intervals : ")
h = (b-a)/n
X = 0
E = 0
O = 0
disp("x             y")
for i = 0:n
x = a + i*h
y = f(x)
disp([x y])
if (i == 0)| (i == n) then X = X+y
else if (modulo(i, 2) == 0) then E = E+y
else
O = O+y
end
if x == b
     break
    end
    end
end
disp("Sum of extreme ordinates : ", X)
disp("Sum of even ordinates : ", E)
disp("Sum of odd ordinate : ", O)
I = (h/3)*(X + 2*E + 4*O)
disp("Intergration by Simpsons one-third rule is : I = (h/3)*[(sum of extreme ordinates) + 2(sum of oeven ordinates) + 4*(sum of odd ordinates)]")
disp("I = ", I)
```

OUTPUT:

Enter lower limit : 0

Enter upper limit : 1

Enter number of intervals : 8

```
  "x  y"

   0.    1.

   0.125   0.6153846

   0.25   0.4444444

   0.375   0.3478261

   0.5   0.2857143

   0.625   0.2424242

   0.75   0.2105263

   0.875   0.1860465

   1.   0.1666667

  "Sum of extreme ordinates : "

   1.1666667

  "Sum of even ordinates : "

   0.9406850

  "Sum of odd ordinate : "

   1.3916815

  "Intergration by Simpsons one-third rule is : I = (h/3)*[(sum of extreme ordinates) + 2(sum of oeven ordinates) + 4*(sum of odd ordinates)]"

  "I = "

   0.3589484
```

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SCI LAB PRACTICAL 4: SIMPSON'S 3/8th METHOD

QUESTION: Using suitable loop, write a sci-lab program to obtain approximate value of integral using Simpson's 3/8th rule (Correct up to five decimal places).

6) $\int_0^1 e^{-2x}\,dx$ by dividing intervals into 9 subintervals. (Roll. No: 51-60)

INPUT CODE:

```
clc;
deff ("g=f(x,y)", "g=((%e)^(-2*x))")
a = input("Enter lower limit : ")
b = input("Enter upper limit : ")
n = input("Enter number of intervals : ")
h = (b-a)/n
X = 0
T = 0
R = 0
disp("x            y")
for i = 0:n
x = a + i*h
y = f(x)
disp([x y])
if (i == 0)| (i == n) then X = X+y
else if (modulo(i, 3) == 0) then T = T+y
else
R = R+y
end
if x == b
   break
   end
   end
end
disp("Sum of extreme ordinates : ", X)
disp("Sum of multiple-of-three ordinates : ", T)
disp("Sum of remaining ordinate : ", R)
I = (3*h/8)*(X + 2*T + 3*R)
disp("Intergration by Simpsons one-third rule is : I = (3*h/8)*[(sum of extreme ordinates) + 2(sum of multiple-of-three ordinates) + 3*(sum of remaining ordinates)]")
disp("I = ", I)
```

OUTPUT:

Enter lower limit : 0

Enter upper limit : 1

Enter number of intervals : 9

```
  "x  y"

   0.   1.

   0.1111111   0.8007374

   0.2222222   0.6411804

   0.3333333   0.5134171

   0.4444444   0.4111123

   0.5555556   0.329193

   0.6666667   0.2635971

   0.7777778   0.2110721

   0.8888889   0.1690133

   1.   0.1353353

  "Sum of extreme ordinates : "

   1.1353353

  "Sum of multiple-of-three ordinates : "

   0.7770143

  "Sum of remaining ordinate : "

   2.5623085
```

"Intergration by Simpsons one-third rule is : I = (3*h/8)*[(sum of extreme ordinates) + 2(sum of multiple-of-three ordinates) + 3*(sum of remaining ordinates)]"

```
  "I = "

   0.4323454
```