

Key

Midterm Exam

COMPUTER PROGRAMMING FOR ENGINEERING AND SCIENCE
(CSCE 150E, SPRING 2009)

Held on 13th March, 2009

13 March, 2009

Name :
Course No : CSCE150E

Instructions:

1. This is open book, open note, but not open neighbor.
2. If you have a question about the meaning of an exercise, ask! Getting things wrong because of misunderstandings can be aggravating for me as well as you.
3. Both sections are taking midterm exams today. You are on your honor not to reveal anything to members of the other section (assuming you are attending the 12:30 section).

1. (10 points) What is output by the following fragment of code? Are you sure? If the 5's are increased to some other value, would the number of steps (and time) increase linearly, quadratically, or cubically?

```
x = [1:5; [1:5].^2]
for ii = x
    fprintf('%3d squared is %3d\n', ii)
end
```

1 squared is 1
 2 squared is 4
 3 9
 4 16
 5 25

2. (10 points) What is output by the following fragment of code? Are you sure? If the size (indicated by the related values 6, 5, and 12) is increased to allow more rows to be printed, would the number of steps (and time) increase linearly, quadratically, or cubically?

```
x = zeros(1,6);
x(1) = 1;
for ii = 1:5
    for jj = 1:12-2*ii
        fprintf(' ')
    end
    for jj = 1:ii
        fprintf('%4d', x(jj))
    end
    fprintf('\n')
    x(2:end) = x(2:end) + x(1:end-1);
end
```

1
 1 1
 1 2 1
 1 3 3 1
 1 4 6 4 1
~~1 5 10 10 5 1~~

3. (10 points) What is output by the following fragment of code? Are you sure? Given arbitrary values of a, b, and c, describe what will be output.

```
a = 10;
b = 12;
c = 11;
if a < b
    if b < c
        x = c; y = b; z = a;
    else
        x = b;
        if a < c
            y = c; z = a;
        else
            y = a; z = c;
        end
    end
end
else
    if a < c
```

12 11 10

reverse order of size

```

    x = c; y = a; z = b;
else
    x = a;
    if b < c
        y = c; z = b;
    else
        y = b; z = c;
    end
end
end
fprintf('%d %d %d\n', x, y, z);

```

4. (10 points) What is output by the following fragment of code?
 If the 3's are increased to some other value, would the number of steps (and time) increase linearly, quadratically, or cubically? (Hint: This could be time consuming to prove, so just give an educated guess. It will likely be correct.)

```

for a = 1:3
    for b = a:3
        for c = 3:-1:b
            fprintf('%d %d %d\n', a, b, c)
        end
        fprintf('bingo!\n')
    end
    fprintf('tango!\n')
end

```

1 1 3	2 2 3
1 1 2	2 2 2
1 1 1	bingo!
bingo!	2 3 3
1 2 3	bingo!
1 2 2	tango!
bingo!	3 3 3
1 3 3	bingo!
bingo!	tango!
tango!	

5. (10 points - 3 points each so 1 point is free) There are three types of files associated with Matlab. Mark as correct the following statements or reword (don't simply cross them off!) to make them correct.

- (a) .m files are used to hold the programs themselves. They can be created and edited using either the Matlab's edit window or any wordprocessor text editor
- (b) Data files are used to hold the data generated by or to be used by a program. The commands in Matlab used to access these files are input and fprintf. load, save
- (c) Diary files are used to keep a comprehensive log of activity while Matlab is running. Once they are created, they can be used to automatically rerun a sequence of steps.

6. (10 points - 2 points each so 2 points are free) Data items in Matlab are held in the computer's memory which is organized as a linear series of cells. Answer the following questions about memory assuming *a* has been assigned the value [1 : 5; 6 : 10]:

- (a) Assuming each piece of data in an array consumes one unit of memory (not really true), and the 8 is stored at location 500, then where in memory would the 2 be stored?
497
- (b) Data are assigned into an array (as in *arr* = [3,5,2;5,2,3]) in (column or row) major form and stored in memory in (column or row) major form.

497 499
 1 2 3 4 5
 6 7 8 9 10
 498 500

- (c) Complex numbers are typically represented as having four components. What are these components? *(real) mantissa + exponent (imaginary) mantissa + exponent*
- (d) Logical values include (what) and (what) that are presented as the integers (what) and (what).
true false 0 1

7. (8 points) Which of the following are short circuited (so that the last part is not executed?) What does each evaluate to?

- (a) true & false *0*
- (b) false & true *0*
- (c) true && true *1*
- ✓ (d) false && false *0*
- (e) true & true *1*
- (f) 3 < 2 || 5 > 2 *1*
- ✓ (g) 5 == 5 || 2 > 1 *1*
- (h) 2 > 1 | 5 == 5 *1*

8. (32 points, 4 points per part) Manipulating matrices is a forte of Matlab. How can one do the following using a single assignment statement?

- (a) Make an array consisting of multiples of each of 3 and 5 from 1 through 1000. (eg. 3, 5, 6, 9, 10, etc.)
- (b) Update only the middle column of an arbitrary array to all ones. (Assume there are an odd number of columns.)
- (c) Update only the lowest rightmost corner cell to be double the upper leftmost cell.
- (d) Zero out all but the diagonal (starting at cell 1,1) of an arbitrary square matrix.
- (e) Zero out all but the diagonal (starting at cell 1,10) of a 10 by 10 matrix.
- (f) Double only the diagonal (starting at cell 1,1) of an arbitrary square matrix.
- (g) Double the four corners of an arbitrary matrix.
- (h) Assign the (integer) quotient and remainder of a/b to a two-element array x .

a) $\text{sort}(3:3:1000, 5:5:1000)$ *though allows duplicates*

b) $x(:, (1+\text{end})/2) = 1$

c) $x(\text{end}) = 2 * x(1)$

d) $x = x .* \text{eye}(\text{length}(x))$

e) $x(:, \text{end}-1:1) = x(:, \text{end}:-1:1) .* \text{eye}(\text{length}(x))$

f) $x = x .* (\text{ones}(\text{length}(x)) + \text{eye}(\text{length}(x)))$

g) $x([1 \text{ end}], [1 \text{ end}]) = K([1 \text{ end}], [1 \text{ end}]) * 2$

h) $x = [\text{floor}(a/b) \text{ mod}(a, b)]$

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Question	Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	8	
8	32	
Total:	100	