INTERNATIONAL UNIVERSITY OF SARAJEVO

Quiz #2 MATH 205 – Numerical Analysis

70 minutes

5% of final grade

Date: 21/05/2018

1. Numerical integration [30]

Evaluate the integral $\int_0^1 \exp(4x)dx$ using trapezoidal rule, with *h*=1/4! Compare with the true value!

Using Simpsons (1/3) rule, evaluate the integral $\int_0^4 \sin^2(x)dx$.

You can use the points (0, 0), (1, 0.7081), (2, 0.8268), (3, 0.0199) and (4, xxx). h=1. Compare with the value obtained analytically (the indefinite integral is I = x/2 - sin(2x)/4 +c) and comment the result!

2. Numerical derivation [35]

Find the derivative of the sampled function, based the data-set given below, using **F**orward **D**ifference **F**ormula, **B**ackward **D**ifference **F**ormula, **C**entral **D**ifference **F**ormula and **R**ichardsons **d**erivation. The data originate from the function $f(x) = \frac{1}{\sqrt{x}}$

x	f(x)
1	1
1.5	0.8165
2	0.7071
2.5	0.6325
3	0.5773

f'(2) FDF	f'(2) BDF	f'(2) CDF	f'(2) RD	f'(2) true value

3. Differential equations [35]

How can you solve the ODE $\frac{dy}{dt} = t^2 - 2y, \quad y_0 = 1$ for 0<t<5, using Matlab command ode45

Note:

ode45 Solve non-stiff differential equations, medium order method.

[TOUT,YOUT] = ode45(ODEFUN,TSPAN,Y0) with TSPAN = [T0 TFINAL] integrates the system of differential equations y' = f(t,y) from time T0 to TFINAL with initial conditions Y0.

How would you plot the solution?

$$I = \frac{h}{2}\left[f(x_0) + 2\sum_{i=1}^{n-1} f(x_i) + f(x_n) \right] \qquad I = (b-a)\frac{f(x_0) + 4\sum_{i=1,3,5}^{n-1} f(x_i) + 2\sum_{j=2,4,6}^{n-2} f(x_j) + f(x_n)}{3n}$$

$$f'(x_i) = \frac{f(x_i) - f(x_{i-1})}{h} \qquad f'(x_i) = \frac{f(x_{i+1}) - f(x_i)}{h} \qquad f'(x_i) = \frac{f(x_{i+1}) - f(x_{i-1})}{2h}$$

$$D_0(h) = \frac{f(x+h) - f(x-h)}{2h} \qquad f'(x) = \frac{4D_0(h) - D_0(2h)}{3}$$