CS 22203: Design and Analysis of Algorithms, Jan-May, 2025

Assignment I

A. Answer the following and justify your answer.

1. Is ½ $n^2 - 4n = \theta(n^2)$?
2. Is $2^{n+1} = O(2^n)$?
3. Is $2^{2n} = O(2^n)$?
4. Is $3n^2 + 2 = \Omega(n^2)$?
5. Is $2n^2 + 1 = \theta(n)$?
6. Is $2n^2 + 1 = O(n)$?
7. Is $n! = O(2^n)$?

B. Give a recursive definition (procedure) for searching an element x in an unsorted list of n elements. Determine the recurrence relation that represents the time taken by your procedure.

C. Consider the following *insertionSort* algorithm to sort a sequence of *n* elements. Find out the time complexity of the algorithm.

```
template<class T>
void insert(T a[], int n, const T& x)
{// Insert x into the sorted array a[0:n-1].
   int i;
   for (i = n-1; i >= 0 && x < a[i]; i--)
      a[i+1] = a[i];
   a[i+1] = x;
}

template<class T>
void insertionSort(T a[], int n)
{// Sort a[0:n-1] using the insertion sort method.
   for (int i = 1; i < n; i++)
   {
      T t = a[i];
      insert(a, i, t);
   }
}
```