NJIT New Jersey's Science & Technology University

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December 2012 | Fall 2012

Exam 2(300 points) | 120 minutes

Name: ..... **Section :** .....

ID Number: ..... **Exam Number:** .....

Grade: 1: ... 2: ... 3: ... 4: ... 5: ... 6: ... 7: ... 8: ... 9: ... 10: ... 11: ... Total: .....

Solve **ALL the problems** in the space provided

Read the Problems CAREFULLY!

There are 7 (SEVEN) pages; This is Page 1 and Page 7 is SCRATCH page

You can carefully tear Page 7 off and work on it; Do not return it then.

Read and Sign the statement below at the end of the exam

Unsigned exams will be marked with grade 0 (zero).

STATEMENT

On my honor, I pledge that I have not violated the provision of the NJIT Student Honor Code.

Sign below at the end of the exam

Signature .....

In the exam, the following matrices MAY be used. Do not get puzzled if a reference to matrix X, Y Z, R, S, T or W arises! 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.

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

$$T = ['COMPUTER' \quad 'Science*'], \quad W = ['Computer' \quad ; \quad 'SCIENCES'],$$

Problem 1. (32 POINTS)
Give short answers to the following questions. If you think an answer does not exist, you can write `UNDEFINED` next to it.

(1) (2pt) How many bytes in 2KiB?

(2) (2pt) How many bytes in 1MB?

(3) (2pt) How many bytes is a MATLAB `logical`?

(4) (2pt) How many bytes is a MATLAB `int16`?

(5) (2pt) How many bytes is a MATLAB `double`?

(6) (2pt) How many bytes is a MATLAB `char` ?

(7) (2pt) Write decimal (base-10) 33 as an unsigned 8-bit binary number.

(8) (2pt) What is the value of $X(end, 1)$?

(9) (2pt) What is the value of $X(1, end)$?

(10) (2pt) What is the value of $X(end, end)$?

(11) (2pt) What is the value of $X(8)$?

(12) (2pt) Convert `0x11` into an unsigned integer base-10.

(13) (2pt) What is the value of $W(end, 2:3)$?

(14) (2pt) What is the value of $W(2, 7)$?

(15) (2pt) What is the value of $W(5)$?

(16) (2pt) How much is $j * j$ in MATLAB?

Problem 2. (16 POINTS)
What is the **value** and **data type** of each one of $p2a, p2b, p2c, p2d$?

(a) $p2a = 2 + 3 < 4 + 5$ `value ..... data type .....`

(b) $p2b = 10 + 4$ `value ..... data type .....`

(c) $p2c = 10.0 + 4.0$ `value ..... data type .....`

(d) $p2d = 5 < 5 < 5$ `value ..... data type .....`

Problem 3. (32 POINTS)
What is the **value** of each one of $p3a, p3b, p3c, p3d$? Size in bytes ? The geometry?

(example) $z = ones(2)$ **Answer** $z = [1 \quad 1; 1 \quad 1]$**, 32 bytes,** z **is a** 2×2 **matrix**.

(a) $p3a = 2 : 5 : 20$

(b) $p3b = Z([1, 3], 2 : end)$

(c) $p3c = size(X)$

(d) $p3d = length(W)$

Problem 4. (50 POINTS)
What is the value, the size in bytes, the data-type of the array class of variable `A`, and its geometry in lines 3, 6, 9, 14,20 below, when the following MATLAB script gets executed?

```
>>  A = (1 <  2) ;
>>  A ;
>>  whos A;          % A = .... ,Size A ....bytes, data type A  ........., geometry ... x ...
>>  A = 1==true -false;
>>  A ;
>>  whos A;          % A = .... ,Size A ....bytes, data type A  ........., geometry ... x ...
>>  A=  size(ones(5,5));
>>  A ;
>>  whos A;          % A = .... ,Size A ....bytes, data type A  ........., geometry ... x ...
>>
>>  A = 10;
>>  A(2)= 20;
>>  A;
>>  whos A;          % A = .... ,Size A ....bytes, data type A  ........., geometry ... x ...
>>
>>
>>  A(2,2) = 40;
>>  A;
>>
>>  whos A;          % A = .... ,Size A ....bytes, data type A  ........., geometry ... x ...
>>
>>
```

Problem 5. (30 POINTS)
(a) What is the value of `p4a` defined as follows.

```
>>   p4a = sum(X(:));
>>
>>   p4a  =
```

(b) What is the value of `p4b` defined as follows.

```
>>   p4b = X * Z;
>>
>>   p4b  =
```

(c) What is the value of `p4c` defined as follows.

```
>>   p4c = X .* Y ;
>>
>>   p4c  =
```

Problem 6. (30 POINTS)
(a) Use a **for** loop to print the integers from 10 down to (including) 2, one per line.

(b) Use a **while** loop to print the integers from 10 down to (including) 2, one per line.

(c) Use neither a **for** loop nor a **while** loop to print the integers from 10 down to (including) 2, one per line. No explicit listing of numbers.

Problem 7. (20 POINTS)
How inefficient is the following function `ip7` (i stands for inefficient)? Comment on it. Then, give a transformation that can make it faster by an order of magnitude or so. Show your transformed code next to the original on the far right below, where we decided to call the new function `ep7` (e for efficient).

```
%Original                          Transformed
function y=ip7(n)                % function    y=ep7(n)
 for ii=1:n                      %
  my(ii) = ii  * 4;              %
 end                             %
 y=my;                           %
end                              % end
```

Problem 8. (20 POINTS)
You are given below the listings of M-file `p8.m`. The intent is to implement function `p8` that accepts as input the sizes of the sides a, b, c of a triangle T and is supposed to return a 'equilateral', 'isosceles', or 'scalene' depending on whether all a, b, c are equal to each other, two of them are equal to each other but not to the third, none is equal to any other. Fill the M-file as needed.

```
function y = p8(a,b,c)                                  % LINE 1
 if ( a == b)   (b == c))                               % LINE 2
    y = 'equilateral';                                  % LINE 3
 elseif ( ( a == b)   (b == c)              )           % LINE 4
    y = 'isosceles' ;                                   % LINE 5
 else                                                   % LINE 6
                                                        % LINE 7
 end                                                    % LINE 8
end
```

Problem 9. (20 POINTS)
Implement a MATLAB function named `p9` with one parameter `n`, that computes and returns two values. One (the first of the two) is the sum of the first n integers i.e. the sum $1 + 2 + \ldots + n$ and the second is the sum of the squares of those integers i.e. $(1^2 + 2^2 + \ldots + n^2)$. Thus `[a b] = p9(5)` would result to $a = 15$ and $b = 55$.

Problem 10. (30 POINTS)
The following code resides in file `myex5.m`.

(a) Properly identify all functions defined (i.e. give name, classify the type of function it is, and indicate the lines stretching from the function line through its matching end). List primary functions first, then nested, and then other types. Do so on the space provided under the labels `Function, Types, Lines-for-function` .

(b) What is the value returned for `z` for the function call `z= myex5(10)`.

```
  % myex5                              This is line 1    Function     Type             Lines-for-function
function z= myex5(z)                   %       line 2
  function z= myex5a (z)               %       line 3
     z= z+z;                           %       line 4
  end                                  %       line 5
  function z= myex5b (z)               %       line 6
     z= z+z+z;                         %       line 7
  end                                  %       line 8
                                       %       line 9
  z= myex5a(z)+myex5b(z)+myex5c(z);    %       line 10
  return;                              %       line 11
end                                    %       line 12
function z=myex5a(z)                   %       line 13
  z= z+z+z+z;                          %       line 14
end                                    %       line 15
function z=myex5c(z);                  %       line 16
  z= myex5a(z)+z;                      %       line 17
end                                    %       line 18  This is the end of file myex5.m

 >> z = myex5(10)
 z =  ...........                          % What is the value of z . Fill in the info on the dotted area
```

Problem 11. (20 POINTS)
What does the following function p11 print when called as in `p11(10)`.

```
function  p11(n)                    %% START OF FILE     p11.m
  if (n==10);
    fprintf('a'); n=n-2;
  end
  if (n==8 );
    fprintf('n'); n=n-2;
  end
  if (n==6);
    fprintf('n'); n=n-4;
  end
  if (n==4);
    fprintf('l'); n=n-4;
  end
  if (n==2);
    fprintf('e'); n=n-4;
  end
  if (n==1);
    fprintf('x'); n=n-1;
  end
end                                 %% END OF FILE     p11.m

>> p11(10)                          % Command window invocation
```

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

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End of Exam 2/ You may tear off this page carefully