

MATH 284 Mathematical Programming
Homework 5: Due Wednesday March 28 at 1:00pm

Exercises:

1. Given $v = [-2 \ 4 \ 1 \ 0 \ 2 \ 1 \ 2]$ and $w = [2 \ 5 \ 0 \ 1 \ 2 \ -1 \ 3]$. Evaluate the following expressions in MATLAB. Make sure you understand the meaning of the output.

- (a) `~v == ~w`
- (b) `w >= v`
- (c) `v > ~-1*w`
- (d) `v > -1*w`

2. Write a program that asks the user to input a vector of integers of arbitrary length. Then, using a for-loop the program examines each element of the vector. If the element is positive, its value is doubled. If the element is negative, its value is tripled. The program displays the vector that was entered and the modified vector. Execute the program, and when the program asks the user to input a vector, type `randi([-10 20],1,19)`. This creates a 19-element vector with random integers between -10 and 20.
3. Write a program that asks the user to input a vector of integers of arbitrary length. Then, using a for-loop the program eliminates all the negative elements. The program displays the vector that was entered and the modified vector, and a message that says how many elements were eliminated. Execute the program, and when the program asks the user to input a vector, type `randi([-15 20],1,25)`. This creates a 25-element vector with random integers between -15 and 20.
4. The Pascal triangle can be displayed in a lower-triangular matrix. For example,

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 2 & 1 & 0 & 0 & 0 \\ 1 & 3 & 3 & 1 & 0 & 0 \\ 1 & 4 & 6 & 4 & 1 & 0 \\ 1 & 5 & 10 & 10 & 5 & 1 \end{bmatrix}.$$

Write a MATLAB program that creates an $n \times n$ matrix that displays n rows of Pascal's triangle. Use the program to create 4 and 7 rows Pascal's triangles. Note that one way to calculate the value of the elements in the lower portion of the matrix is $C_{ij} = \frac{(i-1)!}{(j-1)!(i-j)!}$ where this is used whenever $i \geq j$.

5. The reciprocal Fibonacci constant Ψ is defined by the infinite series

$$\Psi = \sum_{n=1}^{\infty} \frac{1}{F_n},$$

where F_n are the Fibonacci numbers 1, 1, 2, 3, 5, 8, 13, ... Each element in this sequence of numbers is the sum of the previous two. Start by setting the first two elements equal to 1, then $F_n = F_{n-1} + F_{n-2}$. Write a MATLAB program in a script file that calculates the sum first n terms of Ψ for a given value of n . Execute the program for $n = 10, 50, 100$.