

Final??? Exam

COMPUTER PROGRAMMING FOR ENGINEERING AND SCIENCE
Held on 18th of April, 2012 (CSCE 155N, SPRING 2012)

Name : Key
Course No : CSCE155N Matlab

Instructions:

1. This is open book, open note, but not open neighbor. Please do not use email, texting, sign language, 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.

1. (10 points) Consider the following code. Assume ASCII files *list1.dat* and *list2.dat* each contains a list of positive integers, one per line, in increasing order. It merges the two files into a single sorted file, *list3.dat*.

- (a) What happens if the first file is empty?
 (b) What happens when one file becomes exhausted?
 (c) Is there a flaw in the program such that it will not properly merge two files? If so, where?
 (d) Show the results if the two input files contain 23, 51, 92, 125, 127 and 42, 62, 63, 64, 99, 100, 101, 102 respectively (one number per line of the file, of course).

```

fid1 = fopen('list1.dat');
fid2 = fopen('list2.dat');
fid3 = fopen('list3.dat', 'w');
again = ~feof(fid1) && ~feof(fid2);
if again
    t1 = str2num(fgetl(fid1));
    t2 = str2num(fgetl(fid2));
end
while again
    if t1 < t2
        fprintf(fid3, '%d\n', t1);
        again = ~feof(fid1);
        if again
            t1 = str2num(fgetl(fid1));
        end
    else
        fprintf(fid3, '%d\n', t2);
        again = ~feof(fid2);
        if again
            t2 = str2num(fgetl(fid2));
        end
    end
end
while ~feof(fid1)
    t1 = str2num(fgetl(fid1));
    fprintf(fid3, '%d\n', t1);
end
while ~feof(fid2)
    t2 = str2num(fgetl(fid2));
    fprintf(fid3, '%d\n', t2);
end
fclose(fid1);
fclose(fid2);
fclose(fid3);

```

- 2½ a) control skips to 3rd while loop that dumps file 2 into file 3
- 2½ b) exit first while loop, proceed to dump what's left of remaining file into file 3
- 2½ c) yes, a value can be dropped from the non-empty file when control passes from first while loop to a later one. (Two values are fetched but only the second is sent to file 3.)
- 2½ d) 23
42
51
62
63
64
92
99
100
101
102
127
- note, 125 is missing. lose 1 point if present

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) increase by 10% over each unit of time. A square n by n array contains the initial rates. Write Matlab code that calculates the total rainfall over the entire square area, summing up the rates over each of the time units it takes until the storm exits the area. For two bonus points be the first in the class to burst out laughing loudly. Also have it calculate the maximum rainfall over any one grid section.

```

n = 10;
land = rand(10) ] (not really needed)
a) total = land;
   for ii = 2:n
       total land = 1.1 * land;
       total(:, ii:end) = total(:, ii:end) + land(:, 1:end-ii);
   end
b) maximum = max(total(:, n)) ] (or comparable. note maximum must be in eastmost column)

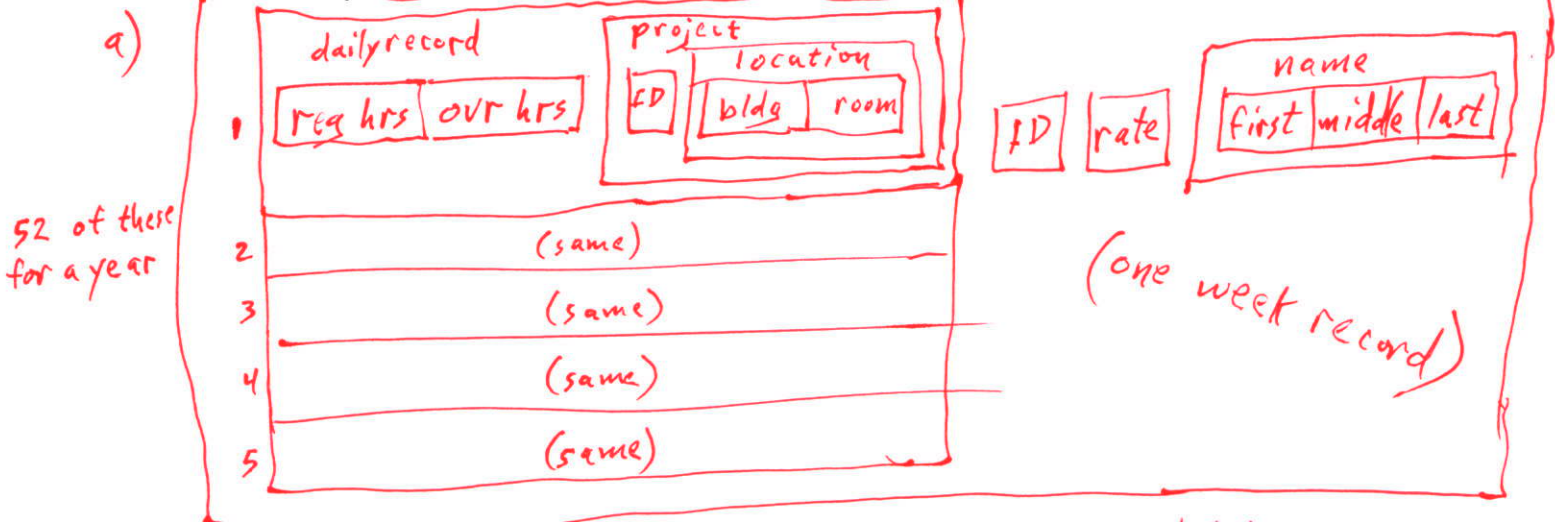
```

3. (10 points) This exercise concerns payroll data for an employee.

5 or 7 day week is fine

(a) Design a structure that allows a program to access a complete week's worth of payroll data that includes daily regular hours worked and overtime hours worked and the project worked on that day. It also includes the employee's ID number, pay rate, and name. The name can be treated as a whole or subdivided into first, middle, and last. The project details include a project ID and location (which can be further broken down into building name and room number.)

(b) Let there be an array of these structures representing a year's worth of data for a given employee. Show how to access the room number of the project location on day 3 of week 15. Show how to access the whole 15th week.

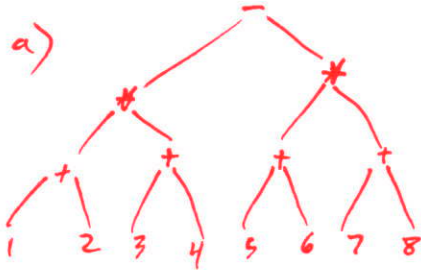


```

b) record(15).dailyrecord(3).project.location      record(15)

```

4. (10 points) Consider an expression built as follows: 1 and 2 are added. 3 and 4 are added. These two results are multiplied together. 5 and 6 are added. 7 and 8 are added. These two results are multiplied together. The second product is subtracted from the first product.
- Draw a binary tree that represents the expression (hint: The nodes are the operators and the leaves are the numbers 1 through 8.)
 - Present the expression using infix notation. Use parentheses as needed.
 - Present the expression using prefix notation.
 - Present the expression using postfix notation.



b) $(1+2) * (3+4) - (5+6) * (7+8)$

c) $- * + 1 2 + 3 4 * + 5 6 + 7 8$

d) $1 2 + 3 4 + * 5 6 + 7 8 + * -$

5. (10 points) Consider the following code.

- Cross off any redundant (unneeded) portions of the code. (The resulting code should always yield the same results, regardless of input.) For two bonus points be the first in the class to shout out "I really love Matlab!".
- This really is a sorry piece of code! Rewrite with a *switch* statement.

```

grade = input('Enter the grade from 0 to 100: ');
if 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 > 90 && grade <= 100
    disp('Nice A')
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

```

Handwritten notes:
 - A red bracket on the right side of the code groups the first four `elseif` blocks. An arrow points from this bracket to the handwritten note "Keep for b)".
 - A red box on the right contains the handwritten code for part (b), which uses a `switch` statement to replace the `if-elseif` structure.

b)

```

grade = ...
if ... < 0 || > 100
    invalid
end

switch grade
case { 91, 92, 93, 94, 95, 96, 97, 98, 99, 100 }
    disp('Nice A')
case { 81 etc
    disp B
case 71 etc
    disp C
case 61 etc
    disp D
case 51 etc
    disp E
otherwise
    disp('Sorry - you blew it!')
end

```

6. (10 points) Consider the following code.

```

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

n^2

n^3

n^3

n^2

~~for~~
~~for~~
~~for~~
~~count =~~
~~end~~
~~end~~
~~count =~~

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

$2n^3 + 2n^2$

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

b)
for
for
for
count =
end
count =
end
count =
end
for q = 1:log(n)
count =
end

7. (10 points) Answer the following concerning GUIs.

(a) In your own words explain the relationship between 'GUI objects' and 'event driven programming.' (Is one needed for the other to exist?) For two bonus points be the first in the class to stand up and clap your hands enthusiastically.

GUI objects : entities on screen with various properties that may be poked or prodded

event driven : program action in response to poking + prodding GUI objects

they go hand in hand (first needed for the second)

- (b) Present the code to generate a push button that displays the string 'on' or 'off' alternately, each time it is poked. (Start with 'off'.)

```
function onoff()
f = uicontrol('style','pushbutton','string','off','callback',@fun);
```

```
function fun(s,e)
if strcmp(get(f,'string'),'on')
set(f,'string','off')
else
set(f,'string','on')
end
end
```

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

14 is returned (length of message), as into an expression
side effect is the message being displayed,
but not returned

9. (10 points) What is printed when the following function is invoked with `curse(6)`?

```
function curse(n)
if n > 1
fprintf('s %d\n', n)
curse(n/2)
fprintf('m %d\n', n)
curse(n/3)
fprintf('b %d\n', n)
end
```

(without indenting)

```
s 6
s 3
s 1.5
m 1.5
b 1.5
m 3
b 3
m 6
s 2
m 2
b 2
b 6
```

10. (10 points) What would be the most valuable use of class time in the coming week?

if completed, counts 10

Held: April 18, 2012

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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	