Name: $\qquad$

ID Number: $\qquad$
$\square$
Grade: 1: ... 2: ... 3: ... 4: ... 5: ... 6: ... 7: ... Total: .......

# Solve ALL the problems in the space provided <br> 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.

$$
X=\left[\begin{array}{llll}
5 & 2 & 2 & 2 \\
1 & 1 & 1 & 3 \\
1 & 0 & 2 & 2
\end{array}\right], Y=\left[\begin{array}{lll}
1 & 2 & 1 \\
2 & 1 & 1
\end{array}\right], Z=\left[\begin{array}{llll}
1 & 2 & 3 & 2
\end{array}\right], R=\left[\begin{array}{l}
2 \\
1 \\
2
\end{array}\right], S=\left[\begin{array}{lll}
1 & 2 & 2
\end{array}\right],
$$

Problem 1. (50 points)
Give short answers to the following questions.
(1) How many bytes in 1 KiB ?
(2) What is a 1 kB ?
(3) How many bytes is a MATLAB int8?
(4) How many bytes is a MATLAB single?
(5) How many bytes is a MATLAB logical?
(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.)
(7) What is matrix element $Y($ end -1, end $)$ ?
(8) What is array element $X(e n d, 2)$ ?
(9) What is array element $X($ end -5$)$ ?
(10) Represent decimal (i.e. base-10) integer 16 in hexadecimal.

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 = .... Size of A in bytes ...... data type of A
>> A = 1==false -true;
>> A
>> whos A Size of A in bytes ...... data type of A
```

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

```
pi(4)= 10;
whos pi; % geom of pi = ... x ... ,data type of pi = ......., pi = .................
%
% Byte count of pi is .... bytes
```

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

```
>> q2 = 10:-2:1 ;
>> q2 % q2 = ......................
    %
>> whos q2; % geom of q2 = ... x ...
    %
    % Byte count of q2 is .... bytes
```

This is the end of page 2 containing Problems 1 and 2. Turn page.

Problem 3. (30 Points)
What is the the result of the following MATLAB operations?
(a) $q 3 a=R * S$;
(b) $q 3 \mathrm{~b}=\mathrm{S} * \mathrm{R}$;
(c) $q 3 c=R \prime$.* $\mathrm{R}^{\prime}$;
(a)
(b)
(c)
q3a $=$
q3b $=$
q3c $=$

Problem 4. (40 points)
Evaluate the following MATLAB expressions. What are the values of $q 4 a, q 4 b, q 4 c, q 4 d$ ?
(a) $\mathrm{q} 4 \mathrm{a}=2^{\wedge} 2^{\wedge} 1^{\wedge} 2 \quad \mathrm{q} 4 \mathrm{a}=\ldots$.
(c) $\mathrm{q} 4 \mathrm{~b}=5==5-5 \quad \mathrm{q} 4 \mathrm{~b}=\ldots$.
(d) $\mathrm{q} 4 \mathrm{c}=5=5=5=5 \quad \mathrm{q} 4 \mathrm{c}=\ldots$.
(e) $\mathrm{q} 4 \mathrm{~d}=\mathrm{NaN}==\mathrm{NaN} \quad \mathrm{q} 4 \mathrm{~d}=\ldots$.

Problem 5. (50 POINTS)
(a) List the elements of $Y$ in column-major filin/form.
(b) List the elements of $Y$ in row-major filin/form.
(c) What is the range of values (smallest, largest possible) for q 5 c that is defined as follows.

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

(d) What is the value of variable q5d defined as follows.
>> $q 5 d=5 *$ ones $(3)+$ eye ( 3 ) ; $\quad \% \quad$ q5d $=\ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots .$.
(e) What is the value of variable q5e defined as follows.
>> $q 5 \mathrm{e}=\operatorname{sum}(1: 2: 5)$

$$
\% \quad \mathrm{q} 5 \mathrm{e}=\ldots \ldots \ldots \ldots . . . . . .
$$

This is the end of page 3 containing Problems 3, 4, and 5. Turn page.

Problem 6. (40 Points)
(a) What is the value of variable q6a defined as follows.

```
>> q6a = 1:5 == 2 % q6a =
```

$\qquad$
(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; | \% q6b $=$ |
| :---: | :---: |
| >> temp = 10; |  |
| >> q6b = q6b+10*temp /2; |  |
| >> q6b; | \% q6b = |
| >> q6b = q6b/2; |  |
| >> q6b; | \% q6b = |

(c) What are the values of my6A, my6B at the end of the MATLAB program below (as indicated)?
>> $m y 6 A=10$;
>> my6B = 20;
>> $\mathrm{t}=\mathrm{my} 6 \mathrm{~A} *$ my6B ; my6A = my6B ; my6B =t/10;
$\gg$ my6A $\quad \%$ my6A $=\ldots \ldots \ldots . . .$.
>>
>> my6B $\%$ my6B $=\ldots \ldots \ldots \ldots .$.

Problem 7. (30 POINTS)
(a) What is the value of $F$ defined as follows.
>> $\mathrm{F}=\mathrm{X}(:, 1: 2: 4)$;
$\% \mathrm{~F}=$ $\qquad$
(b) What is the value of $F$ defined as follows.
>> $G=\mathrm{X}$;
>> G( : , 3:end ) = [ ] ; \% G = $\qquad$
(c) What is the 8 -bit binary representation of 28 ?

This is the end of page 4 containing Problems 6 and 7 . Turn page.

$$
X=\left[\begin{array}{llll}
5 & 2 & 2 & 2 \\
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1 & 0 & 2 & 2
\end{array}\right], Y=\left[\begin{array}{lll}
1 & 2 & 1 \\
2 & 1 & 1
\end{array}\right], Z=\left[\begin{array}{llll}
1 & 2 & 3 & 2
\end{array}\right], R=\left[\begin{array}{l}
2 \\
1 \\
2
\end{array}\right], S=\left[\begin{array}{lll}
1 & 2 & 2
\end{array}\right],
$$

Intentionally left blank. Copies of front-page matrices included
You can tear-off this last page and use it as scratch paper; do not turn IT in

