CSCI 1900 Final Exam Review Problems

1. Given m, n  Z, show that if the product of *m*\**n* is even, then *m* must be even or *n* must be even.
2. Given the expression F(n) = 2 + 8 + 18 +32 + … + 2n2
   1. What is the 5th term in the expression?
   2. What is the kth term in the expression?
   3. What is the value of F(4)?
   4. Write F(n) using summation notation.
   5. What is
3. Compute the following by evaluating the appropriate formula. If you calculator has n*P*r or n*C*r keys, do not use it for this problem.
   1. 4*P*4
   2. 6*P*2
   3. 4*C*4
   4. 6*C*3
4. A user login consists of 6 characters. The first character must be an upper case letter and the last character must be a digit. The four middle characters must be one of   
   {A .. Z, 0 .. 9, !, !, #, &, \*}. How many different passwords are there?
5. How many ways can a six-card hand be dealt from an ordinary deck of 52 playing cards?
6. You wish to buy ten candy bars, selecting from Zagnuts, Baby Ruths, Mary Janes, Paydays, and BB Bats. How many different ways can you buy the candy bars?
7. How many four-letter sequences can be formed from the letters in the word MOSFET?
8. Suppose you are playing a 5-card game with a standard 52-card deck.
   1. What is the probability of being dealt a 4-of-a-kind hand?
   2. What is the probability of being dealt hand with 5 cards of the same suit?
9. Show that if you choose any five numbers in the range 1 ,, 8, two of them will sum to 9.
10. Suppose you have an urn with 11 balls, 5 red and 6 green.
    1. Three balls are chosen at random, what is the probability that all three balls are red?
    2. Three balls are chosen at random, what is the probability that all three balls are green?
    3. Three balls are chosen at random, what is the probability that 1 ball is red and 2 are green.
11. Given A = { 1, 2, 3, 4, 5, 6 }. Let R be a relation on A, where

a R b iff a mod b = 0

* 1. Give R (by enumerations of elements)
  2. Draw the diagraph of R.
  3. Give the matrix that shows the mapping of R from A to A.
  4. What is Dom( R )?
  5. What is the Ran( R )?
  6. Is the relation Symmetric?
  7. Is the relation Reflexive?
  8. Is the relation Transitive?

1. Given A = B = R , C = Z f : B → C, and g : A → B with  and   
   *g(a) =2a +* 1.2   
   1. Evaluate (f 0 g)(1.5).
   2. What is the domain of (f 0 g)?
   3. What is the range of (f 0 g)?
   4. Evaluate (g 0 f)(1).
   5. Evaluate (f 0 g)(x).
2. Compute each of the following
   1. 
   2. 
   3. 
   4. 
   5. 
   6. 
   7. 
   8. 
   9. 
   10. 7 mod 5
3. Order the following functions by Θ class from lowest to highest.



1. Suppose you have an algorithm, which is a member of a specified Θ class. Describe the behavior of the algorithm if you double the number of items to be processed.
   1. Θ( 1 )
   2. Θ( 1911 )
   3. Θ( 134n )
   4. Θ( 11n2 )
   5. Θ( lg n )
   6. Θ( n lg n)
2. Consider the following pseudocode that performs a numerical integration of the data in the Y array.

function integrate( n, x[n], y[n] )

sum ← 0

for i = 1 to n-1

sum ← sum + ( x[i+1] - x[i] )\*( y[i] + y[i+1] )

sum ← 0.5\*sum

return sum

* 1. Determine the critical operation to be counted.
  2. Count the number of critical operations performed.
  3. What is the Θ class of the algorithm?

1. Determine if the following relation R defined on the set A is a tree. If it is a tree, give the root
   1. A = { a, b, c, d, e }  
      R = { (a,b), (a,c), (b,d), (b,e), (c,e) }
   2. A = { 1, 2, 3, 4, 5 }  
      R = { (4,2), (2,1), (2,3), (3,5) }
2. Consider the tree in Figure 8(a) of Rosen (page 749).
   1. Which vertex is the root?
   2. List the vertices at level 3.
   3. List the siblings of *b*.
   4. List the children of *b*.
   5. List the descendants of *b*.
3. Consider the tree in Figure 8(a) of Rosen (page 749). Assume for any vertex with a single child, that child is to the left. List the order in which the nodes will be visited, when performing a
   1. Preorder traversal
   2. Inorder traversal
   3. Postorder traversal
4. Consider the following Huffman codes  
   H = { ( A, 01 ), ( C, 100 ), ( E, 11 ), ( R, 101 ), ( S, 00 ) }
   1. Draw the Huffman tree, with 0 branches to the left and 1 branches to the right.
   2. Encode C R A S S
   3. Encode S C A R
   4. Decode 1 0 1 0 1 1 0 0 1 1 1 0 1
   5. Decode 0 0 1 1 0 1 1 0 1
5. Consider the weighted graph in Exercise 2 of Rosen page 802.
   1. Find the minimal spanning tree on this weighted graph, using Prim’s algorithm. Label the edges, consecutively, as you add them. Begin at vertex *b*.
   2. Find the minimal spanning tree on this weighted graph, using Kruskals algorithm. Label the edges, consecutively, as you add them.
6. Convert as indicated
   1. 515 to base 16
   2. 191 to base 8
   3. 3038 to base 10
   4. 1010102 to base 10
   5. 106 to base 2
   6. 3340 to base 16
   7. FAD16 to base 10