CS1112 Summer 2010

Quiz 4 Solutions
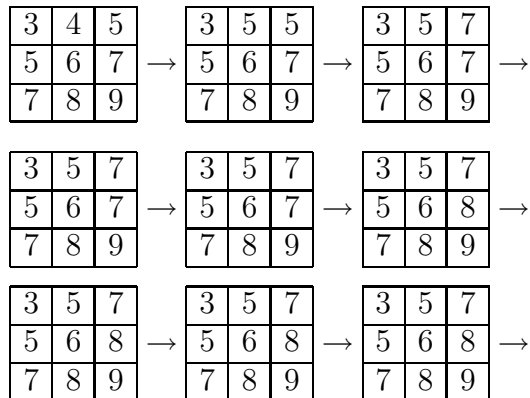
1. (a) What is the output when the following script is executed? Show work.

```
A = zeros(100,100);
for i=1:100
    for j=1:100
        A(i,j) = 2*i+j;
    end
end
fprintf('%10.1f\n',A(100,1))
for i=1:100
    for j=1:100
        A(i,j) = A(j,i);
    end
end
fprintf('%10.1f\n',A(100,1))
```

Let's look at the 3-by-3 version of this. The first nested loop sets up

$$A = \begin{array}{|c|c|c|} \hline 3 & 4 & 5 \\ \hline 5 & 6 & 7 \\ \hline 7 & 8 & 9 \\ \hline \end{array}$$

The second nest loop produces this sequence of updates (there are 9 of them):

$$
\begin{array}{|c|c|c|} \hline 3 & 4 & 5 \\ \hline 5 & 6 & 7 \\ \hline 7 & 8 & 9 \\ \hline \end{array} \rightarrow
\begin{array}{|c|c|c|} \hline 3 & 5 & 5 \\ \hline 5 & 6 & 7 \\ \hline 7 & 8 & 9 \\ \hline \end{array} \rightarrow
\begin{array}{|c|c|c|} \hline 3 & 5 & 7 \\ \hline 5 & 6 & 7 \\ \hline 7 & 8 & 9 \\ \hline \end{array} \rightarrow
$$

$$
\begin{array}{|c|c|c|} \hline 3 & 5 & 7 \\ \hline 5 & 6 & 7 \\ \hline 7 & 8 & 9 \\ \hline \end{array} \rightarrow
\begin{array}{|c|c|c|} \hline 3 & 5 & 7 \\ \hline 5 & 6 & 7 \\ \hline 7 & 8 & 9 \\ \hline \end{array} \rightarrow
\begin{array}{|c|c|c|} \hline 3 & 5 & 7 \\ \hline 5 & 6 & 8 \\ \hline 7 & 8 & 9 \\ \hline \end{array} \rightarrow
$$

$$
\begin{array}{|c|c|c|} \hline 3 & 5 & 7 \\ \hline 5 & 6 & 8 \\ \hline 7 & 8 & 9 \\ \hline \end{array} \rightarrow
\begin{array}{|c|c|c|} \hline 3 & 5 & 7 \\ \hline 5 & 6 & 8 \\ \hline 7 & 8 & 9 \\ \hline \end{array} \rightarrow
\begin{array}{|c|c|c|} \hline 3 & 5 & 7 \\ \hline 5 & 6 & 8 \\ \hline 7 & 8 & 9 \\ \hline \end{array} \rightarrow
$$

Notice that the value of `A(3,1)` is 7, not 5.

```
Solution:

201        2 points
201        3 points    (NOT 102)
```

1. (b) Write a complete specification for the following function:

```
function B = f(A)
[m,n] = size(A);
for j=1:n-1
   B(:,j) = (A(:,j)+A(:,j+1))/2;
end
```

```
A is an m-by-n matrix            1 point
B is an m-by(n-1) matrix         1 point
B's j-th column is the average of A(:,j) and A(:,j+1)  3 points
```

2. Write a function `z = ModifiedSum(A,p,q)` that takes a matrix and `A` and integers `p` and `q` and returns the sum of all the entries in `A` that are neither in row p or column q. Assume that A has at least p rows and at least q columns. Thus, if $p = 2$, $q = 3$

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \\ 17 & 18 & 19 & 20 \end{bmatrix}$$

then the value of `ModifiedSum(A,p,q)` would be $1+2+4+9+10+12+13+14+16+17+18+20$.

Solution 1:

```
[m,n] = size(A);
z = 0;
for i=1:m
  for j=1:n
     if i~=p && j~=q
         z = z + A(i,j);
     end
  end
end
```

Solution 2

```
[m,n] = size(A);
A(p,:) = zeros(1,n);
A(:,q) = zeros(m,1);
z = sum(sum(A));
```

Solution 3

```
z = sum(sum(A)) - sum(A(p,:)) - sum(A(:,q)) + A(p,q)
```

3. Complete the following function so that it performs as specified

```
function B = Update(A,f,g)
% A is an m-by-n matrix.
% f is a column m-vector.
% g is a row n-vector.
% B is an m-by-n matrix. The i-th row of B is obtained by subtracting
% f(i) times g from the i-th row of A.
```

Solution 1:

```
[m,n] = size(A);
B = zeros(m,n);
for i=1:m
   B(i,:) = A(i,:) - f(i)*g;
end
```

Solution 2:

```
[m,n] = size(A);
B = zeros(m,n);
for i=1:m
   for j=1:n
      B(i,j) = A(i,j) - f(i)*g(j);
   end
end
```