

### Three Categories of Code

**Sequences** - lines of code executed one after another

**Selection Structures** - executes some piece of code if some known condition is true, otherwise executes some alternative.

**Repetition Structures** - (loops) causes a group of statements to be executed multiple times.

### Break and Continue

**Break** statements cause the termination of the smallest enclosing while or for loop.

**Continue** statements skip to the rest of loop, advancing to the next loop pass.

### Time

**clock** gives you the current time

**etime** compares between a start and end time

**cputime** returns cpu time since you started matlab

**tic/toc** works like a stopwatch

### Array vs Matrices

**Array** holds stuff: can hold numeric info, char data, or symbolic data. Is "an orderly grouping of information". No special properties by virtue of its existence.

### Array vs Matrices (cont)

**Matrix** is a 2D numeric array used in linear algebra. Used extensively in STEM fields and has special properties.

### To solve $Ax = b$

**Inverse method** solution =  $\text{inv}(A)*b$

**rref command**  $A\_augmented = [A \ b]$

$RREF\_result = \text{rref}(A\_augmented);$

solution =  $RREF\_result(:,end)$

**backslash** solution =  $A \setminus b$

### Structure Arrays

```
A = 'We Are!';
B = [1 4; 3 2];
C = 'Penn State!';
D = single([ 1 2; 3 4]);
E = {A, B, C, D} %default printing, just shows sizes.
celldisp(E) %needed to generate display
E{3} → displays 'Penn State'
E{1}(1,2) %1st row, 2nd col of cell 1 w/ multilayer indexing → displays e
E{2}(:) %concatenates cell 2 into column vector
N.first = 'Hello';
N.second = 'World';
disp('N is: ')
disp(N) → N is:
first:'Hello';
second:'World'
orderfields(N) %orders fields in ASCII dictionary
```

### Structure Arrays (cont)

```
orderfields(N,O) %orders N field like O is ordered
T = 'myphrase1';
L = rmfield(L,T) % removes 'myphrase1' field from L
```

### Short Answer

#### 41. What is the difference between a matrix and 2D array?

A matrix is 2D, has special mathematical properties. An array need not be 2D, and has no special mathematical properties, and is merely a "holder" for data.

#### 42. Why is it a good idea to create a flowchart and pseudocode before you attempt to create a computer program?

Creating a flowchart and pseudocode before attempting to create a computer program is a good idea because it gives you an opportunity to think your way through the program. A builder wouldn't start building a house without a blueprint; it is advisable to think through your programs as well.

### Short Answer (cont)

#### 43. Briefly describe how one would mathematically check if a square matrix is singular. What practical implementation issues arise when implementing that into MATLAB code?

Mathematically, a matrix is invertible if  $\det A \neq 0$ . In terms of implementation, if the determinate is  $\approx 0$  it can be viewed as effectively singular. You could check the determinant against some sort of tolerance to see if your determinant is close enough to 0 to make your matrix numerically act as singular.

### 3D array whose values count down

```
nrows = 3;
ncols = 2;
npages = 4;
B = zeros(nrows,ncols,npages);
counter = 25;
for k = 1:npages;
    for i = 1:nrows;
        for j = 1:ncols;
            counter = counter - 1;
            B(i,j,k) = counter;
        end
    end
end
fprintf('The first page of B is:\n')
disp(B(:,:,1))
etc
```

## Short Answer

**44. What is the benefit of using cell arrays to store chars instead of using character arrays?**

Character arrays have to have the same number of columns in each row. Cell

arrays of chars, however, has no such restriction.

**45. Briefly discuss the difference between cell arrays and structure arrays in MATLAB.**

One of the more prominent differences between cell arrays and structure arrays in MATLAB is content indexing for cells, and the use of fields for structure arrays.



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