

BIOMED 201 - Programming & Modeling for BME

Midterm Exam, 2013.10.30, 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 7 questions in this exam. **Turn in your exam paper before you start working on Question 7.** Submit your code for Question 7 on ProgrammingBank. Sign the sign-out sheet before leaving the room.

Q1 (10 pts). *Indexing.* Let **A** be a row vector with **R** columns. Write a single statement that will reverse the order of elements in **A**. For example, if **A** is [3 7 2 9], after your statement, **A** should become [9 2 7 3]. Do not use loops.

```
A = A(end:-1:1)
```

Q2 (10 pts). *Creating vectors.* Fill in the blanks below with what Matlab would display for the given expression.

```
>> [ 3:1 6:1:4 9:-2:7 reshape repmat([1 3], 3, 1), 1, [] ]  
ans =  
9 7 1 1 1 3 3 3
```

Q3 (10 pts). *Variable scope.* Fill in the blanks in the output.

```
>> a = 5;  
>> b = apple( a );  
>> apple( 7 );  
>> [a b]  
ans =  
5 30
```

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

Q4 (10 pts). *Indexing.* Let **M** be a matrix with **100** rows and **1000000** columns. **M(2468)** can equivalently be expressed as **M(x,y)**. What are the values of **x** and **y**?

$x = \underline{68}$, $y = \underline{25}$

Q5 (10 pts). *Vectorizing code, element-wise operations, logical indexing.* Let \mathbf{M} be a matrix with 3 columns. Write code that keeps in \mathbf{M} only the rows where the first column is smaller than the second column and where the last column is the product of the first two columns. You may define additional variables. Do not use loops.

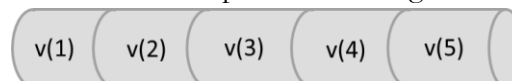
```
I = (M(:,1) < M(:,2)) & (M(:,1) .* M(:,2) == M(:,3))
M = M(I, :)
```

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

```
>> x = zeros(2, 0);
>> for a = [ 1 2 ]; for b = a+1:a+2
>>   x(:,end+1) = [ a b ];
>> end; end; disp ( x )
```

1 1 2 2
2 3 3 4

PROGRAMMING QUESTION – Q7 (40 pts). *Loops or vectorized code.* Consider an experiment where ants are placed in a large glass tube of length L inches and are allowed to move freely in the tube. The glass tube is segmented into L one inch sections and the numbers of ants in each segment are represented by a vector \mathbf{v} . The example below shows an example of a 5-inch glass tube.



After one minute, for any given segment, half the ants move to the segment on the left, and the other half move to the segment on the right. Half the ants in $v(1)$ and $v(L)$ move to the right and left, respectively; while the other half do not move.

Write a function **diffuseants(v)** that takes a vector \mathbf{v} and returns the number of ants in the segments of the glass tube after one minute. For simplicity, assume that the number of ants in a segment does not have to be a whole integer.

ID (e.g., ab1234): _____ Name: _____ Expected Course Grade: _____

```
>> disp( diffuseants( [0 3 0] ) )  
    1.5000         0     1.5000  
>> disp( diffuseants( [3 0 3] ) )  
    1.5000     3.0000     1.5000  
>> disp( diffuseants( [2 2 2 2] ) )  
     2     2     2     2  
>> disp( diffuseants( [10 2 2 2 0] ) )  
     6     6     2     1     1
```