A) Review Questions

Type your answers here. Answer completely. Always say what kind of operations.

1) **Declare a 4x4 matrix M containing a vector of integers.**
   `vector<int> M[4][4];`
2) **What does W(n) mean in general? (W? n? W(n)?)**
   W(n) describes the worst-case scenario number of operations.
   W refers to the basic operation function for an algorithm in terms of its worst case, and n is the input number (such as the elements to sort, or nodes in a tree) for the function.
   The output for W(n) is the number of operations (comparisons, multiplications, etc.) needed for the given input n.
3) **For sequential search:**
   a. **W(n) = n comparisons**
   b. **When does it happen?**
      When the element to be found is at the end of the list.
4) **What does B(n) mean in general? (B?, n?, B(n)?)**
   B(n) means the best-case scenario number of operations needed to execute the basic operation function of an algorithm.
   B refers to the basic operation function in terms of its best case, and n is the input number for the function.
   The output for B(n) is the number of operations needed for the given input n.
5) **For sequential search:**
   a. **B(n) = 1 comparison**
   b. **When does it happen?**
      When the element to be found is at the beginning of the list.
6) **Why is A(n) difficult to determine for the real world problems?**
   Computing A(n) is impractical because the number of operations for all possible input cases must be known (B(n), W(n), etc.) in order to calculate the average case. However, the probability of each case is not likely to be equal in the real world, so calculating the average will only work for one particular case.
7) **Why don't we care about constants and lesser terms in a time complexity expression?**
   Constants and lesser terms are dropped because we only care about the rate of growth as the input size grows; small values become negligible.
8) **Prove that 3n^2 + 4n = O(n^2) as I did in the notes. (must give C and the starting point for n)**
   - **$3n^2 + 4n = O(n^2)$**
     $3n^2 + 4n <= Cn^2$
     $4n <= (C - 3)n^2$
     $4 <= (C - 3)n$
   - **Let C = 7, so**
     4 <= 4n
   - **This relation is true for all n >= 1 QED.**
9) **Binary search corresponds to the perfect/triangular binary search tree.**
   Sequential search corresponds to a / the skewed tree.
   Hint: think of the shape/height
10) **Thus, the fastest ordered list search does W(n)=Theta(log n) comparisons (going through all levels of recursion).**
11) **But, the fastest unordered list search does W(n)=Theta(n) comparisons (going through the entire list).**