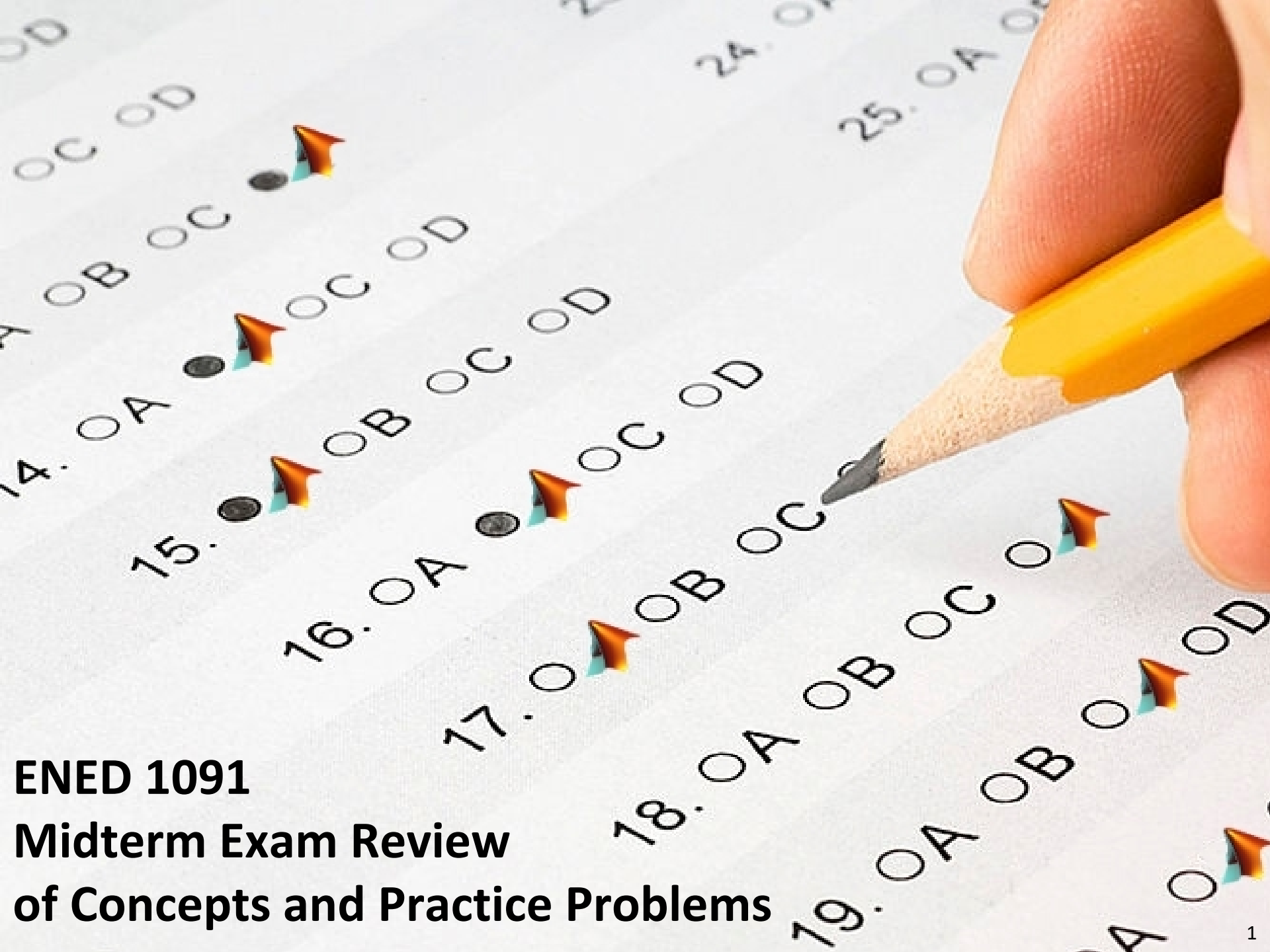

ENED 1091
Midterm Exam Review
of Concepts and Practice Problems

Arrays Review

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- Arrays allow you to store and access data easily and in a programmatic way
- There are two main types of arrays we've used:
  - 1-dimensional arrays (also called vectors)
  - 2-dimensional arrays (also called array or matrix)

Arrays Review

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- The number of dimensions in an array determines how the data is stored and accessed:
  - Vectors have a single dimension, and thus a single index to access data:
    `vector_name(index)`
  - Arrays have two dimensions, requiring multiple indices to access data:
    `array_name(row_index,col_index)`
- Remember: indices always start at 1!

Arrays Practice

- Assuming that A is created as shown below, determine the results of the following commands:

```
>> A = [9 8 7 6 5 4 3 2 1 0];
```

```
>> A(2)
>> A(1:4)
>> A(2:2:end)
>> A([1 3 5 7 9])
>> A.^2
>> A >= 3 & A < 6
```

Arrays Practice

- Assuming that A is created as shown below, determine the results of the following commands:

```
>> A = [1 2 3 4; 5 6 7 8; 9 10 11 12];
```

```
>> A(2,3)
>> A(1,:)
>> A(:,4)
>> A(1:2,3:4)
>> A([1 3],[1 3])
>> A > 3 & A < 10
```

Nested Loops Review

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- Nested loops consist of one loop inside another
- You can nest any type of loop inside another
  - Most commonly used this semester was a for inside a for
- With nested loops, the inner loop will complete all iterations for every one iteration of the outer loop

Nested Loops Practice

Determine the result of running the following script in MATLAB:

```
x = [1  2  3];
y = [1  3  5  7];
for r = 1:length(x)
      P(r)= x(r);
      for c = 1:length(y)
            P(r)=P(r)+(-1)^r*y(c);
      end
end
disp('P=');disp(P)
```

Nested Loops Practice

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- Consider the following code and determine the output when it is executed:

```
X = [1 2 3; 4 5 6; 7 8 9];
[rows cols] = size(X);
for r = 1:rows
    for c = 1:cols
        Y(r,c) = sum(X(r:3,c));
    end
end
disp('X = '); disp(X);
disp('Y = '); disp(Y);
```

Nested Loops Practice

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The voltage across the capacitor in a series RC circuit with a voltage source of 12 volts is:

$$V_{cap}(t) = 12(1 - e^{-\frac{t}{RC}})$$

Create a vector for time that starts at 0, increments by 0.01, and ends at 12. Create a vector of resistances that starts at 1000, increments by 500, and ends at 3000. Assume C = 0.001.

Using nested loops, go through each entry in the time vector and each entry in the resistance vector to create a matrix of capacitor voltages. Plot the results.

Note: this could be done without nested loops but the point is to practice nested loops!

Array Functions Review

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- There are a number of functions that are useful when dealing with arrays:
  - **length**: determines the number of entries in a vector
  - **size**: determines the number of elements along different dimensions of an array
  - **min**: determines the minimum value
  - **max**: determines the maximum value
  - **sum**: adds the values in an array
  - **find**: gives the index for any non-zero value in an array
  - **mean:** determines the average value

Array Functions Practice

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- What do each of the following commands do?

	1-D Array	2-D Array
– sum()		
– max()		
– min()		
– find()		

Array Functions Practice

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- Assuming that A is created as shown below, determine the results of the following commands:

```
>> A = [4 5 3 1 8 9 5 7 2];
```

```
>> length(A)
>> sum(A)
>> max(A)
>> min(A(7:9))
>> find(A == 5)
```

Array Functions Practice

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- Assuming that A is created as shown below, determine the results of the following commands:

```
>> A = [4 5 7 6; 1 8 2 4; 3 9 7 1];
```

```
>> [a, b] = size(A)
>> sum(A)
>> max(A(3,:))
>> min(min(A))
>> sum(sum(A == 7))
```

Array Functions Practice

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- Assuming that A is created as shown below, determine the results of the following commands:

```
>> A = [4 5 7 6; 1 8 2 4; 3 9 7 1];
```

	Result:
`>> sum(A(2,:)>=2)`	3
`>> sum(A(2,:)>=2 & A(3,:)<=7)`	2
`>> n = find(A(:,1)>=2); mean(A(n,4))`	3.5

(Note: n would be [1 3])

Matrix Operations

A =

$$\begin{bmatrix} Y & Z & 8 \\ 2 & 7 & -3 \end{bmatrix} + \begin{bmatrix} 5 & -2 & 12 \\ 4 & 7 & -2 \end{bmatrix}$$

A = ?

Matrix Operations

Which of the following are invalid matrix operations?

$$\begin{bmatrix} 2 \\ 1 \\ -2 \\ Z \end{bmatrix} \times \begin{bmatrix} 4 & -1 & Y \end{bmatrix}$$

$$\begin{bmatrix} 2 \\ 1 \\ -2 \\ Z \end{bmatrix} \times \begin{bmatrix} Y \\ 1 \\ 3 \\ 7 \end{bmatrix}$$

$$\begin{bmatrix} Z & 0 \\ -1 & 1 \\ 1 & 2 \end{bmatrix} \times \begin{bmatrix} 4 & 0 & Y \\ 5 & -3 & 2 \end{bmatrix}$$

Matrix Operations

$$A = \begin{bmatrix} 2 \\ 1 \\ -2 \\ Z \end{bmatrix} \times \begin{bmatrix} 4 & -1 & Y \end{bmatrix}$$

A = ?

Solving Systems of Linear Equations

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Set up the matrix equation for the following set of linear equations. How do we determine whether or not there is a unique solution?

$$3x + 2y - z = 6$$
$$4x - 3y + 2z = 12$$
$$x + y - 5z = 4$$

Solving Systems of Linear Equations

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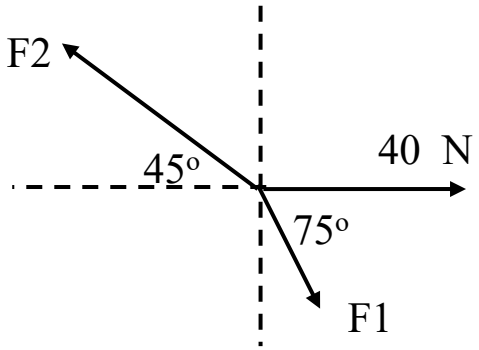
Set up the matrix equation for the following set of linear equations. How do we determine whether or not there is a unique solution?

$$2v + x + 2y + z = 4$$
$$v + 5x - y - 3z = 1$$
$$4v - 2x + 6y - z = -16$$
$$2v + 6x - 9z = 10$$

Force Balance Equations



Write the matrix equation for the force balance equations.

Circuit Mesh Equations

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Homework #5 – Problems 4 and 5

Lecture: Week 6