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BIOMED 201 - Programming & Modeling for BME
Midterm Exam, 2014.10.28, 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: _____*

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. Write a single statement that will remove from **A** all of its zero elements. For example, if **A** is [3 0 2 9 0 10 0], after your statement, **A** should become [3 2 9 10]. Do not use loops.

Q2 (10 pts). *Variable scope.* Fill in the blanks in the output.

```
>> a = 10;
>> b = apple( a );
>> apple( 15 );
>> disp([a b])


_____
```

```
function b = apple( a )
if mod(a,2)==0;
a=orange(a); end
b=a*10;
a=a+7;
```
```
function b = orange( a )
b=a/2;
```

Q3 (10 pts). *Indexing.* Let **M** be a matrix with **1000** rows and **3333** columns. **M(5555)** can equivalently be expressed as **M(x,y)**. What are the values of **x** and **y**?

x=_____,   y=_____

Q4 (10 pts). *Vectorizing code, element-wise operations, logical indexing; or loops.* Let **A** be a matrix with 3 columns. Write code that creates a new matrix **B** that contains all rows of **A** where the first column is smaller than or equal to the second column and also the product of first column and second column equals to the third column. E.g., if **A** is [2 4 8; 4 2 8; 2 3 8; 8 2 2; 3 3 9], after your code, B should contain [2 4 8; 3 3 9].

Q5 (10 pts). *Creating vectors.* Fill in the blanks below with what Matlab would display for the given expression.

```
>> [ 44:42 33:-3:30 23:2:24 reshape(repmat([1 2],2,1),1,[]) ]
ans =


_____
```

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

```
>> m = [16 2 3 13; 5 11 10 8; 9 7 6 12; 4 14 15 1];   x = [];
>> for a = 1:size(m,1);   for b = 1:a-1
>>    if mod(m(a,b),2)==1;  x(end+1) = m(a,b); end
>>  end; end
>> disp ( x )




_____
```

PROGRAMMING QUESTION – Q7 (40 pts). Consider an experiment where bacteria are grown on a plate divided into an **R**-by-**C** grid. Let matrix **M** (with **R** rows, **C** columns) represent the number of bacteria in each block of this grid. When a drop of antibiotic is delivered to a specific block at row **x** and column **y**, it kills all of the bacteria on that block and half of the bacteria in all of the neighboring blocks. The figure below shows an example of a plate composed of a 4-by-4 grid, where the numbers represent bacteria count in each block. After the antibiotic is delivered to the block at 2nd row and 3th column, it kills all of the 10 bacteria on that block and half of the bacteria in neighboring blocks: (2+3+13+11+8+7+6+12)/2=31; killing a total of 41 bacteria. Write a function **killbacteria(M,x,y)** that returns the total number of bacteria killed.


```
>> disp(killbacteria([16 2 3 13; 5 11 10 8; 9 7 6 12; 4 14 15 1],2,3))
     41
>> disp(killbacteria([16 2 3 13; 5 11 10 8; 9 7 6 12; 4 14 15 1],1,1))
     25
>> disp(killbacteria([16 2 3 13; 5 11 10 8],1,4))
     23.5
```