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1) Solve the following short questions. Use the following arrays when needed.

Each question is independent from the others.

(12 marks) (11)

$$A = \begin{bmatrix} -1 & 7 & 2 & -4 \\ 3 & -5 & -1 & 3 \\ 7 & -6 & -4 & 5 \\ -9 & 4 & 3 & -4 \end{bmatrix}$$

$$D = \begin{bmatrix} 2 & 4 & 7 \\ 1 & 3 & 6 \end{bmatrix}$$

$$E = \begin{bmatrix} 1+i & 2-3i \\ 1+i & 2+3i \end{bmatrix}$$

1.	<pre>>>X = A < 0; >>X1 = find(X);</pre>	<pre>>>X1 ↓ [1 4 6 7 10 11 15 16]</pre>
2.	<pre>>>X2 = A(1:8); >> X2(find(X2>4)) = 5</pre>	<pre>>>X2 ↓ [-1 3 5 -9 5 -5 -6 4]</pre>
3.	<pre>>>X3 = D(1:2, 1:2).*E;</pre>	<pre>>>X3 ↓ [2+2i 8-12i 1+i 6+9i]</pre>
4.	<pre>>> X4 = [eye(2,2) (ones(2) - eye(2,2)) ; (ones(2) - eye(2,2)) eye(2,2)]</pre>	<pre>>>X4 ↓ [1 0 0 1 0 1 1 0 0 0 0 1 1 0 0 1]</pre>
5.	<pre>>> X5 = A(2:4,:);</pre>	<pre>>>X5 ↓ [3 7 -9 7 -5 -6 4 4 -1 -4 5 11 3 5 -11 1]</pre>
6.	<pre>>> X6 = D ^ D</pre>	<pre>>>X6 ↓ error</pre>

7.	<pre>>> X7 = real(E) * imag(E)</pre>	<pre>>>X7 ↓</pre> $\begin{bmatrix} 3 & 3 \\ 3 & 3 \end{bmatrix}$
8.	<pre>>> X8 = min(max(A));</pre>	<pre>>>X8 ↓</pre> <p style="text-align: center;">3</p>
9.	<pre>>> Fcn = @(x) 2*sqrt(x)+1; >> X9 = Fcn(sum(sign(A)));</pre>	<pre>>>X9 ↓</pre> $[\dots]$
10.	<pre>>> X10 = conv(D(1,:), D(2,:));</pre>	<pre>>>X10 ↓</pre> $[2 \quad 10 \quad 31 \quad 45 \quad 42]$
11.	<pre>>> X11 = poly(roots(A(1:4)));</pre>	<pre>>>X11 ↓</pre> $[-1 \quad 3 \quad 7 \quad -9]$
12.	<pre>>> xx = A([5:8]); >> X12 = polyval(xx, 0);</pre>	<pre>>>X12 ↓</pre> <p style="text-align: center;">4</p>

$$\begin{bmatrix} -1 & 1 & 1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & -1 & -1 & 1 \\ -1 & 1 & 1 & -1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 \\ 1 & 2 \end{bmatrix} \begin{bmatrix} 1 & -3 \\ 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 1+2 & *3 \\ 1+2 & -3+6 \end{bmatrix}$$

$$[2 \quad 4 \quad 7] [1 \quad 3 \quad 6]$$

$$2x^4 + 4x^3 + 12x^2 + 4x^3 + 12x^2 + 24x + 7x^2 + 21x + 42$$

2) Choose the best answer for each of the following items:

(4 Marks)

<p>To solve the matrix equation $Ax = b$ (where x is the only variable in the equation), which of the following Matlab operations would you use:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> $A \setminus b$ <input type="checkbox"/> A/b <input type="checkbox"/> $b \setminus A$ <input type="checkbox"/> b/A 	<p>Which Matlab function can be used to obtain all the zeros of the equation $x^2 = 7$</p> <ul style="list-style-type: none"> <input type="checkbox"/> solve($x^2 = 5$) <input type="checkbox"/> fzero('x^2-5', 0) <input type="checkbox"/> roots([1 0 -5]) <input checked="" type="checkbox"/> none of the above
<p>If $x = -7.7$, then</p> <ul style="list-style-type: none"> <input type="checkbox"/> round(x) = fix(x) <input type="checkbox"/> round(x) = ceil(x) <input type="checkbox"/> fix(x) = floor(x) <input checked="" type="checkbox"/> round(x) = floor(x) 	<p>Assume that Function(X) returns a square array with size $X \times X$ where all elements are 1. The output of the following code:</p> <pre>S = sum(ones(3)); for i = 1:length(S) K = sum(sum(Function(S(i)))) end</pre> <ul style="list-style-type: none"> <input type="checkbox"/> 14 <input checked="" type="checkbox"/> 9 <input type="checkbox"/> 1 <input type="checkbox"/> None of the above

3) Write a Matlab function ARRAY which accepts a certain array as input from the command window, if the array is square it asks the user which of the following operations she/he wishes to execute (sum of all array elements, matrix multiplication by itself), if the array is not square, it asks the user for the following operation (sorting rows, sorting columns). The function ARRAY returns the desired operation. Use sub-functions for each desired operation.

(6 Marks)

```
function array2 = ARRAY(A)
    [c,r] = size(A);
    if (c == r)
        option = input('select an operation: 1-sum of elements 2-matrix multiplication');
        switch option
            case 1
                % sum of elements
            case 2
                % matrix multiplication
        end
    else
        % non-square array
    end
end
```

4) Write down the declaration of the following function using MATLAB

The MATLAB function *letsDraw* draws the following two mathematical functions in two different output formats:

- ❖ ('s') The two figures are drawn together on the **same** graph
- ❖ ('b') The two graphs are drawn **besides** each other in the same window

The functions are:

$$f = 3t^2 + 2t - 0.5$$

$$g = 2t \cos(t)$$

Where the variable t varies from 0 to 10 with steps of 0.5

The *letsDraw* function accepts the following two parameters:

1. Choice of figure output format 's' or 'b'
2. The choices of the graph colors and formats for each of the two graphs

The choices are stored in a cell array inside another cell as follows:

'bx'	'g-x'	'r-x'
'bo'	'g-o'	'r-o'
'b+'	'g-+'	'r-+'

1. Write down the declaration of the "letsDraw" function

```
function letsDraw (fig_format, graph1_format, graph2_format);
```

```
t = [0:0.5:10];
```

```
f = polyval([3, 2, 0, -0.5], t);
```

```
g = 2*t.*cos(t);
```

2. Write down the command(s) to draw the functions beside each other, the first graph is **dashed red with + markers**, the second is **blue with x markers**.

```
g1_format = A{1,1} [3,3];
```

```
g2_format = A{1,2} [1,1];
```

```
letsDraw ('b', g1_format, g2_format);
```

```
if (fig_format == 's')
```

```
subplot(1,2,1);
```

```
plot(t, f, graph1_format);
```

```
subplot(1,2,2);
```

```
plot(t, g, graph2_format);
```

```
elseif (fig_format == 'b')
```

```
plot(t, f, graph1_format)
```

```
hold on
```

```
plot(t, g, graph2_format)
```