

Name: .....SOLUTIONS.....

ID Number: .....INSTRUCTOR.....

Exam Number:

Grade: 1: ... 2: ... 3: ... 4: ... 5: ... 6: ... 7: ... Total: .....

SOLVE ALL the problems IN THE SPACE PROVIDED

Read the Problems CAREFULLY!

THERE ARE 5 (FIVE) PAGES THIS PAGE INCLUDED

In the exam, the following matrices will be used. Do not get puzzled if a reference to matrix  $X$ ,  $Y$  or  $Z$  or etc arises! No problem modifies  $X, Y, Z, R, S$  in a way that missing that problem would change the answer of any other problem of the exam.

If you are asked to evaluate a MATLAB expression, and you think the result would generate an ERROR because a variable is undefined you could write **ERROR** instead of giving an answer. For example `five == 5` generates an **ERROR** since variable `five` has not been defined.

$$X = \begin{bmatrix} 5 & 2 & 2 & 2 \\ 1 & 1 & 1 & 3 \\ 1 & 0 & 2 & 2 \end{bmatrix}, Y = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \end{bmatrix}, Z = [ 1 \ 2 \ 3 \ 2 ], R = \begin{bmatrix} 2 \\ 1 \\ 2 \end{bmatrix}, S = [ 1 \ 2 \ 2 ],$$

**Problem 1.** (50 POINTS)

Give short answers to the following questions.

- (1) How many bytes in 1KiB? **1024**
- (2) What is a 1kB? **1000B i.e. 1000 bytes**
- (3) How many bytes is a MATLAB `int8`? **1**
- (4) How many bytes is a MATLAB `single`? **4**
- (5) How many bytes is a MATLAB `logical`? **1**
- (6) What is the range of values for an 8-bit unsigned integer such as `uint8` in MATLAB? (give number of values, lowest and highest value in the range.) **256 values, from 0 to 255.**
- (7) What is matrix element  $Y(\text{end} - 1, \text{end})$ ? **1**
- (8) What is array element  $X(\text{end}, 2)$ ? **0**
- (9) What is array element  $X(\text{end} - 5)$ ? **2**
- (10) Represent decimal (i.e. base-10) integer 16 in hexadecimal. **0x10**

**Problem 2.** (60 POINTS)

(a) What is the value, the size in bytes, and the data-type of the array class of variable A in lines 3 and 6 below, when the following MATLAB program get executed?

```
>> A = (1 < 2) + 1;
>> A;
>> whos A           % A = 2           Size of A in bytes 8           data type of A   double
>> A = 1==false -true;
>> A
>> whos A           % A = 0           Size of A in bytes 1           data type of A   logical
```

(b) What is the geometry of `pi`, what is its data type, and what is/are its values? What is the size of `pi` in bytes as reported by `whos pi`)?

```
pi(4)= 10;
whos pi; % geom of pi = 1 x 4 ,data type of pi = double , pi = [ 0 0 0 10]
%
% Byte count of pi is 32 bytes
```

(c) What is the effect of performing  $q2 = 10 : -2 : 1$ ? What is the value of  $q2$ , what is its geometry, and its size in bytes?

```
>> q2 = 10:-2:1 ;
>> q2           % q2 = [ 10 8 6 4 2 ]
%
>> whos q2; % geom of q2 = 1 x 5
%
% Byte count of q2 is 40 bytes
```

**Problem 3.** (30 POINTS)

What is the result of the following MATLAB operations?

- (a)  $q3a = R * S;$
- (b)  $q3b = S * R;$
- (c)  $q3c = R' .* R';$

(a)	(b)	(c)
$q3a =$ $[ 2 \ 4 \ 4 ]$ $[ 1 \ 2 \ 2 ]$ $[ 2 \ 4 \ 4 ]$	$q3b =$ 8	$q3c =$ $[ 4 \ 1 \ 4 ]$

**Problem 4.** (40 POINTS)

Evaluate the following MATLAB expressions. What are the values of  $q4a, q4b, q4c, q4d$ ?

- (a)  $q4a = 2 ^ 2 ^ 1 ^ 2$        $q4a = 16$
- (c)  $q4b = 5 == 5 - 5$        $q4b = 0$
- (d)  $q4c = 5 == 5 == 5$        $q4c = 0$
- (e)  $q4d = NaN == NaN$        $q4d = 0$

**Problem 5.** (50 POINTS)

- (a) List the elements of  $Y$  in column-major filin/form.  
**1,2,2,1,1,1**

- (b) List the elements of  $Y$  in row-major filin/form.  
**1,2,1,2,1,1**

- (c) What is the range of values (smallest, largest possible) for  $q5c$  that is defined as follows.

```
>> q5c = round(5*rand() + 3);      % Smallest possible value for q5c = 3
                                          %
                                          % Largest possible value for q5c = 8
```

- (d) What is the value of variable  $q5d$  defined as follows.

```
>> q5d = 5*ones(3)+eye(3) ;      % q5d = [ 6 5 5]
                                          [ 5 6 5]
                                          [ 5 5 6]
```

- (e) What is the value of variable  $q5e$  defined as follows.

```
>> q5e = sum(1:2:5)                      % q5e = 9
```

**Problem 6.** (40 POINTS)

(a) What is the value of variable **q6a** defined as follows.

```
>> q6a = 1:5 == 2           %   q6a = [ 0 1 0 0 0]
```

(b) What is the value of **q6b** after the second statement is executed, the fifth, and the seventh? Write down the values in the corresponding space below.

```
>> q6b = 20;
>> q6b;                               % q6b =    20
>> temp = 10;
>> q6b = q6b+10*temp /2;
>> q6b;                               % q6b =    70
>> q6b = q6b/2;
>> q6b;                               % q6b =    35
```

(c) What are the values of **my6A**, **my6B** at the end of the MATLAB program below (as indicated)?

```
>> my6A = 10;
>> my6B = 20;
>> t=my6A * my6B ; my6A = my6B ; my6B =t/10;
>> my6A                               % my6A = 20
>>
>> my6B                               % my6B = 20
```

**Problem 7.** (30 POINTS)

(a) What is the value of **F** defined as follows.

```
>> F= X(: , 1:2:4 );                % F = [ 5 2 ]
                                       [ 1 1 ]
                                       [ 1 2 ]
```

(b) What is the value of **F** defined as follows.

```
>> G= X;
>> G( : , 3:end ) = [ ] ;           % G = [ 5 2 ]
                                       [ 1 1 ]
                                       [ 1 0 ]
```

(c) What is the 8-bit binary representation of 28? **00011100**

$$X = \begin{bmatrix} 5 & 2 & 2 & 2 \\ 1 & 1 & 1 & 3 \\ 1 & 0 & 2 & 2 \end{bmatrix}, Y = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \end{bmatrix}, Z = [1 \ 2 \ 3 \ 2], R = \begin{bmatrix} 2 \\ 1 \\ 2 \end{bmatrix}, S = [1 \ 2 \ 2],$$

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You can tear-off this last page and use it as scratch paper; do not turn IT in

End of Exam 1