

Midterm 1 Review

These questions are designed to help you think about course material, not to show you actual exam questions. The exam will be about 40-60 percent multiple choice, as discussed in class. The remainder will be short answer or coding.

Research shows that the best way to study for an exam is with other people. In group study, the people who start knowing more learn more (think about why), so don't think that it is only valuable to study with people who know more than you do.

1. (16 pts) Complete this code section with a for loop that traverses the array x and does two things: it changes any value 4 to a zero; and it adds one to any other number. Use the code framework provided and fill in the blanks. Do not change the code provided.

For example, after the script the matrix shown should be [3 8 0 6].

```
x = [2 7 4 5];  
  
for _____  
    if (_____  
        _____  
    else  
        _____  
    end  
end  
end
```

2. (20 pts) Suppose you are **given** a function that calculates the area of a circle, called calcCircleArea. You type "help calcCircleArea" and see the following:

```
%calcCircleArea(radius) returns the area of a circle.
```

Write a **different** function that 1) asks a user for a radius, 2) calls the function calcCircleArea, and 3) prints a nice message that includes the area of the circle. The function should not perform arithmetic.

For each of the following questions, assume

- you are at the start of a Matlab session (i.e. this is the first command).
- any script or function code is in a correctly named file in the current directory.

If the code will not run correctly, choose "error".

3. (2 pts) Consider the function f:

```
function answer = f()  
    answer = 7;  
end
```

What will be in x after the command:

```
>> x = f ();
```

- (a) 7
- (b) f(7)
- (c) answer
- (d) error
- (e) none of these

4. (2 pts) Consider the function f:

```
function [] = f(x)
    output = 7;
end
```

What will be in x after the command:

```
>> x = f(3);
```

- (a) 7
- (b) f(7)
- (c) ans
- (d) error
- (e) none of these

5. (2 pts) Which expression tests whether variable x is between (but not the same as) the values 5 and 10.

- (a) $5 < x < 10$
- (b) $5 \leq x \leq 10$
- (c) $5 < x \ \& \ x > 10$
- (d) $x < 10 \ \& \ 5 < x$
- (e) none of these

6. (2 pts) Which of the following is a MATLAB expression for testing “x is outside the range from 3 to 5” (the range includes 3 and 5)?

- (a) $3 > x \ \& \ x > 5$
- (b) $3 > x \ | \ x < 5$
- (c) $3 > x \ | \ x > 5$
- (d) cannot be expressed in MATLAB
- (e) none of the above

7. (2 pts) In MATLAB the value 1 is true, and true is:

- (a) there are no boolean types in MATLAB
- (b) any value that isn't zero
- (c) 1
- (d) 0
- (e) none of the above

8. (2 pts) A call to zeros(2) will produce which of the following?

- (a) 0 0
- (b) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$
- (c) $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$
- (d) error
- (e) none of these

9. (2 pts) A call to ones(2) will produce which of the following?

- (a) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$
- (b) 1 1
- (c) $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$
- (d) error
- (e) none of these

10. (2 pts) If x is the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ then sum(x) will produce:

- (a) 10
- (b) $\begin{bmatrix} 3 \\ 7 \end{bmatrix}$
- (c) $\begin{bmatrix} 1 & 3 \\ 6 & 10 \end{bmatrix}$
- (d) error
- (e) none of these

11. (2 pts) A call to magic(3) could produce:

- (a) $\begin{bmatrix} 8 & 1 & 6 \\ 3 & 5 & 0 \\ 4 & 9 & 2 \end{bmatrix}$
- (b) $\begin{bmatrix} 8 & 1 & 6 \\ 3 & 5 & 7 \\ 4 & 9 & 2 \end{bmatrix}$

(c) $\begin{bmatrix} 8 & 1 & 6 \\ 3 & 2 & 7 \\ 4 & 9 & 5 \end{bmatrix}$

(d) error

(e) none of these

12. (3 pts) Suppose you have a matrix $x = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 3 & 4 & 5 & 6 \end{bmatrix}$. Which of the following will evaluate to $\begin{bmatrix} 3 \\ 5 \end{bmatrix}$?

(a) $x(3)$

(b) $x(3,:)$

(c) $x[:,3]$

(d) $x(:,3)$

(e) none of these

13. (3 pts) Which of the following will extract $[5 \ 6 \ 7]$ from the matrix m shown?

`>> m = [3 4 5 6 7 8];`

(a) $m(3:5)$

(b) $m(5:end-1)$

(c) $m(end-1:5)$

(d) $m[5, 7]$

(e) none of these

14. (3 pts) Suppose you have a matrix $x = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 \end{bmatrix}$. Which of the following will evaluate to $\begin{bmatrix} 1 & 2 & 3 & 4 & 5 \end{bmatrix}$?

(a) $x(1,end)$

(b) $x(end-1)$

(c) $x(1,end-1)$

(d) $x(1,1-end)$

(e) none of these

15. (3 pts) Suppose you have a matrix $x = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$. Which of the following will evaluate to 6?

(a) $x(3,2)$

(b) $x(1,2)$

(c) $x[2,2]$

(d) $x[2,3]$

(e) none of these

1. There are important differences between values that are printed and output values. Consider the following function definitions, and assume they are in three different M-files:

```
function [] = f(x)
    disp(x);
end
```

```
function result = g(x)
    result = 2*x;
end
```

```
function output = h(x)
    result = 3*x;
end
```

Which of the following function calls will run correctly?

- (a) `>> f(1)`
- (b) `>> g(1)`
- (c) `>> h(1)`
- (d) `>> x = f(1)`
- (e) `>> x = g(1)`
- (f) `>> x = h(1)`
- (g) `>> fprintf('%f', f(1))`
- (h) `>> fprintf('%f', h(1))`
- (i) `>> disp(g(1))`
- (j) `>> disp(h(1))`

2. What is “Unit testing”?

3. Assume that you have two directories inside your home directory, lab01 and lab02. If lab02 is your current directory at the start of each of the following questions, show how to use a single Unix shell command to:

- (a) make home your current directory
- (b) make lab01 your current directory
- (c) copy file spam.txt from lab01 to lab02
- (d) move file spam.txt from lab02 to lab01
- (e) change the name of spam.txt in lab02 to vegemite.txt
- (f) list the files in lab02
- (g) delete the file marmite.txt from lab02
- (h) display the name of the current directory
- (i) show all .m files in the current directory
- (j) change in to your home directory and create a directory for lab03 (you may use two commands for this one).

4. Find the bug in a program similar to one you wrote for lab (to do this, get a study mate to put a bug in three M-files, and you do the same for them, then swap papers).
5. Given a test function, write the function that it is supposed to test.
6. Given a function, write a test function for it (on the exam, you would be expected to identify boundary cases without a reminder).
7. Given a function, show how to use it from the MATLAB command line.
8. Identify a Matlab command that reads your function comments.
9. Write the format specifier that goes in the blank below:

```
fprintf('The answer is: _____', 12.1234);
```

so that it will print the following exactly (there are seven spaces):

```
The answer is: 12.123
```

10. Given a function that you wrote in lab that has a missing line or section of code, fill in the missing code.
11. Evaluate relational and logical expressions as Matlab does:

(a) $4 < 5 \ \& \ 6 > 7$

(b) $(5 = 5) \ | \ 1$

(c) $(1 \ \& \ 1) \ | \ 0$

(d) $4 \ \& \ 3 < 2$

- (a) Write an if statement that prints “boo” if a number is between 12 and 17, inclusive.
- (b) Write code that prints “blue” for numbers less than 5, “green” for numbers from 5 to 10 inclusive, and “mauve” for numbers higher than 10.
- (c) Write a recursive function to match a recursive definition (e.g. Newton’s approximation, factorial).
- (d) Given a recursive function with an error, fix it.
- (e) Write a function that behaves as described in problem ??.
- (f) Write a for loop to display the even numbers from 0 to 10.
- (g) Write a for loop to count the number of sevens in a matrix x.
- (h) Write a for loop to change each seven in a matrix x to an 8.
- (i) Write a for loop to sum the elements in a matrix x.
- (j) Write a for loop to get user input to fill the elements in a matrix x.

12. In a diary demonstrate all the following:

- (a) Create a row vector called “a” with the even numbers from 0-6, inclusive, by specifying an interval.
- (b) Show how to access the number 4 from vector a

- (c) Set “b” to the transpose of a (i.e. b will be a column)
 - (d) Show how to change the 4 in b to a 7;
 - (e) Use a for loop to display each member of b.
 - (f) Create a matrix “c” with three rows and four columns, with consecutive integers starting at 1 in the first row, 5 in the second row, 9 in the third.
 - (g) Show how to access the numbers 7 and 11 from c.
 - (h) Set the 10 in c to 10.5
 - (i) Set “d” to be the third column from c.
 - (j) Set “e” to be the second row from c.
 - (k) From Chapman 2.5, Quiz 2.2 number 1, parts a-f.
 - (a) Make a 2x3 matrix of zeros without typing any zeros.
 - (b) Make an array of ones the same dimensions as the matrix x.
 - (c) ASCII stuff: What is the integer which corresponds to 'A'? Show a loop that will print the alphabet. Use the char and double functions.
 - (d) Write a function to compare the time the cpu spends performing two functions 100 times each. Do not plot the data, just report the times.
 - (e) Given some data in matrices, show how to plot it using the plot function.
 - (f) Write by hand every program in your labs. Then compare it to your working code and see what is different; re-write until your hand-written code is aesthetically pleasing as well as functional. Remember, you will have to write code by hand on the exam; practice, and don't forget to indent.
 - (g) How do we handle testing the output of functions when there may be slight differences in the precision of the answers?
13. Consider the following expression: $1 < x < 20$. Can you identify a value for x that will make this expression true? that will make it false? **Explain** your answer.
14. (5 pts) The expression `s = ['test'; 'spam']` creates a matrix. Under some circumstances you would use the MATLAB char function to do this instead. Give an example (similar to one of your lab problems) where the char function would be *required*, and explain what the char function does to make that example work correctly.
15. (5 pts) The built-in MATLAB function max, called on a single vector, returns the highest value in the vector, but you can also get other information from it. Give an example statement showing how you would do this, and explain or label what the values are.
16. (15 pts) Write a function (no comments) that will take one parameter, a vector, and return the minimum value (not the index!) from the vector. The function will not use any MATLAB functions.
Example: `myMin([3 1 2 4])` → 1
17. (8 pts) Some functions have output variables and others do not. Give an example of a MATLAB statement that works in one case and not the other, and explain.

18. (10 pts) Xenon the programmer wants to write a test function for the sphereVolume function. In the interpreter Xenon tries the formula with radius 4 and sees:

```
>> 4/3 * pi * 4^3
```

```
ans =
```

```
268.0826
```

So Xenon tests `sphereVolume(4) == 268.0826`, and sees that they are *not* equal.

- (a) Explain why they are not equal.
- (b) Write a single test to put in the test function `sphereVolumeTest.m` that will test `sphereVolume(4)` and print an error if it is not correct. You may *not* use the formula for sphere volume, but you may express the test in terms of a *tolerance*.
19. (15 pts) Complete the following code using the lines provided. Ask the user to enter a number, and place it in the vector `v`. When the vector is full, tell the user the program is done. You may not need all of the lines provided.

```
v = zeros(1,50);
```

```
for _____
```

```
_____
```

```
_____
```

```
_____
```

```
_____
```

```
_____
```

20. (5 pts) Write a single MATLAB statement that asks for user input and puts it in a variable called "data".
21. (8 pts) Fill in the blank with a for loop specification so that this code displays the even numbers from 2 through 100. Do not list all the numbers. Do not change the code provided.

```
disp(i);  
end
```


22. (12 pts) This problem is about tracing function calls. The function `f` below is **not** identical to one we saw in class. In the blanks provided, **show what is printed by the function** after the call shown in the command line. The first printed line is shown to get you started. (Do not count spaces for this problem, but do pay attention to newlines.) You may not need all of the blanks.

```
function result = f(a, b)

    fprintf('%2.0f %2.0f \n', a, b);

    if (b == 0)
        result = a;

    else
        result = f(a+1, b-1);
    end
```

at the command line:

```
>> f(3, 4)
```

```
3 4
```

```
<- This is the first line printed;
    Show the rest in the blanks provided.
```

- (a) (2 pts) Suppose you have two directories in your home directory, `Lab01` and `Lab02`. You are currently in `Lab01`. What command would move the file `spam.m` from `Lab01` into your home directory?

- i. `cp spam.m home`
- ii. `mv spam.m ..`
- iii. `mv Lab01/spam.m ~/`

- iv. `cp spam.m Lab01/..`
 - v. none of these
- (b) (2 pts) Suppose you have two directories in your home directory, Lab01 and Lab02. You are currently in Lab01. What command would make a directory Lab03 in your home directory?
- i. `mkdir ../Lab03`
 - ii. `mkdir ~/Lab03`
 - iii. both a and b
 - iv. have to switch to home directory first
 - v. none of these
- (c) (2 pts) Suppose you have two directories in your home directory, Lab01 and Lab02. You are currently in Lab01. What command would copy the file spam.m from Lab01 into Lab02?
- i. `cp spam.m home/Lab02`
 - ii. `cp Lab01/spam.m ~/Lab02`
 - iii. `mv Lab01/spam.m ~/Lab02`
 - iv. `cp spam.m Lab02/..`
 - v. none of these