1) Write an algorithm (in pseudocode) that takes as input a list of \( n \) distinct integers and returns the location (i.e., index number) of the largest even integer in the list or returns 0 if there are no even integers in the list.

2) Write an algorithm (in pseudocode) that returns the index of the last occurrence of the smallest element in a finite list of integers, where the integers in the list are not necessarily distinct (i.e., the same number can appear multiple times in the list).

3) For a list of length \( n \) determine the maximum number of comparison operations (e.g., \( \geq \), \( < \), \( \neq \), etc) necessary, or worst-case performance,
   a) used to locate an element in a list of \( n \) terms using linear search (Alg 2, Handout 7).
   b) used to locate an element in a list of \( n = 2^k \) terms using binary search (Alg 3, Handout 7).

4) Consider the typical-case performance for the search algorithms listed below. In other words, the average number of comparisons needed over all possible positions where the element can be found
   a) used to locate an element in a list of \( n \) terms with linear search (Alg 2, Handout 7).
   b) used to locate an element in a list of \( n = 2^k \) terms using binary search (Alg 3, Handout 7).

5) Determine whether each of these functions is \( \mathcal{O}(x^2) \).
   a) \( f(x) = 17x + 11 \)
   b) \( f(x) = x^2 + 1000 \)
   c) \( f(x) = x \log x \)
   d) \( f(x) = \lfloor x \rfloor \cdot \lceil x \rceil \)
6) Let $k$ be a positive integer. Show that $1^k + 2^k + \cdots + n^k$ is $O(n^{k+1})$.

7) 
   a) Show that $3x + 7$ is $\Theta(x)$.
   b) Show that $2x^2 + x - 7$ is $\Theta(x^2)$.
   c) Show that $\lfloor x + 1/2 \rfloor$ is $\Theta(x)$.
   d) Show that $\log(x^2 + 1)$ is $\Theta(\log_2 x)$. 