MAE 8 - Winter 2015
Homework 2

Instructions: Follow the homework solution template. Put all answers in a MATLAB script named **hw2.m**. Submit **hw2.m** through TED before 9 PM on 01/22/2015. Use double precision unless otherwise stated.

Problem 1:

(a) Using the colon operator, create a row vector **p1a** containing every 5^{th} year from 1900 to 1995.

(b) Using **linspace**, create a row vector **p1b** containing every 5^{th} year from 2000 to 2095.

(c) Concatenate the vectors created in parts (a) and (b) such that the resulting vector **p1c** has all of the years from 1900 to 2095.

(d) What is the length of the vector in part (c) ? Give the answer to **p1d**.

(e) Extract every even years of the vector from part (c) into vector **p1e**.

(f) Which element of the vector in part (c) is the year 2050 ? Use function **find**. Give the answer to **p1f**.

(g) Add the year 2100 to the end of the vector in part (c) to create vector **p1g**.

(h,i) Write an expression that would store the first half of the vector in part (c) in vector **p1h** and the second half in vector **p1i**.

Problem 2:

(a) Create a column vector **p2a** with all the integers from -7 to 7 by entering all of elements.

(b) Create a column vector **p2b** with all the integers from -7 to 7 using the colon operator.

(c) Create a column vector **p2c** with all the integers from -7 to 7 using **linspace**.

(d) Create a column vector **p2d** with all the odd numbers from 1 to 1000.

(e) Square all of the elements of the vector in part (d) and put the answer in **p2e**.

(f) Sum all elements of the vector in part (e) and put the answer in **p2f**.

(g) Find the product of the vector in part (e) and put the answer in **p2g**.

(h) Find the cumulative sum of the vector in part (e). Put the answer in **p2h**.

Problem 3:

(a) Create a 5 x 5 matrix **p3a** with a value of 0 for every element.

(b) Create a 5 x 5 matrix **p3b** with a value of 0 for every element except for the fifth column where the elements have a value of 1.

(c) Transpose the matrix in part (b) and put the answer in **p3c**.

(d) Rotate the matrix in part (b) 90° counterclockwise 3 times and put the answer in **p3d**.

(e) Are the matrices in part (c) and (d) the same ? Put the answer in **p3e**.

Problem 4: Explore different ways to solve a linear system of equations by typing **help inv** and **help ** in command window, and then perform the following exercises.

(a) Create a 3 x 3 matrix **A** with the following values and set **p4a = A**.

$$\begin{bmatrix} 1 & 3 & 5 \\ 2 & 2 & 4 \\ 4 & 5 & 7 \end{bmatrix}$$

(b) Create a 3-element column vector **b** with values of 1, 4 and 9. Set **p4b = b**.

(c) Using function **inv**, solve the system of equations Ax=b for **x**. Set **p4c = x.**

(d) Using \ operator, solve the same system of equations Ax=b for **x**. Set **p4d=x**.

(e) Is the answer in part (c) and part (d) the same ? Put the answer in **p4e**.

(f) Compute the difference between part (c) and (d) and put the answer in **p4f**.

Problem 5: Perform the following exercises to find the sum of the first ten terms of the geometric series:

$$1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + ...$$

(a) Create a row vector **p5a** having 10 elements all with value of 1.

(b) Create a row vector **p5b** with values of 1 to 10 with a step of 1.

(c) Use function **sum** with the vectors in part (a) and (b) to obtain the sum of the geometric series. Put the answer in **p5c**.

Problem 6: Estimate the derivative of the function $f(x) = tanh(x)$ by performing the following exercises.

(a) Create a vector **x** that has values from -1 to 1 with a step of 0.01. Set **p6a=x**.

(b) Compute **f** and set **p6b=f**.

(c) Use function **diff** to estimate the derivative f'. Put the answer in **p6c**.

(d) What is maximum value of f' ? Put the answer in **p6d**.

Problem 7: Estimate the following integral: $\int_{-1}^{1} g(z)\,dz$ where $g(z) = sech^2(z)$ by performing the following exercises.

(a) Create a vector **z** that has values from -1 to 1 with a step of 0.01. Set **p7a=z**.

(b) Compute **g** and set **p7b=g**.

(c) Use function **sum** to approximate the integral. Put the answer in **p7c**.