Name	
Signature	

General instructions: You may not ask questions during the test. If you believe that there is something wrong with a question, write down what you think the question is trying to ask and answer that.

Question	Points	Score
1	5	
2	5	
3	5	
4	5	
5	5	
6	5	
7	5	
8	5	
9	5	
10	5	
11	5	
12	5	
13	5	
14	5	
15	5	
16	5	
17	5	
18	5	
19	5	
20	5	
Total	100	

1. Which statement creates a pseudo-random 3D array with integer values ranging from 1-10?

    (a) `myArray = randi(10,2,5,3)` ⇐
    (b) `myArray = rand(3,2,5)`
    (c) `myArray = randi(10,2,5)`
    (d) `myArray = rand(10,2,5,4)`
    (e) `myArray = randi(10,3)`

2. Given `myArray = [ 10, 20, 30, 40, 50; 60 70 80 90 100 ]`, match the statement in the left column with the result in the right column.

`size(myArray)`	`[2, 5]`
`length(myArray)`	5
`numel(myArray)`	10
`ndims(myArray)`	2

3. Consider the following code:

```
myArray = [ 1, 0, 3; -2, -4, 1 ];
myArray2 = repmat(myArray,1,2);
myArray3 = repmat(myArray,2,1);
myArray2 = reshape(myArray2,4,3);
```

   Which statement is true after all the above code has executed?

    (a) `myArray3` has two rows and one column.
    (b) `myArray2` is a 2×6 array.
    (c) `myArray2` and `myArray3` are equal.
    (d) The call to `reshape` will generate an error because `myArray2` does not have the right number of elements.
    (e) `myArray2` and `myArray3` have the same elements but in a different order. ⇐

4. What is the value of `result` after the following code executes?

```
myArray = [ 2 5 1; 3 5 5 ];
myArray2 = [ 5 5 3; 3 1 5 ];
result = find(myArray - myArray2 == 0);
```

    (a) `[ -3 0 -2; 0 4 0 ]`
    (b) `[ 0 1 0; 1 0 1 ]`
    (c) `[ 1 0 1; 0 1 0 ]`
    (d) `[ 2 3 6 ]'` ⇐
    (e) `[ 2 4 6 ]'`

5. For each statement about `sort` and `sortrows`, indicate wether the statement is true or false.

   (T /F) `sort` will sort the columns of a 2D array independently of each other.

   (T /F) Given the array `names = char('Frank','Kate','Jane');`, the command `sortrows(names)` will alphabetize the names.

   (T /F) Given the code `[sortedArray, sortedIndices] = sort(array);` for some numeric array `array`, the statement `all(sortedArray == array(sortedIndices))` will evaluate to true.

   (T /F) Given `array = [ 8 10 7 1 9 ]; [sortedArray, sortedIndices] = sort(array);`, the value of `sortedIndices` is `[ 4 3 1 5 2 ]`.

6. Let

   ```
   A = [ 1 2; 3 4 ];
   B = [ 5 6; 1 3 ];
   ```

   Fill in the results of the following operations.

A * B	=	[7 12; 19 30]
A .* B	=	[5 12; 3 12]
A.^2	=	[1 4; 9 16]
B'	=	[5 1; 6 3]

7. Given the system of equations,

$$5x + 4y + 3z = 7$$
$$x - 3y + z = -1$$
$$2x - z = 0,$$

   write a few lines of Matlab code in the space below to solve the system for x, y, and z.

   ```
   A = [ 5 4 3 ; 1 -3 1 ; 2 0 -1 ];
   b = [ 7 -1 0 ]';
   solution = A \ b;
   ```

8. What is the value of `myVal` after the following code executes?

```
myVal = 5;
if( myVal <= 1 )
    myVal = myVal + 1;
elseif( myVal <= 3 )
    myVal = 2 * myVal;
elseif( myVal <= 7 )
    myVal = myVal - 1;
elseif( myVal <= 10 )
    myVal = myVal + 5;
else
    myVal = 0;
end
myVal = myVal * 2;
```

(a) 4

(b) 8 ⇐

(c) 2

(d) 20

(e) 0

9. Consider the code

```
num = 2;
while( num < 10 )
    num = 2 * num;
end
```

For each statement, indicate whether the statement is true or false.

(T/F̲) The value of `num` after the code executes is 8.

(T̲/F) The loop body executes 3 times.

(T/F̲) The code results in an infinite loop.

(T/F̲) In this particular case, the result will be the same if we check `num ~= 10` instead of `num < 10`.

10. Consider the code

```
count = 1;
sum = 0;
while ( count <= 3 )
    for i = 1:count
        sum = sum + i;
    end
    count = count + 1;
end
```

The value of **sum** after the code executes is

  (a) 1

  (b) 3

  (c) 6

  (d) 10 ⟸

  (e) None of the above.

11. Consider the following three blocks of code which result in the same value for **arrayOfSquares**. Write the number 1 by the block of code that you expect to be the fastest, 2 by the next fastest, and 3 by the slowest. Explain why you would expect this result.

_____

1

```
n = 10^5;
arryOfSqrs = ones(1, n);
arryOfSqrs = arryOfSqrs.^arryOfSqrs;
```

_____

3

```
n = 10^5;
arryOfSqrs = [];
for i = 1:n
  arryOfSqrs = [arryOfSqrs, i^2];
end
```

_____

2

```
n = 10^5;
arryOfSqrs = zeros(1, n);
for i = 1:n
  arryOfSqrs(i) = i^2;
end
```

_____

Roughly: 3 is slowest because it has to reallocate in each loop iteration, every time the array is resize. 2 is better because it preallocates the array using the zeros function. 1 is the best as it takes advantage of the fast array operations in Matlab.

12. For each statement about scope of variables, indicate whether the statement is true or false.

(T/ F) A local function shares a workspace with the other functions in the same file.

(T /F) A nested function shares a workspace with its parent function.

(T/ F) The main workspace (associated with the command line) can access variables defined inside functions if they are declared to be persistent.

(T /F) A function workspace can access a variable defined in the main workspace if it is declared to be global.

13. Answer the following questions about functions in Matlab.

(a) Assign `fHandle` to be a handle to the function `sin`.

```
fHandle = @sin
```

(b) Write down a Matlab expression creating an anonymous function that takes two variables and returns their sum.

```
@(x,y) x + y;
```

(c) Given the name of a function stored in a variable `myFunction` of type `char`, how would you call that function and pass it the argument five?

```
feval(myFunction,5)
```

14. Consider the recursive function

```
function result = Fibonacci(n)
  if ( n == 0 )
      result = 0;
      return;
  elseif ( n == 1 )
      result = 1;
      return;
  end
  result = Fibonacci(n-1) + Fibonacci(n-2);
end
```

Given the function call `Fibonacci(5)`, how many *additional* calls to the function `Fibonacci` will be made?

(a) 0

(b) 2

(c) 10

(d) 14 ⟸

(e) None of the above.

15. Consider the function

```
function result = MyFunction(x,y,z)
  switch ( nargin )
    case 1
      y = 1;
      z = 2;
    case 2
      z = 2;
  end
  result = x * y * z;
end
```

Which statement regarding this code is <u>false</u>?

(a) The caller can pass in arguments x and y and omit z.

(b) The caller can pass in arguments x and omit y and z.

(c) The caller can pass in arguments x and z and omit y. ⟸

(d) MyFunction(1,2) will return 4.

(e) MyFunction(1) will return 2.

16. Let myArray be a 3D array. Indicate whether each statement below is true or false.

(⟦T⟧/F) myArray(:,:,1) returns all the elements in the first layer of myArray.

(T/⟦F⟧) size(myArray) == 3.

(⟦T⟧/F) ndims(myArray) == 3.

(T/⟦F⟧) myArray(1:2:end,1:2:end,1:2:end) has half the number of elements as myArray.

17. A Matlab RGB image

(a) must have type uint18.

(b) must have type double.

(c) is a 3D array of size $m \times n \times 3$. ⟸

(d) uses a colormap to determine how the image will be displayed.

(e) can have any numeric type.

18. Which statement regarding Matlab indexed images is <u>false</u>?

(a) The colormap array can have as many rows and columns as the user desires. ⟸

(b) An indexed image consists of a 2D image array and a 2D colormap array.

(c) User-defined colormaps can be used.

(d) The colormap array contains red, green, and blue color information.

(e) Indexed images can be displayed with either image or imagesc.

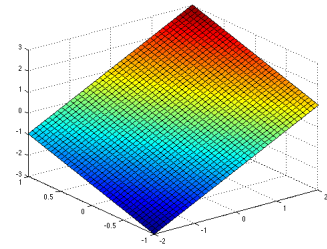19. Match the Matlab command with the resulting plot.

```
t = linspace(0,10*pi,1000);
x = t.*sin(5*t);
y = t.*cos(5*t);
z = t;
plot3(x,y,z)
```
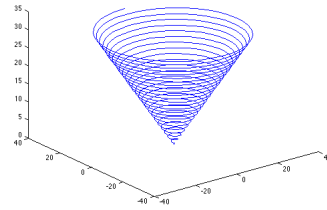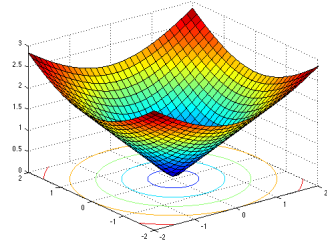


```
xRow = linspace(-2, 2, 40);
yRow = linspace(-1, 1, 40);
[x, y] = meshgrid(xRow,yRow);
z1 = x + y;
mesh(x, y, z1);
```
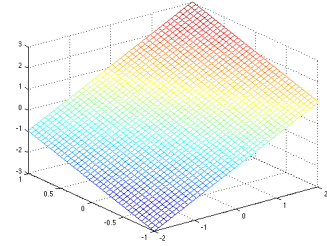


```
xRow = linspace(-2, 2, 40);
yRow = linspace(-1, 1, 40);
[x, y] = meshgrid(xRow,yRow);
z1 = x + y;
surf(x, y, z1);
```



```
xRow = linspace(-2, 2, 30);
yRow = linspace(-2, 2, 30);
[x, y] = meshgrid(xRow,yRow);
z1 = sqrt( x.^2 + y.^2 );
surfc(x, y, z1);
```


20. Indicate whether each statement about cell arrays and structure arrays is true or false.

(T /F) Cell arrays can be indexed with either cell or content indexing.

(T /F) Cell arrays can mix a variety of data types unlike regular arrays.

(T/ F) Structure arrays cannot mix data of different types.

(T /F) A structure stores data in named fields unlike a cell array.