

Name: _____

Date: _____

Collaborators: _____

(Collaborators submit their individually written assignments together)

Question:	1	2	3	4	5	Total
Points:	10	25	20	10	10	75
Score:						

Instructor/grader comments:

Matlab

1. (10 points)

☐ I've watched the video *Who invented the great numerical algorithms?*

Sign and date here: _____

2. The goal of this exercise is (a) to write a matlab function that uses **for** loop and preallocates an array, and (b) write a script that uses the function to plot a graph.

Consider the following integral:

$$y(n) = \int_0^1 x^n e^{-x} dx, \quad (A)$$

where n is non-negative integer, $n = 0, 1, 2, \dots$

The integral (A) has the following properties:

1. All $y(n)$ are positive, $y(n) > 0$ for $n = 0, 1, \dots$
2. $y(n)$ (as well as $|y(n)|$) is monotonously decreasing function of n , i.e. $y(n) < y(n-1)$ for $n = 1, 2, \dots$

To evaluate the integral numerically, we integrate (A) by parts to obtain the following relation:

$$y(n) = n y(n-1) - \frac{1}{e}. \quad (B)$$

The value of the integral (A) for $n = 0$ is

$$y(0) = \int_0^1 e^{-x} dx = 1 - \frac{1}{e}. \quad (C)$$

Using (C) and (B) for $n = 1$ we can find that

$$y(1) = y(0) - \frac{1}{e} = 1 - \frac{2}{e}. \quad (D)$$

We now can repeat the steps to calculate $y(2), y(3), \dots$

- (a) (15 points) Write matlab function `hw01p2integral` (place the code in the file named **hw01p2integral.m**) that accepts a positive integer parameter n and returns a vector containing the values of the integral (A) for $n = 1, 2, \dots, n$. The function must use the relation (B) and the value of $y(1)$. Your function must pre-allocate the array that it returns. Use for loop when writing your code. Provide the help text for the function.
- (b) (10 points) Write matlab script (place it into a file **hw01p2.m**) that uses your function to calculate the values of the integral (A) $y(n)$ for $n = 1, 2, \dots, 19$. Plot the graph of $y(n)$. Provide meaningful title and axis labels, as well as draw the grid. Use a linestyle that marks the data points and connects them with a line.
- Hint: If you wrote your function correctly, the results of the calculations will clearly contradict the properties 1. and 2. of the integral. We'll learn later in this class why correct programs produce wrong results.
3. (20 points) Write a script (place it into a file **hw01p3.m**) that uses the function `hw01p3data` (available for download from the class website) to plot a figure consisting of four subplots that represent the data provided by the function using linear, loglog and semilogx/semilogy axes. Each subfigure should have grid, a title, and axes labels. Use a linestyle that marks the data points and connects them with a line.

Gitlab

4. (10 points) Sign up for a gitlab account. Use your UConn email address for the registration. Chose a 'human readable' user name. (The 'name' part of your UConn email is a good choice for the user name.)

My gitlab user name: _____

5. (10 points) Create a gitlab project called **hw01** (name it exactly as shown). Upload **all** matlab files that are required to run your code. Share the project with the instructor and the TA and grant them **Reporter** privileges.