

Name: .....

ID Number: .....

Exam Number:

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

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

$$T = ['computer' \quad 'science'], \quad W = ['COMPUTER' \ ; \ 'SCIENCES'],$$

**Problem 1.** (60 POINTS)

Give short answers to the following questions. If you think an answer does not exist, you can write UNDEFINED next to it.

- (a) (5pt) How many bytes in 2KiB?
- (c) (5pt) How many bytes is a MATLAB double?
- (d) (5pt) Write decimal (base-10) 11 as an unsigned 8-bit binary number.
- (e) (5pt) What is the value of  $X(2,2)$  ?
- (f) (5pt) What is the value of  $X(3,2)$  ?
- (g) (10pt) What is the value of  $T(2)$  ? What is the value of  $T(1)$  ?
- (h) (10pt) What is the value of  $W(2,8)$  ? What is  $W(1,:)$ ?
- (i) (10pt) What is the value of  $X(7)$  ? What is the value of  $W(3)$ ?
- (j) (5pt) How much is  $i * i$  in MATLAB?

**Problem 2.** (30 POINTS)

Evaluate the following MATLAB expressions by providing the values of the variables  $a, b, c, d$ .

- (a)  $a = 10/2 * 4/2 + 2^1 \wedge 2$ .
- (b)  $b = 1 \& \sim 5 - 5$ .
- (c)  $c = 2 == 3 - 2$ .
- (d)  $d = 1 > 2 < 3$ .

**Problem 3.** (30 POINTS)

Evaluate the following MATLAB expressions by providing the values of the variables  $a, b, c, d$ . Also indicate whether  $a, b, c, d$  is a scalar ( $1 \times 1$  matrix) or not; in the latter case identify the dimension(s) of the result.

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

- (a)  $a = 1 : 2 : 8$ .
- (b)  $b = X(1 : end, 2 : 3)$ .
- (c)  $c = size(X)$ .
- (d)  $d = length(T)$ .

**Problem 4.** (30 POINTS)

With reference to the following MATLAB code, answer the following questions.

```
function b=exam2p4(s)
    n=length(s);
    if (n<=1)
        b=1;
        return;
    end
    if (s(1)==s(n))
        b = exam2p4(s(2:n-1));
    else
        b = 0;
    end
end
```

- (a) What is the effect of `a= exam2p4('abc')`? What is the value of  $a$  returned?
- (b) What is the effect of `b= exam2p4('aba')`? What is the value of  $b$  returned?
- (c) What is the effect of `b= exam2p4('abccba')`? What is the value of  $b$  returned?
- (d) What is the effect of `b= exam2p4('abcabc')`? What is the value of  $b$  returned?
- (e) What does function `exam2p4` compute for an input that is a string of characters? Explain.

**Problem 5.** (30 POINTS)

- (a) How many types of functions have we encountered in MATLAB? List them also.
- (b) List three types of variables in MATLAB .

**Problem 6.** (30 POINTS)

For the following sorting algorithms write a YES or NO in the second column to indicate whether the algorithm sorts in-place or NOT, write a YES or NO in the third column to indicate whether the algorithm is stable or not, write a LINEAR, LOG-LINEAR, or QUADRATIC to indicate whether the worst-case running time is linear ( $n$ ), log-linear ( $n \lg n$ ) or quadratic ( $n^2$ ) respectively to the number of keys  $n$  to be sorted.

Column 1 Algorithm	Column 2 in-place	Column 3 stable	Column 4 running-time
BubbleSort/Odd-even transposition			
SelectionSort			
InsertionSort			

**Problem 7.** (30 POINTS)

You are given the following MATLAB code residing in file with filename `exam2p7.m`. What does it get printed when we call it with `a= exam2p7(5);`. What is the value of  $a$ ?

```
function s=exam2p7(n)
k=1;
s=0;
while (k<n)
    s= s+1;
    k= k+1;
end
fprintf('s= %2d \n',s);
exam2p7b(n);
end
```

```
function s=exam2p7b(n)
k=1;
s=1;
while (k<=n)
    s=s*2;
    k=k+1;
end
fprintf('s= %2d \n',s);
end
```

**Problem 8.** (30 POINTS)

You are given the following MATLAB code residing in file with filename `exam2p8.m`. What does it get printed when we call it with `exam2p8()`;

```
function exam2p8()
p8 = 20;
for ii=1:3:10
    p8 = p8 - 2;
end

fprintf('p8 = %2d \n',p8)

p8 = 20;
for ii=1:3:10
    p8 = p8 - ii;
end
fprintf('p8 = %2d \n',p8)
end
```

**Problem 9.** (30 POINTS)

You are given the following MATLAB code residing in file with filename `exam2p9.m`. We then issue the two calls `[c d] = exam2p9(40,10)` and `[a b]=exam2p9(20,10)` shown below. What are the values of  $c, d, a, b$ ?

```
function [c d]= exam2p9(a,b)
    c= a-b;
    d= a+b;
end

>> [c d]= exam2p9(40, 10);
>> c
    c =
>> d
    d =
>> [a b]= exam2p9(20, 10);
>> a
    a =
>> b
    b =
```

End of Page 5/Turn Page

**Problem 10.** (33 POINTS)

Implement a function `sumton (n)` that computes the sum  $1 + 2 + \dots + n$ . Thus a call `sumton (10)`; will print

The sum from 1 to 10 is = 55

and the call `sumton (100)`; will print

The sum from 1 to 100 is = 5050.

It is imperative that you not only implement the function that computes correctly the sum, but you also include in the function's body, code that prints the relevant information as shown in the examples above. (You can use for that an `fprintf` or a `disp` function.)

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$$T = ['computer' \quad 'science'], \quad W = ['COMPUTER' \quad ; \quad 'SCIENCES'],$$

Intentionally left blank otherwise with copies of front-page matrices  
End of Exam 2/ You can tear off carefully this page