

King Fahd University of Petroleum and Minerals
College of Computer Sciences and Engineering

CISE 301 – Numerical Methods (T152)

Homework # 07 (due date & time: Sunday 24/04/2016 during class period)

*** Show all your work. No credit will be given if work is not shown! ***

Problem 1 (30 points):

- (a) Evaluate the integral $\int_0^{\pi/2} (5 - 3\sin x) dx$ using:
- (10 points) Single application of the trapezoidal rule.
 - (10 points) Multiple-application trapezoidal rule $n = 4$.
- (b) (10 points) Estimate the true percent relative error ε_t for each approximation.

Problem 2 (10 points): Evaluate the integral of the following tabular data with the trapezoidal rule

x	-2	0	2	4	6	8	10
$f(x)$	34	5	-10	2	4	3	19

Problem 3 (20 points): Use order of h^8 Romberg integration to evaluate $\int_0^{\pi/2} (5 - 3\sin x) dx$ and compare ε_t on the basis of the analytical solution.

Problem 4 (20 points): Obtain an estimate of the integral $\int_0^{\pi/2} (5 - 3\sin x) dx$ using three-point Gauss-Legendre formula. Compute ε_t on the basis of the analytical solution.

Problem 5 (40 points): Using each of the following methods, solve the following problem over the interval from $x = 0$ to 1.5 using a step size of 0.5 where $y(0) = 1$.

$$\frac{dy}{dx} = (2 + 4x)\sqrt[3]{y}$$

- (10 points) Euler's method.
- (10 points) Midpoint method.
- (10 points) Heun's method without the corrector.
- (10 points) Fourth-order RK method.

Problem 6 (30 points): Solve the following problem with the third-order RK method:

$$\frac{d^2y}{dx^2} + 0.5\frac{dy}{dx} + 7y = 0$$

where $y(0) = 4$ and $y'(0) = 0$. Solve from $x = 0$ to 2 with $h = 0.5$.