Universidade Federal de Viçosa - Florestal
Ciências da Computação

Atividade Prática 03 – Cálculo Numérico

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Florestal
2022

1. **Código em Python**

```
#deve ser rodado em python 3.10 ou superior
import math


def trapezio(a , b, n):
    if n < 0 or n % 2 != 0:
        raise ValueError("ERROR")
    h = (b - a) / n
    soma = 0
    for k in range(1,n):
        soma += f(a + k * h)
    soma *= 2
    soma += (f(a)+ f(b))
    return (h/2)*soma

def simpson(a,b,n):
    if n < 0 or n % 2 != 0:
        raise ValueError("ERROR")
    h=(b-a)/n
    soma_odd, soma_even = 0 ,0
    for k in range(1,n,2):
        soma_odd += f(a + k * h)
    for k in range(2, n, 2):
        soma_even += f(a + k * h)
    return (h/3) * (f(a) + 4 * soma_odd + 2*soma_even + f(b))

def Euler(x0,y0, h, n):
    for k in range(n):
        y0 += h * g(x0, y0)
        x0 += h
        print("x", k+1,"=",x0," y",k+1,"=",y0)

def g(x,y):
    return x + y

def f(x):
    return math.exp(-x ** 2)

print("""Escolha:
      [1]. Integral utilizando trapezio
      [2]. Integral utilizando simpson
      [3]. EDO com metodo de Euler
      """)
escolha = int(input())
```

```
match escolha:
    case(1):
        print("digite o primeiro valor do intervalo: ")
        a= float(input())
        print("digite o segundo valor do intervalo: ")
        b= float(input())
        print("digite o número de pontos do intervalo: ")
        n = int(input())

        print("Resultado: ", trapezio(a,b,n))
    case(2):
        print("digite o primeiro valor do intervalo: ")
        a = float(input())
        print("digite o segundo valor do intervalo: ")
        b = float(input())
        print("digite o número de pontos do intervalo: ")
        n = int(input())
        print("Resultado ", simpson(a,b,n))
    case(3):
        print("y0: ")
        y0 = float(input())
        print("h: ")
        h = float(input())
        print("n: ")
        n = int(input())
        Euler(0,y0,h,n)
```

1)

```
digite o primeiro valor do intervalo:
0
digite o segundo valor do intervalo:
1
digite o número de pontos do intervalo:
4
Resultado:  0.6033421200416386
```

2)

```
digite o primeiro valor do intervalo:
4
digite o segundo valor do intervalo:
4.5
digite o número de pontos do intervalo:
1000
Resultado:  0.027777777971572087
```

3)

```
digite o primeiro valor do intervalo:
3
digite o segundo valor do intervalo:
6
digite o número de pontos do intervalo:
1000
Resultado:  46.49999999999999
```

4)

```
digite o número de pontos do intervalo:
4
Resultado  0.7891807143586561
```

5)

```
-2
digite o segundo valor do intervalo:
-1
digite o número de pontos do intervalo:
6
Resultado  0.35573663705404296
```

6)

```
digite o primeiro valor do intervalo:
3
digite o segundo valor do intervalo:
3.3
digite o número de pontos do intervalo:
6
Resultado  13.62202499999999
```

7)

A)

x 1 = 0.05 y 1 = 2.0
x 2 = 0.1 y 2 = 2.0025
x 3 = 0.15000000000000002 y 3 = 2.007375
x 4 = 0.2 y 4 = 2.01450625
x 5 = 0.25 y 5 = 2.0237809375
x 6 = 0.3 y 6 = 2.0350918906250004
x 7 = 0.35 y 7 = 2.0483372960937505
x 8 = 0.39999999999999997 y 8 = 2.063420431289063
x 9 = 0.44999999999999996 y 9 = 2.0802494097246096
x 10 = 0.49999999999999994 y 10 = 2.0987369392383792
x 11 = 0.5499999999999999 y 11 = 2.1188000922764605
x 12 = 0.6 y 12 = 2.1403600876626374
x 13 = 0.65 y 13 = 2.1633420832795056
x 14 = 0.7000000000000001 y 14 = 2.1876749791155303

x 15 = 0.7500000000000001 y 15 = 2.213291230159754
x 16 = 0.8000000000000002 y 16 = 2.240126668651766
x 17 = 0.8500000000000002 y 17 = 2.268120335219178
x 18 = 0.9000000000000002 y 18 = 2.297214318458219
x 19 = 0.9500000000000003 y 19 = 2.3273536025353083

B)
x 1 = 0.01 y 1 = 2.0
x 2 = 0.02 y 2 = 2.0001
x 3 = 0.03 y 3 = 2.000299
x 4 = 0.04 y 4 = 2.00059601
x 5 = 0.05 y 5 = 2.0009900499000004
x 6 = 0.060000000000000005 y 6 = 2.0014801494010004
x 7 = 0.07 y 7 = 2.0020653479069903
x 8 = 0.08 y 8 = 2.0027446944279204
x 9 = 0.09 y 9 = 2.003517247483641
x 10 = 0.09999999999999999 y 10 = 2.0043820750088046
x 11 = 0.10999999999999999 y 11 = 2.0053382542587164
x 12 = 0.11999999999999998 y 12 = 2.0063848717161292
x 13 = 0.12999999999999998 y 13 = 2.0075210229989677
x 14 = 0.13999999999999999 y 14 = 2.008745812768978
x 15 = 0.15 y 15 = 2.0100583546412882
x 16 = 0.16 y 16 = 2.0114577710948756
x 17 = 0.17 y 17 = 2.012943193383927
x 18 = 0.18000000000000002 y 18 = 2.014513761450088
x 19 = 0.19000000000000003 y 19 = 2.016168623835587
x 20 = 0.20000000000000004 y 20 = 2.0179069375972314
x 21 = 0.21000000000000005 y 21 = 2.019727868221259
x 22 = 0.22000000000000006 y 22 = 2.0216305895390465
x 23 = 0.23000000000000007 y 23 = 2.023614283643656
x 24 = 0.24000000000000007 y 24 = 2.0256781408072193
x 25 = 0.25000000000000006 y 25 = 2.027821359399147
x 26 = 0.26000000000000006 y 26 = 2.0300431458051555
x 27 = 0.2700000000000001 y 27 = 2.032342714347104
x 28 = 0.2800000000000001 y 28 = 2.034719287203633
x 29 = 0.2900000000000001 y 29 = 2.0371720943315963
x 30 = 0.3000000000000001 y 30 = 2.03970037338828
x 31 = 0.3100000000000001 y 31 = 2.0423033696543973
x 32 = 0.3200000000000001 y 32 = 2.0449803359578533
x 33 = 0.3300000000000001 y 33 = 2.047730532598275
x 34 = 0.34000000000000014 y 34 = 2.050553227272292
x 35 = 0.35000000000000014 y 35 = 2.053447694999569
x 36 = 0.36000000000000015 y 36 = 2.056413218049573
x 37 = 0.37000000000000016 y 37 = 2.0594490858690775
x 38 = 0.38000000000000017 y 38 = 2.0625545950103867
x 39 = 0.3900000000000002 y 39 = 2.0657290490602827
x 40 = 0.4000000000000002 y 40 = 2.06897175856968
x 41 = 0.4100000000000002 y 41 = 2.0722820409839833

x 42 = 0.4200000000000002 y 42 = 2.0756592205741433
x 43 = 0.4300000000000002 y 43 = 2.079102628368402
x 44 = 0.4400000000000002 y 44 = 2.082611602084718
x 45 = 0.45000000000000023 y 45 = 2.086185486063871
x 46 = 0.46000000000000024 y 46 = 2.0898236312032323
x 47 = 0.47000000000000025 y 47 = 2.0935253948912
x 48 = 0.48000000000000026 y 48 = 2.0972901409422877
x 49 = 0.49000000000000027 y 49 = 2.101117239532865
x 50 = 0.5000000000000002 y 50 = 2.1050060671375364
x 51 = 0.5100000000000002 y 51 = 2.108956006466161
x 52 = 0.5200000000000002 y 52 = 2.1129664464014994
x 53 = 0.5300000000000002 y 53 = 2.1170367819374842
x 54 = 0.5400000000000003 y 54 = 2.1211664141181092
x 55 = 0.5500000000000003 y 55 = 2.1253547499769283
x 56 = 0.5600000000000003 y 56 = 2.129601202477159
x 57 = 0.5700000000000003 y 57 = 2.1339051904523876
x 58 = 0.5800000000000003 y 58 = 2.1382661385478636
x 59 = 0.5900000000000003 y 59 = 2.142683477162385
x 60 = 0.6000000000000003 y 60 = 2.1471566423907613
x 61 = 0.6100000000000003 y 61 = 2.1516850759668538
x 62 = 0.6200000000000003 y 62 = 2.156268225207185
x 63 = 0.6300000000000003 y 63 = 2.1609055429551134
x 64 = 0.6400000000000003 y 64 = 2.1655964875255624
x 65 = 0.6500000000000004 y 65 = 2.170340522650307
x 66 = 0.6600000000000004 y 66 = 2.175137117423804
x 67 = 0.6700000000000004 y 67 = 2.179985746249566
x 68 = 0.6800000000000004 y 68 = 2.18488588878707
x 69 = 0.6900000000000004 y 69 = 2.1898370298991994
x 70 = 0.7000000000000004 y 70 = 2.194838659600207
x 71 = 0.7100000000000004 y 71 = 2.199890273004205
x 72 = 0.7200000000000004 y 72 = 2.204991370274163
x 73 = 0.7300000000000004 y 73 = 2.2101414565714212
x 74 = 0.7400000000000004 y 74 = 2.215340042005707
x 75 = 0.7500000000000004 y 75 = 2.2205866415856503
x 76 = 0.7600000000000005 y 76 = 2.2258807751697938
x 77 = 0.7700000000000005 y 77 = 2.231221967418096
x 78 = 0.7800000000000005 y 78 = 2.236609747743915
x 79 = 0.7900000000000005 y 79 = 2.2420436502664756
x 80 = 0.8000000000000005 y 80 = 2.247523213763811
x 81 = 0.8100000000000005 y 81 = 2.253047981626173
x 82 = 0.8200000000000005 y 82 = 2.258617501809911
x 83 = 0.8300000000000005 y 83 = 2.264231326791812
x 84 = 0.8400000000000005 y 84 = 2.2698890135238936
x 85 = 0.8500000000000005 y 85 = 2.2755901233886546
x 86 = 0.8600000000000005 y 86 = 2.281334222154768
x 87 = 0.8700000000000006 y 87 = 2.2871208799332203
x 88 = 0.8800000000000006 y 88 = 2.292949671133888
x 89 = 0.8900000000000006 y 89 = 2.2988201744225494

x 90 = 0.9000000000000006 y 90 = 2.304731972678324
x 91 = 0.9100000000000006 y 91 = 2.3106846529515406
x 92 = 0.9200000000000006 y 92 = 2.316677806422025
x 93 = 0.9300000000000006 y 93 = 2.322711028357805
x 94 = 0.9400000000000006 y 94 = 2.328783918074227
x 95 = 0.9500000000000006 y 95 = 2.3348960788934847
x 96 = 0.9600000000000006 y 96 = 2.34104711810455
x 97 = 0.9700000000000006 y 97 = 2.347236646923504
x 98 = 0.9800000000000006 y 98 = 2.3534642804542694
x 99 = 0.9900000000000007 y 99 = 2.3597296376497265

8)
x 1 = 0.2 y 1 = 1.2
x 2 = 0.4 y 2 = 1.3733333333333333
x 3 = 0.6000000000000001 y 3 = 1.531495145631068
x 4 = 0.8 y 4 = 1.6810845693206247
x 5 = 1.0 y 5 = 1.8269481804182377

9)
x 1 = 0.1 y 1 = 2.0
x 2 = 0.2 y 2 = 2.01
x 3 = 0.30000000000000004 y 3 = 2.029
x 4 = 0.4 y 4 = 2.0561
x 5 = 0.5 y 5 = 2.09049
x 6 = 0.6 y 6 = 2.131441
x 7 = 0.7 y 7 = 2.1782969000000003
x 8 = 0.7999999999999999 y 8 = 2.2304672100000005
x 9 = 0.8999999999999999 y 9 = 2.2874204890000005
x 10 = 0.9999999999999999 y 10 = 2.3486784401000005