CS1112 Section Exercise 7

1 Determinant of a 3×3 matrix

Write a function `myDeterminant(x)`, where `x` is a 3×3 matrix. Use the following formula:

$$\det\left(\begin{pmatrix} a & b & c \\ d & e & f \\ g & h & i \end{pmatrix}\right) = a\det\left(\begin{pmatrix} e & f \\ h & i \end{pmatrix}\right) - b\det\left(\begin{pmatrix} d & f \\ g & i \end{pmatrix}\right) + c\det\left(\begin{pmatrix} d & e \\ g & h \end{pmatrix}\right)$$

Use the built-in function `det` to find the determinants of 2×2 matrices. For example, `det(m)` returns the determinant of 2×2 matrix `m`. This question is all about accessing individual components or submatrices in a matrix. Recall that you can construct a matrix by putting two row vectors one below the other or two column vectors side by side.

2 Find a value in a matrix

Write the following function:

```
function [r, c] = findInMatrix(n,M)
% Find all occurrences of the number n in matrix M.
% r and c are column vectors of row and column numbers such that
%   M(r(k),c(k)) is equal to n.
% If n is not found in M, r and c are empty vectors.
```

Use loops in this problem; *do not* use the built-in function `find`.

Note: The next two questions require that you *design* solutions. Instead of giving you the specifications of a function, we are asking you to design a complete solution: you decide what functions and/or scripts are necessary and implement those functions/scripts. Take some time to do the planning—think about what values you need to keep track of and choose "appropriately-shaped" variables to store them.

3 Random walk

A random walk that starts from the center of a 21×21 grid ends when a boundary is reached. On average which "square" or grid point is visited most often? Function `RandomWalk2D` (discussed in lecture) is shown on the next page for your reference.

4 Bounded random walk

In a bounded random walk, a set number of steps are taken within a bounded area. For example, when the right boundary (excluding the corners) is reached, the next step can go left, up, or down only. Similarly, when a corner is reached, the next steps can be in two directions only. For a 100-step bounded random walk in a 21×21 grid, which "square" is visited most often?

```
function [x, y] = RandomWalk2D(N)
% Simulate a 2D random walk in an (2N+1)-by-(2N+1) grid.
% N is a positive integer.
% Walk starts from the middle and continues until the an edge, abs(N),
% is reached.
% x and y are row vectors with the property that (x(k),y(k)) is the
% location of the token after k hops, k=1:length(x).

% Initializations...
k=0;  xc=0;  yc=0;

% In general, (xc,yc) is the location after k hops.
while abs(xc)<N && abs(yc)< N
    % Standing at (xc,yc), randomly select a step
    r= rand(1);
    if r < .25
        yc= yc + 1;  % north
    elseif r < .5
        xc= xc + 1;  % east
    elseif r < .75
        yc= yc -1;   % south
    else
        xc= xc -1;   % west
    end
    % Record location...
    k= k + 1;  x(k)= xc;  y(k)= yc;
end
```