**SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY**

**MATHEMATICAL SCIENCES DEPARTMENT**

Math 373 Hour Exam Dec 1, 2014

Do not waste time on repetitive computations until each problem you can work is set up and its solution method clearly demonstrated. **Closed Note. Closed Book. No Calculators**

1. Find the value of by the

a) Rectilinear Rule and

b) Trapezoid Rule.

c) Simpson’s 1/3 Rule

  **x f(x)**

 0.0 2.00

 0.1 1.92

 0.2 1.68

 0.3 1.27

 0.4 0.71

 0.5 0.00

 0.6 -0.83

 0.7 -1.73

 0.8 -2.63

 0.9 -3.43

 1.0 -4.01

2. Show how to find z when t = 1.2 by any 4th order Runge-Kutta. The rate of change of z with t is given below.
At t = 1, z = 2. Use a step size of 0.2.

= (1 + t) - 0.01z2

3. Show how to use 3rd order Gaussian Quadrature to determine the value of the following integrals.

a) 

b) 

4. Describe how to find the best values for the coefficients for the equation

 

that fit the below data using

1. MATLAB’s *fminsearch (complete)*

fminsearch(@

function f

1. Excel Solver

(There is no need to write repetitive equations once the idea is written once. You are encouraged to write on columns 3 and 4 of the Data table below. Use “etc.” or “fill down” to avoid repetition. )

**Data**

|  |  |  |  |
| --- | --- | --- | --- |
| **x** | **f(x)** |  |  |
|  1.1 | 2.40 |  |  |
| 1.2 | 2.91 |  |  |
| 1.6 | 4.28 |  |  |
| 2.2 | 6.57 |  |  |
| 3.1 | 11.47 |  |  |
| 6.3 | 57.72 |  |  |

5. a) If a unimodal function has an unknown-to-the-searcher maximum at 50 with linear declines to zero at 0 and 88, where would the first 4 evaluations be placed in a search to reduce the Interval of Uncertainty from 0 to 88 to 1?

88

50

0

 b) One is to arrive at the *best values* for A, B, C, D, E, and F.

 i.) Describe in mathematical detail the criteria for the “best values” and

 ii.) What the search variables might be.

 The following relationships must be satisfied: A=B+C and C+D=E+F.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **A** | **B** | **C** | **D** | **E** | **F** |
| 300 | 80 | 225 | 25 | 71 | 180 |
| 301 | 81 | 220 | 26 | 75 | 184 |
| 304 | 79 | 214 | 24 | 76 | 179 |
| 298 | 88 | 223 | 28 | 78 | 178 |
| 297 | 74 | 225 | 29 | 77 | 171 |
| 301 | 85 | 215 | 22 | 79 | 170 |

6. Describe what to do next on the following Linear Programming SIMPLEX tableaus.

a)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x1 | x2 | x3 | S1 | S2 | S3 | S4 | A1 | A2 | F | RHS |
| 50 | 3 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4000 |
| 5 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 500 |
|  | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 15 |
| 1 |  |  | 0 | 0 | 0 | -1 | 1 | 0 | 0 | 25 |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 150 |
| -2010 | -1002 | -1006 | 0 | 0 | 0 | 1000 | 0 | 0 | 1 | -175000 |

b)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x1 | x2 | x3 | S1 | S2 | S3 | S4 | A1 | A2 | F | RHS |
| 0 | 0 | 0 | 0.021 | 0 | -0.02 | 1 | -1 | -0.06 | 0 | 50.2128 |
| 0 | 1 | 0 | -0.02 | 0 | -0.98 | 0 | 0 | 1.064 | 0 | 59.7872 |
| 0 | 0 | 0 | -0.06 | 1 | 2.064 | 0 | 0 | -1.81 | 0 | 4.3617 |
| 1 | 0 | 0 | 0.021 | 0 | -0.02 | 0 | 0 | -0.06 | 0 | 75.2128 |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 15 |
| 0 | 0 | 0 | 0.17 | 0 | 3.83 | 0 | 1000 | 1001 | 1 | 961.702 |

c)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x1 | x2 | x3 | S1 | S2 | S3 | S4 | A1 | A2 | F | RHS |
| 50 | 3 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4000 |
| 5 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 500 |
|  | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 15 |
| 1 |  |  | 0 | 0 | 0 | -1 | 1 | 0 | 0 | 25 |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 150 |
| -10 | -2 | -6 | 0 | 0 | 0 | 0 | 1000 | 1000 | 1 | 0 |

d)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x1 | x2 | x3 | S1 | S2 | S3 | S4 | A1 | A2 | F | RHS |
| 0 | 3 | 4 | 1 | 0 | 0 | 50 | -50 | 0 | 0 | 2750 |
| 0 | 2 | 0 | 0 | 1 | 0 | 5 | -5 | 0 | 0 | 375 |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 15 |
| 1 | 0 | 0 | 0 | 0 | 0 | -1 | 1 | 0 | 0 | 25 |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | -1 | 1 | 0 | 125 |
| 0 | -1002 | -1006 | 0 | 0 | 0 | -1010 | 2010 | 0 | 1 | -124750 |

Scratch Paper - discard