Problems 1 - 4 below are from the text (*Algorithms by Dasgupta, Papadimitriou, Vazirani* pages 8 - 10).

(1) (1 pt. each) Ex. 0.1 (c) - (o). For each part, briefly show the algebra justifying your answer.

(2) (1 pt. each) Ex. 0.2

(3) (3 pts each) Ex. 0.3

(4) (3 pts each) Ex. 0.4 (a) - (d). You may do part (e) for extra credit.

(5) Write a recursive procedure to perform Linear Search for a key in an array A. Prove your proc correct and estimate its running time.

(6) Prof. Ivan A. Ripof has invented a new search algorithm that he calls Trinary Search. He argues that it executes correctly and searches more efficiently than Binary Search.

Pre: A a sorted array

Post: An array index of key in A or -1 if key not found

TrinSearch(A, fst, lst, key)

```
1   if (lst < fst)
2         index = −1
3   else
4         thrd = ⌊(lst+fst)/3⌋
5         twrd = 2∗⌊(lst+fst)/3⌋
6         if (key == A[thrd])
7               index = thrd
8         else
9             if (key < A[thrd])
10                  index = TrinSearch(A, fst, thrd − 1, key)
11            else
12                if (key == A[twrd])
13                      index = twrd
14                else
15                    if (key < A[twrd])
16                          index = TrinSearch(A, thrd + 1, twrd − 1, key)
17                    else
18                          index = TrinSearch(A, twrd + 1, lst, key)
19  return index
```

(a) Prove that $TrinSearch(A, fst, lst, key)$ works correctly.

(b) Support or dispute Prof. Ripof's claim about the efficiency of the code. Give clear reasons for your answer (no argument no credit).