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ID Number: (7 points) Exam Number:

Grade: 1: ... 2: ... 3: ... 4: ... 5: ... 6: ... 7: ... 8: ... 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! If a problem modifies X and then another problem (not a question in a problem) uses X again, for the latter problem ignore the prior modifications; use/read X as it appears on this page not as modified before.

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

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

Problem 1. (50 POINTS)

Give short answers to the following questions.

- (a) How many bytes in 2KiB? **Answer: 2048 bytes**
- (b) What is a 1MB? **Answer: 1,000,000 bytes**
- (c) What is a 1Mb? **Answer: nothing**
- (d) How many bytes is a MATLAB double? **Answer: 8 bytes**
- (e) How many bytes is a MATLAB logical? **Answer: 1 byte**
- (f) What is the range of values for an 8-bit unsigned integer? (give number of values, lowest and highest value in the range.) **Answer: 256 values, 0-255**
- (g) What is matrix element $X(1,3)$? **Answer: 3**
- (h) What is array element $X(4)$? **Answer: 2**
- (i) What is array element $Z(3)$? **Answer: 1**
- (j) Represent decimal 128 in (8-bit unsigned) hexadecimal. **Answer: 0x80**

Problem 2. (30 POINTS)

(a) What is the number of bytes used to store `ans` after each one of the two lines below is executed? What is the data type of the array class used to store `ans` respectively?

```
>> ans = 13;
>> whos ans           % Give size of ans in bytes .8....    data type .double..
>> ans = true;
>> whos ans           % Give size of ans in bytes .1....    data type .logical.
```

(b) How many bytes would MATLAB use to store R, S, X, Y, Z as defined on the cover page? Circle all that apply of the following answers:

- 31 bytes
- 62 bytes
- 124 bytes
- 248 bytes **Answer: 248 bytes since they collectively store 31 numbers represented in double.**
- between 31 and 62 bytes (inclusive of the end points)

(c) If we want to clean up from the command window the variables already defined which command do we use. Circle all that apply.

- clear **Answer: clear is the answer, clc just clears the screen.**
- clc
- either one

Problem 3. (30 POINTS)

What is the result of the following MATLAB operations?

(a) $t3 = R * S$

(b) $u3 = Y * R$

(c) $w3 = R' .* S$

Answer:

$$t3 = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 2 & 2 & 2 \end{bmatrix}$$

$$u3 = \begin{bmatrix} 5 \\ 9 \\ 8 \end{bmatrix}$$

$$w3 = \begin{bmatrix} 1 & 2 & 2 \end{bmatrix}$$

Problem 4. (40 POINTS)

Evaluate the following MATLAB expressions. What are the values of a, b, c, d ?

(i) $a = 2^3 + 2^1 \cdot 2/2$ **Answer: a= 10.**

(ii) $b = 1 + \sim 1 \& \sim 0$ **Answer: b=1**

(iii) $c = 2 == 4 - 2 * \text{true}$ **Answer: c=1**

(iv) $d = 1 < 2 > 3$ **Answer: d= 0**

Problem 5. (40 POINTS)

(i) List the elements of Z in column-major fillin/form. **1, 2, 1, 2**

(ii) List the elements of Y in row-major fillin/form. **1,1,1, 1,2,2, 2,2,1**

(iii) Write MATLAB code that generates row vector S in two different ways. (A third way is the traditional $\gg S = [1 \ 1 \ 1]$. Give code for two other ways.

Method 1
`S= [1 , 1 , 1]` % Use commas

Method 2
`S= ones(1,3)` % Use ones

(iv) What is the effect of doing $K = 1 : 3 : 11$?

Answer: $K = [1 \ 4 \ 7 \ 10]$

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

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

End of Exam 1