

**Problem Set 1 — Invariants and Induction**

1. Problem 2.1-3

The variation of the sequential search detailed in the problem does have different efficiencies. For the best case efficiency the classical sequential search is 1. In this case, the search key is found in the first element so the algorithm terminates after one loop. However, in the variation all elements need to be searched since a list of key locations need to be returned. And the key may be in the last element. The worst case is the same in both versions, since the key is found in the last element the entire array needs to be searched which makes the efficiency  $n$ . Finally, for the average efficiency they differ. The average efficiency for the variation is  $n$  since all elements are accessed.

2. Problem 2-2 in CLRS, 3rd edition.

3. Prove by induction that for every non-negative integer  $n$

$$\sum_{k=0}^n k^2 = \frac{n(n+1)(2n+1)}{6}.$$

4. Prove that given an unlimited supply of 6-cent coins, 10-cent coins, and 15-cent coins, one can make any amount of change larger than 29 cents.