Engr 5011: Homework #0

Introduction to numerical integration

Please submit with this page first, and the problems attached in order.
Due 21 September in class (or by 11PM in canvas)

Name (print): Aaron Snyder **TUID:**

9	1	5	1	8	7	2	8	9
I	**H**	**G**	**F**	**E**	**D**	**C**	**B**	**A**

USE THE ABOVE VALUES (A,B,C, ETC) WHEN A QUANTIFIED (NUMERICAL) ANSWER IS NEEDED.

"Technical points" possible for each question are shown; excellent documentation will recieve a bonus.
Also, if you have not already, **download matlab to your laptop computer from**

`https://download.temple.edu`

1. Problem 1 score/comments
   (a) Problem 1.a [**2 pt**]
   (b) Problem 1.b [**5 pt**]
   (c) Problem 1.c [**18 pt**]
2. Problem 2 score/comments.
   (a) Problem 2.a [**5 pt**]
   (b) Problem 2.b [**10 pt**]
3. Problem 3 score/comments
   (a) Problem 3.a [**3 pt**]
   (b) Problem 3.b [**7 pt**]

Engr-5011: Homework #0 Problem #1: Definite Integrals

Assemble submission for this problem in the following order:
(1) this page on top, followed by
(2) your handwritten notes for parts b,c followed by
(3) listing of your matlab scripts/functions for parts a,b,c,
(4) printout of matlab plotted results for parts a,b,c

Name (print): Aaron Snyder

Collaborants (print): _____

Documents & resources used: _____

1. **Definite integrals!**

   (a) Implement the simpson-rule integrator and demonstrate that it works on a problem you can do another way.

   (b) Plot $I(b)$ on $-0 \le b \le 5$, computing $I\,(b)$ to at least three significant digits.

$$I(b) = \int_0^5 e^{-b\cos(\tau)}\, d\tau \quad \text{on} \quad b = 0 : 1/10 : 5$$

   What is $I(4.6)$? Write it here: $I(4.6) =$ _____

   (c) Evaluate I to at least three significant digits and write it here:

$$I = \int_0^5 \frac{dx}{2-\sqrt{x}}; \qquad I = \text{_____}$$

Engr-5011: Homework #0 Problem #2. Integrals on data

Assemble submission for this problem in the following order:
(1) this page on top, followed by
(2) your handwritten notes
(3) your matlab code(s)
(4) your computed results

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Documents or resources used: _____

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2. **Predictor-corrector integration scheme**

(a) Implement a predictor/corrector integration scheme and test it on a problem you can do another way.

(b) To three significant digits, integrate and plot y_j (where $y_j = y(t_j)$) if

$$y' = \frac{y}{\cos(\frac{t}{3}) + \alpha\ f(t)} + t; \quad y(0) = -1$$

α = (average of your TUID digits)

Here $f(t)$ is tabulated data given by:

0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	**t**
1.00	0.84	0.78	0.73	0.68	0.65	0.61	0.58	0.55	0.53	0.50	0.48	0.45	0.43	0.41	0.39	0.37	0.35	0.33	**f**

Estimate the minimum value of y on $0 \le t \le 1.8$ from your results and write them here:

$t =$ _____

$y =$ _____

Engr-5011: Homework #0 Problem #3. Numerical integration of initial-value problems

Assemble submission for this problem in the following order:
(1) this page on top, followed by
(2) your handwritten notes
(3) your matlab code(s)
(4) your computed results

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Collaborants (print): _____

Documents or resources used _____

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3. **Numerical integration of initial-value problems**

(a) Implement the 4^{th}-order Runge Kutte integration scheme and test it on a problem that you can do another way.

(b) To three significant digits, integrate and plot $y(t), y'(t)$, and $y''(t)$ on $t \subseteq [0, 5]$ if

α	=	$\frac{\text{average(A,B,C)}}{10}$
β	=	$\frac{\text{average(D,E,F)}}{10}$
γ	=	$\frac{\text{average(G,H,I)}}{10}$

and

$$y''' + \alpha\, y'' + \beta\, y\, y' + \gamma\, y = \cos(3t); \quad y(0) = \text{A};\ y'(0) = \text{B};\ y''(0) = \text{C};$$

Here [A,B,C,D,E,F,G,H,I] are taken from your TUID.

At what value of $t \subseteq [0, 5]$ is $y(t)$ maximized? Write them here:

$t =$ _____

$y =$ _____