

Final Exam

COMPUTER PROGRAMMING FOR ENGINEERING AND SCIENCE
Held on 11th of August, 2011 (CSCE 155N, SUMMER 2011)

Name :

Save : YES NO

Course No : CSCE155N Matlab

Instructions:

1. This is open book, open note, but not open neighbor. Please do not use email, texting, etc. during the exam.
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. If you wish to have the exam saved so that you can retrieve it later, please indicate this. Exams so marked will be saved until the end of fall semester. Otherwise they may be recycled in September.

1. (10 points) Consider the following code. Assume ASCII files *list1.dat* and *list2.dat* each contains a list of positive integers in increasing order, ending with -1. It *merges* the two files into a single sorted file.

- (a) Write a function *trygetl()* that takes an fid as an argument and returns the next number in the file, assuming there is a next number, or a -1 if the file is exhausted.
- (b) Use this function to modify the following code so that the files do not need (and should not have) -1 as the last value.

```
fid1 = fopen('list1.dat');
fid2 = fopen('list2.dat');
fid3 = fopen('list3.dat', 'w');

t1 = str2num(fgetl(fid1));
t2 = str2num(fgetl(fid2));

while t1 ~= -1 && t2 ~= -1
    if t1 < t2
        fprintf(fid3, '%d\n', t1)
        t1 = str2num(fgetl(fid1));
    else
        fprintf(fid3, '%d\n', t2)
        t2 = str2num(fgetl(fid2));
    end
end
while t1 ~= -1
    fprintf(fid3, '%d\n', t1)
    t1 = str2num(fgetl(fid1));
end
while t2 ~= -1
    fprintf(fid3, '%d\n', t2)
    t2 = str2num(fgetl(fid2));
end

fclose(fid1)
fclose(fid2)
fclose(fid3)
```

2. (10 points) Consider a thunderstorm that forms over a square section of land. Suppose that it moves from west to east at a constant speed, and the rainfall rates as measured over a grid of points delineating the storm are constant. A square n by n array contains these rates. Write Matlab code that calculates the total rainfall over the entire area, summing up the rates over each of the time units it takes until the storm exits the area. Also have it calculate the maximum rainfall over any one grid section.

3. (10 points) This exercise concerns mailing labels.
- (a) Design a structure that allows a program to access a complete name and address, a complete name or first and/or last separately, street address, city/state/zip as a package, or as separate components.
 - (b) Let there be an array *mailingAddresses()* of these structures. Show how to access the whole name of the 7th element. Show how to access the zip of the 2nd element.
4. (10 points) Consider an expression built as follows: 1 and 2 are added. 3 and 4 are multiplied. These two results are multiplied together. 5 and 6 are added. 7 is subtracted from this result. Finally, the two resulting results above are added.
- (a) Draw a binary tree that represents the expression (hint: The nodes are the operators and the leaves are the numbers 1 through 7.)
 - (b) Present the expression using infix notation. Use parentheses as needed.
 - (c) Present the expression using prefix notation.
 - (d) Present the expression using postfix notation.
 - (e) Were you able to use the tree to help generate the expressions? (Saying no will not count off your score.)

5. (10 points) Consider the following code, which is very similar to what you have seen!
- Cross off any redundant (unneeded) portions of the code. (The resulting code should always yield the same results, regardless of input.)
 - Rewrite the code in an optimal fashion, reordering the elseif blocks, to minimize the number of tests.

```
grade = input('Enter the grade from 0 to 100: ');
if grade > 90 && grade <= 100
    disp('Nice A')
elseif grade > 80 && grade <= 90
    disp('Not a bad B')
elseif grade < 0 || grade > 100
    disp('Invalid input')
elseif grade <= 50 && grade >= 0
    disp('Sorry - you blew it')
elseif grade > 60 && grade <= 70
    disp('Discouraging D')
elseif grade > 50 && grade <= 60
    disp('An E for effort is all you get')
elseif grade > 70 && grade <= 80
    disp('Average C')
end
```

6. (10 points) Consider the following code.

```
count = 0;
for a = 1:n
    for b = 1:n
        for c = 1:n
            count = count + 1;
        end
        for d = 1:n
            count = count + 1;
        end
    end
    for e = 1:n
        count = count + 1;
    end
end
```

(a) Give an algebraic formula using n for the final value of *count*.

(b) Rewrite the loops so that *count* ends up at $n^3 + 2n^2 + n\log_2 n$.

7. (10 points) Answer the following concerning GUIs.
- (a) Describe what happens in the program when a GUI element is poked (in some fashion) for which there is a call back function.
 - (b) There may be a risk in making a GUI element visible immediately upon creation. Explain.

8. (10 points) The function call `fprintf('Greetings!')` generates a return value. What is it? It also generates a side effect. What is it? Explain both.

9. (10 points) What is printed when the following function is invoked with `curse(8)`?

```
function curse(n)
    if n >= 1
        disp('do')
        curse(n/2)
        disp('re')
        curse(n/2)
        disp('mi')
    end
```

10. (10 points) What was the most interesting thing about Matlab or programming in general that you learned in this course?

Question	Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
Total:	100	