

**UNIVERSITY OF CALIFORNIA
COLLEGE OF ENGINEERING**

**E77: INTRODUCTION TO COMPUTER PROGRAMMING
FOR SCIENTISTS AND ENGINEERS**

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Spring 2007

First Midterm Exam—February 21, 2007

[37 points ~ 37 minutes]

| Exam Statistics | |
|------------------------|----------|
| Mean | 29.48485 |
| Mean % | 79.69% |
| StDev | 4.721096 |
| StDev% | 12.76% |
| Median | 31 |
| Median% | 83.78% |
| Max | 37 |
| Max% | 100.00% |

| Question | Points | Grade |
|--------------|-----------|-------|
| Part I | 9 | |
| Part II | 6 | |
| Part III | 12 | |
| Part IV | 10 | |
| TOTAL | 37 | |

Notes:

1. Write your name/SID on the top of every page and your signature below.
2. Please give all your answers only in the spaces provided.
3. You may NOT ask any questions during the exam.
4. You may NOT leave the exam room before the exam ends.

Your **signature**: _____

Your **E77N LECTURE SECTION 1**(12-1pm) or **2**(1-2pm) (Circle your section #)

Circle your Lab Section (where the graded midterms will be returned).

| | | |
|----------------|----------------|-----------------|
| #11: MW 8-10 | #12: MW 10-12 | #13: MW 2-4 |
| #14: MW 4-6 | #15: TuTh 8-10 | #16: TuTh 10-12 |
| #17: TuTh 12-2 | #18: TuTh 2-4 | #19: TuTh 4-6 |

Part I:**Questions 1 – 3: General Matlab operators**

1. (1 point) The semicolon operator (;) in Matlab is used to:
 - a. Comment you code
 - b. Separate values in a logical operation
 - c. Separate elements in a row vector
 - d. None of the above
2. (1 point) The colon operator (:) and the linspace command in Matlab can create the same arrays. Select the true statement below:
 - a. linspace (1,2,4) = 1:0.25:2
 - b. linspace (1,2,5) = 1:0.20:2
 - c. linspace (1,2,5) = 1:0.25:2
 - d. linspace (1,2,4) = 1:.025:1.75
3. (1 point) To calculate the natural log of 6 and assign it to variable x in Matlab, which of the following commands is correct?
 - a. >>x = ln(6)
 - b. >>x = log 6
 - c. >>x = log(6)
 - d. >>x = ln 6

Questions 4 – 9: Matrix Operations

The following questions refer to the following matrices:

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \quad B = \begin{pmatrix} 1 & 2 & 3 \end{pmatrix}$$

4. (1 point) True or False: Matrices A and B can be multiplied (i.e. $C = A*B$ is a defined value)
 - a. True
 - b. False
5. (1 point) Typing `>>x = length(B)` assigns which of the following values to x?
 - a. 3
 - b. 0
 - c. 1
 - d. No value. There is a matlab error.
6. (1 point) After typing `>> C = A.*A`, then $C(2,3) =$
 - a. 96
 - b. 36
 - c. 25
 - d. $A.*A$ is an invalid Matlab command

7. Typing the command `>>A(1,2) = 0` assigns A to the value

a. $A = 0$

$$\text{b. } A = \begin{pmatrix} 1 & 0 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

$$\text{c. } A = \begin{pmatrix} 0 & 0 & 0 \\ 4 & 0 & 6 \\ 7 & 0 & 9 \end{pmatrix}$$

$$\text{d. } A = \begin{pmatrix} 0 & 2 & 3 \\ 0 & 0 & 0 \\ 0 & 8 & 9 \end{pmatrix}$$

8. (1 point) The command `>>y = size(A(1,:))` assigns which of the following to y?

a. [1 3]

b. 1

c. 3

d. [3 1]

9. (1 point) Which one of the following assignments will correctly produce the matrix H give below?

$$H = \begin{pmatrix} 1 & 2 & 3 & 1 \\ 4 & 5 & 6 & 2 \\ 7 & 8 & 9 & 3 \end{pmatrix}$$

a. $H = [A; B]$

b. $H = [A, B']$

c. $H = [A, B]$

d. $H = [A; B']$

Part II:

Questions 10-15: Logical and Relational Operators

Consider the following two programs in files myprogram1.m and myprogram2.m respectively:

| | |
|---|---|
| <pre>function [y] = myprogram1(x) if x>4 y=x+2; elseif x<=3 y=x/2; elseif x>3 & x<=4 y=x; end</pre> | <pre>function [y] = myprogram2(x) if gt(x,4) y=x+2; elseif le(x,3) y=x/2; else y=x; end</pre> |
|---|---|

10. (1 point) Do these two Matlab programs compute the same mathematical function? Assume the input lies in the set of rational numbers.

- a. Yes
- b. No
- c. myProgram1 is incorrect
- d. Both myProgram1 and myProgram2 are incorrect

11. (1 point) What is the value assigned to y by myProgram1 when x=5 ? 7

12. (1 point) What is the value assigned to y by myProgram2 when x=3.14 ? 3.14

13. (1 point) Which of the following statements is true:

- a. myProgram1(3) will fail to produce an output
- b. myProgram1(4) will fail to produce an output
- c. myProgram1(2) will fail to produce an output
- d. myProgram1 will produce an output for every rational input

14. (1 point) Which of the following can be a types for the function computed by this program?

- a. $\text{Rationals} \rightarrow \text{Naturals}$
- b. $\text{Naturals} \rightarrow \text{Naturals}$
- c. $\{x \in \text{Naturals} : x > 4\} \rightarrow \text{Naturals}$
- d. $\text{Boolean} \rightarrow \text{Boolean}$

15. (1 point) Consider a square centered at (0,0), and having sides of length 2. The point (x,y) is represented by Matlab variables x and y. Which of the following will produce the output in = 1 when (x,y) is on the inside or on the border of the square, and will the output in = 0 otherwise?

- a. $\text{in} = \text{and}(\text{and}(\text{le}(x,1),\text{ge}(y,-1)),\text{and}(\text{le}(y,1),\text{ge}(x,-1)))$
- b. $\text{in} = \text{and}(\text{or}(\text{le}(x,1),\text{ge}(y,-1)),\text{or}(\text{le}(y,1),\text{ge}(x,-1)))$
- c. $\text{in} = \text{or}(\text{and}(\text{lt}(x,1),\text{ge}(y,-1)),\text{and}(\text{le}(y,1),\text{gt}(x,-1)))$
- d. $\text{in} = \text{and}(\text{and}(\text{le}(x,1),\text{ge}(y,-1)),\text{and}(\text{lt}(y,1),\text{gt}(x,-1)))$

Part III:

Questions 16-24: Functions, Nested Functions, Scope, Type

The contents of myFunc3.m are as follows:

```
function y = myFunc3 (x)
x = 2;
y = x^2;
end
```

16. (1 point) The final value assigned to x in the Matlab workspace after entering `>> x = 3; y = myFunc3(x)`; at the command prompt is:

- a. 3 b. 2 c. 4 d. No value. There will be a Matlab error.

17. (1 point) The final value assigned to y in the Matlab workspace after entering `>> x = 3; y = 3; y = myFunc3(x)`; at the command prompt is:

- a. 3 b. 0 c.) 4 d. No value. There will be a Matlab error.

18. (1 point) The contents of myFunc1.m are as follows

```
function x = myFunc1 (x)
end
```

The value assigned to y in the Matlab workspace by `>>y = myFunc1(2)` is:

- a. NaN b. No value. There will be a Matlab error. c. 2 d. 0

19. (1 point) The contents of myFunc2.m are as follows:

```
function y = myFunc2 (x)
y = x^2;
disp(x)
end
```

The final value assigned to x in the Matlab workspace by `>> x = 3; x = myFunc2 (x)` is:

- a. 3 b. 9 c. 1.5 d. No value. There will be a Matlab error.

20. (1 point) Typing `>>clear; y = myFunc2(3); x` at the command prompt will result in:

- a. Assignment of value 3 to the variable x in the Matlab workspace
 b. Assignment of value 3 to the variable y in myFunc2

```
 c. A matlab error.
```

21. (2 points) Add 2 lines in the blanks below to the function in the file myFunc4.m so that it will compute the mathematical function $y = 3x$.

```

1 function y = myFunc4 (x)
2 y = x + gunc1(x);
3 end

4 

5 

6 end
    
```

22. (3 points) The following are the contents of f.m, g.m, and h.m. They are all in the working matlab directory:

```

function y = f(x)
y = x + g(x) + h(x);
end
    
```

```

function y = g(x)
y = x*h(x);
end
    
```

```

function y = h(x)
y = x;
end
    
```

Fill in the following blanks:

The value assigned to z by `>> z = h(2)` is _____ **2** _____

The value assigned to z by `>> z = g(2)` is _____ **4** _____

The value assigned to z by `>> z = f(2)` is _____ **8** _____

23. (1 point) If func has type $A \rightarrow B$ and gunc has type $C \rightarrow D$, then $\text{gunc}(\text{func}(\cdot))$ has type $A \rightarrow D$ provided

- a. $C \subseteq B$ b. $B \subseteq C$ c. $A = \emptyset$ d. $A = C$ **(B)**

24. (1 point) The type for the **and** function in Boolean algebra is:

- a. Boolean \rightarrow Boolean
 b. Naturals \times Naturals $\rightarrow \{0\}$
 c. $\{0,1\} \rightarrow \{0,1\} \times \{0,1\}$
 d. $\{0,1\} \times \{0,1\} \rightarrow \{0,1\}$

Part IV:

Questions 25-27: Recursion

25. (2 points) The following is a recursive Matlab function for the Tribonacci sequence.

```
function [out] = Tribonacci(n)
if le(n,2)
    out = 1
elseif eq(n,3)
    out = 2
else
    out = Tribonacci(n-1) + Tribonacci(n-2) + Tribonacci(n-3)
end
```

What will be value assigned to out by out = Tribonacci(1)?

1

What will be the value assigned to out by out = Tribonacci(4)?

4

26. (2 points) Notice there are no semi colons at the end of any lines in Tribonacci. This means that as soon as any line is run, it will display the result of that line at the Matlab command prompt.

What will be the sequence of numbers displayed to the screen when the following command is typed into the command prompt?

>> Tribonacci(5);

- a. 7, 4, 2, 1, 2, 1, 1
- b. 3, 2, 1, 4, 2, 2, 5
- c. 2, 1, 1, 2, 1, 4, 7
- d. 2, 1, 1, 4, 2, 1, 7
- e. 7, 4, 3, 2, 3, 2, 1

| |
|------------------------|
| d. 2, 1, 1, 4, 2, 1, 7 |
|------------------------|

27. (2 points) Write a recursive Matlab function by filling in the blanks below that will compute y defined by as follows. Assume $n \in \text{Naturals}$:

$$y(1) = 1$$

$$y(2) = \frac{1}{2} + 1$$

$$y(n) = \frac{1}{n} + \dots + \frac{1}{2} + 1 \text{ where } n \geq 3$$

```
function y = myFun(n)

if _____eq(n,1)_____

    y = _____1;_____

else

    y = _____1/n + myfun(n-1);_____

end
```

Questions 28-29: Iteration

28. (2 points) Assume that `isOdd` is a Matlab function that takes in a positive whole number, n , and returns 1 if that number is odd and 0 otherwise.

Now consider the following function and the matrix A :

$$A = \begin{pmatrix} 7 & 8 & 12 \\ 1 & 11 & 3 \\ 8 & 2 & 4 \end{pmatrix}$$

```
function out = f(in)
out = 0;
for i = 1:2
    for j = 1:2
        if not(isOdd(A(i,j)))
            out = out + A(i,j);
        end
    end
end
end
end
```

What value will be assigned to the variable `out` by `out = f(A)`?

- a. 27
- b. 7
- c. 34
- d. 19

e. 8

29. (2 points) Consider the following function:

```
function out = g()
n = 1;
out = 1;
while n < 5
    if eq(out,1)
        out = out + 1;
    else
        out = out - 1;
    end
    n = n + 1;
end
end
```

What value will be assigned to the variable out by out = g?

- a. -2
- b. -1
- c. 0
- d. 1
- e. 2

| |
|------|
| d. 1 |
|------|