Computer Science 245

Final Reveiw

Do not turn in!

1. Give the $\Theta()$ running time for each of the following functions, in terms of the input parameter n:

   (a)
   ```
   int f(int n) {
      int i;
      sum = 0;
      for (i=0; i<n; i=i+2)
         sum++;
      return sum;
   }
   ```
   (b)
   ```
   int g(int n) {
      int i;
      sum = 0;
      for (i=0; i<n; i=i+1)
         sum += f(n);  // function f from part a
      return sum;
   }
   ```
   (c)
   ```
   int h(int n) {
      for (i=1; i<n; i=i*2)
         sum += f(n); // function f from part a
      return sum;
   }
   ```

2. For each of the following recursive functions, describe what the function computes, give the recurrence relation that describes the running time for the function, and then solve the recurrence relation.

   (a)
   ```
   int recursive1(int n) {
      if (n <= 1)
         return 1;
      else
         return recursive1(n-2) +  recursive1(n-2);
   }
   ```
   (b)
   ```
   int recursive2(int n) {
      if (n <= 1)
         return 1;
      else
         return 2 * recursive2(n-2);
   }
   ```

3. Consider a B-Tree with maximum degree k (that is, all interior nodes have $\lceil k/2 \rceil \dots k$ children – a 2-3 tree is a B-Tree with maximim degree 3).

   (a) What is the largest number of keys that can be stored in a B-Tree of height h with maximum degree k?

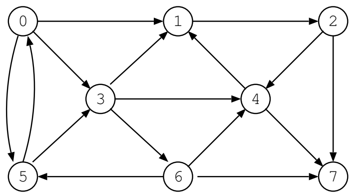
   (b) What is the smallest number of keys that can be stored in an B-Tree of height h with maximum degree k?

   Show your work!

   (Hint: You may find the following formula helpful:)

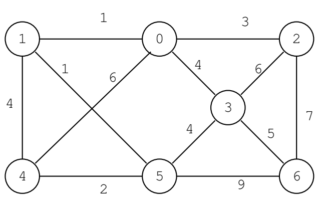
$$\sum_{i=0}^{n} x^i = \frac{x^{n+1} - 1}{x - 1}$$

4. Consider the following directed graph:



Run the connected component algorithm on this graph. Show all discovery and finish times, as well as the depth-first forrest for the final pass of the algorithm.

5. Consider the following graph:



   (a) Show the Vertex / Distance / Path table after Dijkstra's algorithm is run on this graph
   (b) Show the Vertex / Distance / Path table after Prim's algorithm is run on th this graph

6. Look over all the visualizations for algorithms used in the class, be sure you know how all of them work.