

# Midterm Exam 1

COMPUTER PROGRAMMING FOR ENGINEERING AND SCIENCE  
Held on 24th July, 2012 (CSCE 155M, SUMMER 2012)

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Name :  
Course No : CSCE155M

Key

## 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. If answers do not fit in the space provided, use the back of a sheet and very carefully indicate and label this so I don't miss it in grading.
4. You may take the entire period.

1. (10 points) Keeping in mind that a logical array is utilized quite differently from a numeric array, consider the follow interaction:

```
>> x = [2 4 7 1 3 5 6]
x =
     2     4     7     1     3     5     6
>> y = x > 0
y =
     1     1     1     1     1     1     1
>> z = double(y)
z =
     1     1     1     1     1     1     1
>> w = x > 3;
```

- (a) What is the result of entering the following three expressions?

```
2 >> x(w)  4 7 5 6
2 >> x(y)  2 4 7 1 3 5 6
2 >> x(z)  2 2 2 2 2 2 2
2 >> x(x)  4 1 6 2 7 3 5
```

- 2 (b) What is the 'type' of variable y? of variable z?

*logical, double*

2. (10 points) Consider the following code.

```
a1 = input('Enter first matrix: ');
a2 = input('Enter second matrix: ');
[r1, c1] = size(a1);
[r2, c2] = size(a2);
if c1 ~= r2
    disp('impossible')
else
    a3 = zeros(r1, c2);
    for r = 1:r1
        for c = 1:c2
            s = 0;
            for ii = 1:c2
                s = s + a1(r,ii) * a2(ii,c);
            end
            a3(r,c) = s;
        end
    end
end
end
```

- 2 (a) How many additions plus multiplications are performed on the array contents? (Give an algebraic expression.)  $2 \cdot n \neq O(2^2)$
  - 2 (b) If all the array dimensions are the same, call it x, then what would be the answer to part a?  $2x^3$
  - 2 (c) Would execution of this code increase in time linear, quadratic, cubic, or some other factor of the size of x? *cubic*
  - 2 (d) What common operation is being performed by the code? *matrix multiplication*
  - 2 (e) What useful purpose is served by assigned 0's to a3? *preassign array  $\Rightarrow$  faster than incrementally growing it*
3. (10 points) What is output by the following fragment of code?

```

10 for a = 5:-1:3
    for b = a:5
        for c = b:-1:a
            fprintf('%1d %1d %1d\n', a, b, c)
        end
        fprintf('cackle!\n')
    end
    fprintf('whee!\n')
end
    
```

5 5 5  
 cackle!  
 whee!  
 4 4 4  
 cackle!  
 4 5 5  
 4 5 4  
 cackle!  
 whee!  
 3 3 3  
 cackle!  
 3 4 4  
 3 4 3  
 cackle!  
 3 5 5  
 3 5 4  
 3 5 3  
 cackle!  
 whee!

4. (10 points) Consider the following function definition. Write an expression that uses it (and only it - so no operators!) to calculate the volume of a cone, given radius of the base as r and height as h.  $\frac{1}{3}\pi r^2 h$  or  $\pi r^2 h / 3$

```

function x = mOp(a, b, op)
switch op
case '+'
    x = a + b;
case '-'
    x = a - b;
case '*'
    x = a * b;
case '/'
    x = a / b;
case '^'
    x = a ^ b;
otherwise
    x = 0;
end
    
```

$\frac{\pi * r^2 * h}{3}$   
 $1 * \pi * r^2 * h / 3$   
 $\pi r^2 * h * 3 /$   
*mOp*  
 $mOp(mOp(mOp(\pi, mOp(r, 2, '^'), '*'), '/'), '1')$

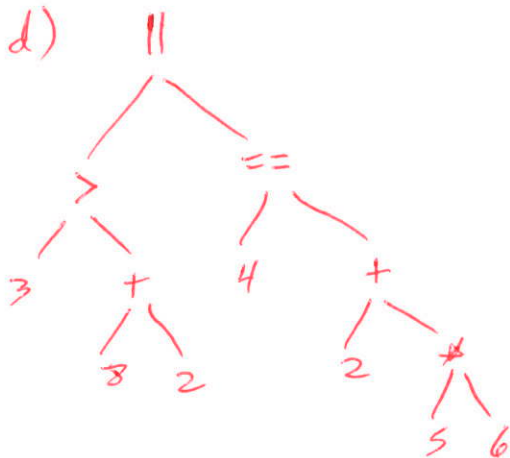
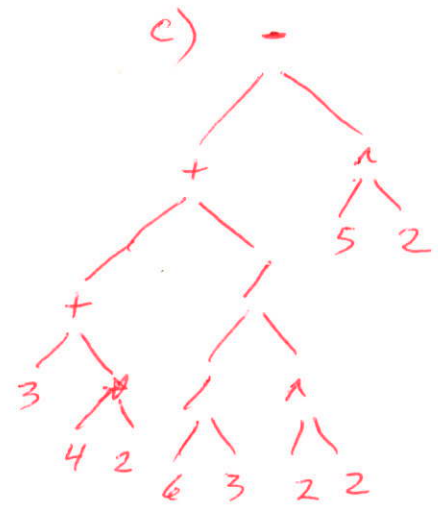
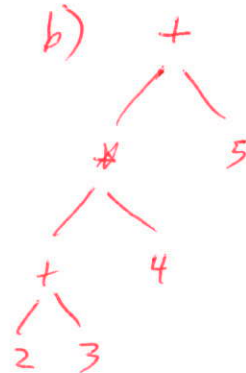
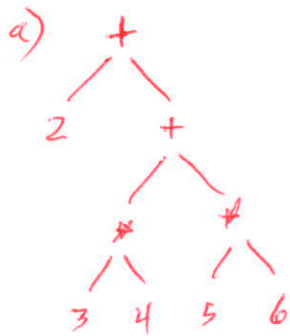
5. (10 points) Show each of the following as parse trees (like the ones in class that the squirrel ran around on). Indicate whether each is prefix, infix, or postfix.

2 (a)  $2\ 3\ 4\ * \ 5\ 6\ * \ + \ +$  *post*

2 (b)  $+ \ * \ + \ 2\ 3\ 4\ 5$  *pre*

3 (c)  $3 + 4 * 2 + 6 / 3 / 2^2 - 5^2$  *in*

3 (d)  $3 > 8 + 2 || 4 == 2 + 5 * 6$  *in*



6. (10 points) Consider the following logic expressions.

- (a) Check the expressions in which short circuiting is enabled.
- (b) Circle the expressions in which short circuiting actually occurs.
- (c) Evaluate each expression.
- (d) Where does a side effect of a function take place, and what happens?

Here are the expressions:

- (a)  $25 > 357 \&\& true$       0
- (b)  $-5 == 8 || 21 > 9$       1
- (c)  $45 < 24 \& \text{logical}(\text{fprintf}('howdy'))$       0      side effects  
print howdy
- (d)  $45 < 245 || \text{logical}(\text{fprintf}('howdy'))$       1      ~~###~~
- (e)  $45 < 245 \& \text{logical}(\text{fprintf}('howdy'))$       1
- (f)  $true | 2 > 71$       1
- (g)  $2 - 16 < 6 \&\& 5 > 2$       1

7. (10 points) Write a piece of code that determines if  $x$  is positive, zero, or negative, and sets  $y$  to 1, 2, or 3 depending on the answer. Do this in each of the following ways.

- (a) Three separate *if* statements
- (b) One nested *if* statement
- (c) An *if* with *elseif*s

Finally use a switch statement to print out appropriate messages regarding the value of  $x$ . (Note - this is a bit crazy. One would not do this in practice.)

```

a) if x < 0
    y = 1
end
if x == 0
    y = 2
end
if x > 0
    y = 3
end

b) if x < 0
    y = 1
else
    if x == 0
        y = 2
    else
        y = 3
    end
end

c) if x < 0
    y = 1
elseif x == 0
    y = 2
else
    y = 3
end

d) switch y
    case 1
        disp('under')
    case 2
        disp('zilch')
    case 3
        disp('over')
end
    
```

Question	Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
Total:	70	