Name: Answers

Checkpoint Quiz:

1. Write any correct matlab code to create a matrix $M$ that is a 5 x 5 array of zeros with a 1 in the middle of it.

   Option 1
   
   \[
   M = \begin{bmatrix}
   0 & 0 & 0 & 0 & 0 \\
   0 & 0 & 0 & 0 & 0 \\
   0 & 0 & 1 & 0 & 0 \\
   0 & 0 & 0 & 0 & 0 \\
   0 & 0 & 0 & 0 & 0 
   \end{bmatrix}
   \]

   Option 2
   
   \[
   M = \text{zeros}(5) \
   \text{ or } \quad M = \text{zeros}(5,5)
   \]

   $M(3,3) = 1$

2. Suppose $Q$ is a vector. Write any correct matlab code to change all the 1’s in $Q$ to be 2’s. That is, if $Q$ starts off as [0 1 4 1 3.3], then it should become [0 2 4 2 3.3].

   Option 1
   
   \[
   Qones = \text{find}(Q == 1)
   \]

   \[
   Q(Qones) = 2
   \]

   Option 2
   
   \[
   Q(Q == 1) = 2
   \]
Checkpoint Quiz 3 (with make up questions for Quiz 1):

(The first two questions are "replacement questions". If you correctly answered the corresponding question on the first quiz, you do not need to answer them here).

1.1 Write any correct matlab code to create a matrix M that is a 5 x 5 array of ones with a 2 in the middle of it.

\[
\begin{align*}
M &= \text{ones}(5,5) \\
M(3,3) &= 2
\end{align*}
\]

or

\[
\begin{align*}
M &= \text{zeros}(5,5) \\
M &= M + M \\
M(3,3) &= 2
\end{align*}
\]

1.2 Suppose Q is a vector. Write any correct matlab code to change all the 0's in Q to be 1's. That is, if Q starts off as [0 1 4 1 0], then it should become [1 1 4 1 1]. Your code should work with *any* vector Q, not just the example values above.

\[
\begin{align*}
Q(Q == 0) &= 1 \\
\text{find}(Q == 0) &= 1 \\
Q(n) &= 1
\end{align*}
\]

or

\[
\begin{align*}
\text{for } i \in 1: \text{size}(Q,2) \\
\quad \text{if } Q(i,1) == 0 \\
\quad \quad Q(i,1) &= 1 \\
\text{end}
\end{align*}
\]

3.1 Suppose that n is a positive integer already defined in your workspace. (for instance, n might be 7). Write a for-loop that calculates n factorial (1 * 2 * 3 * ... * n). Indicate which variable contains the value of n-factorial when your loop is finished.

\[
\begin{align*}
\text{fact} &= 1 \\
\text{for } k = 1: n \\
\quad \text{fact} &= \text{fact} \times k \\
\text{end}
\end{align*}
\]

variable "fact" contains answer
Checkpoint Quiz 4 (with make up questions for Quiz 1,3):

(The first two questions are "replacement questions". If you correctly answered the corresponding question on the first quiz, you do not need to answer them here). Everyone has now gotten the first question correct, so the make-up questions start with the second question on the first quiz.

1.2 Suppose Q is a vector. Write any correct matlab code to change all the 4's in Q to be 5's. That is, if Q starts off as [0 1 4 1 0], then it should become [0 1 5 1 0]. Your code should work with *any* vector Q, not just the example values above.

\[ \text{idx} = \text{find}(Q == 4) \]
\[ Q(\text{idx}) = 5 \]

3.1 Suppose that n is a positive integer already defined in your workspace. (for instance, n might be 7). Write a for-loop that calculates the sum of the numbers from 1 to n. \((1 + 2 + 3 + \ldots + n)\). Indicate which variable contains the final sum when your loop is finished. You may not use the matlab "sum" command, nor may you use multiplication (to compute this directly).

\[
K = 0 \\
\text{for } i = 1: n \\
\quad K = K + i \\
\text{end} \\
K \text{ has value } 1 + 2 + 3 + \ldots + n
\]

4.1 Suppose that you have defined the function foo as follows:

```matlab
function y = foo(x) 
    z = 2*x 
    y = 2*z 
    z = y - 4 
end
```

What are the values returned from the following calls:

\[
\text{>> foo(10)} \\
\quad 40 \\
\text{>> foo( foo(2))} \\
\quad 32
\]
Checkpoint Quiz 5 (with make up questions for Quiz 1, 3, 4):

1.2 Suppose Q is a vector. Write any correct matlab code to change all the 0's in Q to be 2's. That is, if Q starts off as [0 1 4 1 0], then it should become [2 1 4 1 2]. Your code should work with *any* vector Q, not just the example values above.

\[ Q (Q = 0) = 2 \]

3.1 Suppose that \( n \) is a positive integer already defined in your workspace. Write a for-loop that calculates the product of the numbers from 1 to \( 2 \times n \): \( 1 \times 2 \times 3 \times 4 \times \ldots \times n \times (n+1) \times \ldots \times 2n \). (For example, if \( n \) was 3, you need to calculate \( 1 \times 2 \times 3 \times 4 \times 5 \times 6 \).) Indicate which variable contains the final answer when your loop is finished. You may not use the matlab “product” command.

\[ a = 1 \]
\[ \text{for } k = 1 : 2 \times n \]
\[ a = a \times k \]
\[ \text{end} \]

4.1 Suppose that you have defined the function bar as follows:

<table>
<thead>
<tr>
<th>function c = bar(a) b = a + 2; c = a * 2; d = b + c;</th>
<th>What are the values returned from the following calls?</th>
</tr>
</thead>
</table>
| b = a + 2; c = a * 2; d = b + c; | \[ \text{>> bar(10)} \]
| | \[ 20 \]
| | \[ \text{>> bar(bar(4))} \]
| | \[ 16 \]

5.1 Define a function foo that takes an array of sample values of a function as returns the “zero-crossings” of the function. You may assume that the input is never exactly zero. Examples of what the function should return:

\[ \text{>> foo([-3 -1 1 2 -1])} \]
\[ \text{>> foo([4 3 1 -1])} \]
\[ \text{>> foo([4 2 0 -2])} \]

Because the function changes sign after the 2\(^{\text{nd}}\) and 4\(^{\text{th}}\) entry in the array. Because the function changes sign after the 3\(^{\text{rd}}\) entry. I will accept any answer because you can assume there are no zeros.

I will get you started:

```matlab
function zeroCrossings = foo(A)
    ZC = 0
    for k = 1 : length(A) - 1
        if A(k) \times A(k-1) < 0
            ZC(k) = 1
        end
    end
    zeroCrossings = find(ZC)
end
```

```matlab
P = A(1:end-1) \times A(2:end)
zeroCrossings = find(P < 0)
```

5.2 C: 0

\[ \text{for } k = 1 : size(A,2) - 1 \]
\[ \text{if } A(k) > 0 \& A(k+1) < 0 \]
\[ ZC(k) = 1 \]
\[ \text{else if } A(k) < 0 \& A(k+1) > 0 \]
\[ ZC(k) = 1 \]
\[ \text{end} \]
\[ \text{end} \]
\[ ZC(C = 1) \]