

The objective of this homework is to test your understanding of the content of Module 4. Due date of the homework is: **Friday, September 25th, 2020**. You have to upload a scanned version of your solutions on Blackboard. If you don't have a scanner around you, you can use Cam Scanner—a mobile app that scans images in a neat way, as if they're scanned through a copier.

For questions related to the homework, please email the two teaching assistants: (a) Wasim (email: wasim.dipon@my.utsa.edu) and (b) Yuvaraj (email: yuvaraj.munian@utsa.edu).

You can send your question to both of them on the same email. Feel free to CC me as well, but that is not necessary.

1. I believe you all have heard of the famous story about “The Compound Effect”. That an emperor wanted to thank the inventor of the game of chess and asked the inventor to name his reward. The inventor asked for one grain of rice for the first square, 2 for the second, 4 for the third, and so on, doubling for each of the 64 squares. That may sound modest, but there wasn't that much rice in the empire!

Write a program in MATLAB to calculate the number of squares that are required to give the inventor a stated number of grains of rice that is provided as the input. For example, the program should calculate the number of squares that are required to earn at least 1000 grains of rice, at least 1,000,000 grains, at least 1,000,000,000 grains, etc. Demonstrate that the program works using sample inputs from the user. Follow the series and the equation below to develop your algorithm. T_{64} is the total number of grains.

[Hint: The code to read a user input: `T_X = input('Enter the number of grains:')`] **(25 points)**

$$T_{64} = 2^0 + 2^1 + 2^2 + \dots + 2^{63}$$

$$T_X = 2^X - 1$$

[Hint: Write a MATLAB program for the above formula where T_x will represent T_x and from the formula find the value of X .]

2. For the array of integers {-1, 3, 13, 5, 4, 8, 7}. Write a MATLAB program to find the peak in the given array. The output should be “A peak value is 13.” Note that 13 occurs at index 3. (The array starts at index 1.) [Hint: Convert the array into matrix using “cell2mat” and find the maximum value. For instance, say `A = {-1, 3, 13, 5, 4, 8, 7}`, use `Mat_A = cell2mat(A)` and then find the maximum value of `Mat_A`] **(25 points)**

3. You are given the below column vector A. Write a MATLAB program using the concept of Preallocation to get to the vector B from vector A.

[Hint: First of all look at the pattern of matrix B, from 2nd column onwards, each column value is double the value of the column before it.] (20 points)

$$A = [2 ; 3 ; 7]$$

$$B = \begin{bmatrix} 2 & 4 & 8 & 16 \\ 3 & 5 & 12 & 24 \\ 7 & 14 & 28 & 56 \end{bmatrix}$$

4. Write a MATLAB function which calculates the volume of a cube (Volume = X^3 , where X length of a side). Write a MATLAB program which calculates the volume of a cube by taking user input of the length of a side of the cube by calling this function. [Hint: Read three user input X and call the function you have written for calculating volume of cube.] (30 points)