

ID: _____ Name: _____

Midterm Exam, 201?..??, Instructor: Ahmet Sacan

Sign the honor code below. **No credit will be given for the exam without a signed pledge.**

I have neither given nor received aid on this examination.
Signed: _____

There are 10 questions in this exam. Turn in Questions 1-7 before you start working on Questions 8-10. Submit your programs for Questions 8-10 on BBVista, in addition to turning in your paper exam. Sign off your submission before exiting the room.

Q1 (5 pts). *Indexing.* Let **A** be a square matrix with at least 3 rows. Write a single statement that will assign into **B**, the 6 elements located in the last 2 rows and last 3 columns of **A**. After your statement executes, **B** should become a 2x3 matrix. Do not use loops.

```
B = A(end-1:end, end-2:end)
```

Q2 (5 pts). *Linear Indexing.* If matrix **M** has 5 rows and 7 columns, **M(3,2)** can equivalently be expressed as **M(x)**. What is the value of **x**?

8

Q3 (5 pts). *Creating vectors.* Use colon operator “:” to create a vector **X** that has values [4 11 18 25 32]. Create another vector **Y** that has the same values, using the linspace function.

```
X = 4:7:32  
Y = linspace( 4, 32, 5 )
```

Q4 (5 pts). *Logical Indexing.* Let **M** be a matrix of any size. First construct a logical matrix **I** that has the same size as **M** and has true for even elements of **M**. Making use of **I**, change the even elements of **M** by dividing them with 2. Making use **I**, then change the odd elements of **M** by multiplying them with 2.

ID: _____ Name: _____

```
I = mod(M,2)==0  
M(I) = M(I) ./2  
M(~I) = M(~I) .*2
```

Q5 (5 pts). *Variable scope.* The function apple is as given below. Fill in the blanks in the output.

```
>> x = 5; y = 6;  
>> y = apple( x );  
>> a = 2; b = 3;  
>> b = apple (a);  
  
>> fprintf('x=%d y=%d a=%d b=%d\n', x,y,a,b);  
  
x=5 y=30 a=2 b=12
```

```
function a = apple( b )  
b = b*3;  
a = b * 2;
```

Q6 (10 pts). *Nested for loops.* Fill in the blanks in the outputs below.

```
>> x = [ ];  
>> for a = [ 3 5 ]  
>> for b = [2 4 8]  
>> x(end+1) = b;  
>> end  
>> x(end+1) = a;  
>> end  
>> disp ( x )  
  
2 4 8 3 2 4 8 5
```

```
>> x=0; disp( 3 < x < 5 )  
  
1  
  
>> disp ( 4>3 +1 )  
  
0
```

Q7 (5 pts). *Binary numbers.* What is the decimal value of the binary number 10101 ?

ID: _____ Name: _____

21

ID: _____ Name: _____

I have neither given nor received aid on this examination.

Time of submission: _____

Signed: _____

Q8 (20 pts). *Loops or vectorized code, strings.* Write a function **getfancyrectangle(R,C)** that takes the number of rows and columns and returns a string as a character matrix, containing a "fancy" rectangle filled with alternating '@' and '#' characters, as shown below.

```
>> getfancyrectangle(2,4)
ans =
@#@#
#@#@
>> getfancyrectangle(3,4)
ans =
@#@#
#@#@
@#@#
```

```
function s = getfancyrectangle(R,C)
%R=4; C=5;

if mod(R,2)==0
    s = getfancyrectangle(R+1,C);
    s(end,:)= [];
else
    s = repmat('#',R,C);
    s(1:2:end) = '@';
end
```

Q9 (20 pts). *Loops or vectorized code.* Write a function **baileypi(n)** that calculates an approximation to π using the following formula. Also fill in the blanks in the following output.

$$\pi \approx \sum_{k=0}^n \frac{1}{16^k} \left(\frac{4}{8k+1} - \frac{2}{8k+4} - \frac{1}{8k+5} - \frac{1}{8k+6} \right)$$

```
>> disp( baileypi(0) )
    3.1333
>> disp( baileypi(1) )
    3.1414
>> disp( baileypi(10) )

    3.1416
```

```
function p=baileypi(n)

k=0:n;

p = sum( (1./16.^k) .* ( ...
    4./(8*k+1) ...
    - 2./(8*k+4) ...
    - 1./(8*k+5) ...
    - 1./(8*k+6) ) );
```