Exercise for Analysis of Algorithms

Exercise 21

We want to compare the following two programs for a search in a sorted array:

```
                                   int binsearch2(double v) {
int binsearch(double v) {            int l,r,m;
  int l,r,m;                         l=1; r=N;
  l=1; r=N;                          while (r-l>1) {
  while (l<=r) {                       m=(r+l)/2;
    m=(r+l)/2;                         if (v<a[m]) r=m-1; else l=m;
    if (v==a[m]) return 1;           }
    if (v<a[m]) r=m-1; else l=m+1;   if (a[l]==v) return 1;
  }                                  if (a[r]==v) return 1;
  return 0;                          return 0;
}                                  }
```

Analyse how many **if**-instructions are executed by the programs in case of a successful or unsuccessful search for v. Find an exact solution for the first program and an estimate of the form $f(n) + O(1)$ for the second one. Make the usual assumptions about v.

Exercise 21

Consider the following algorithm that searches an element x in a sorted array a of length $n = km + 1$:

```
i:= 1;
while a[i]<=x
  if a[i]=x then return i;
  i:=i+m;
  if i>n return 0;
for j=i-1 downto max(1,i-(m-1))
  if a[j]=x then return j;
  if a[j]<x then return 0;
return 0;
```

a) Draw the search tree and compute the internal and external path length for $n = 10$ and $m = 3$.

b) Determine C^+ and C^- for arbitrary m, k.

c) What is, for given n, the best choice for m w.r.t. the running time?

Exercise 23

Compute the generating functions of the following series:

1. $a_n = 2^n + 3^n$
2. $b_n = (n+1)2^{n+1}$
3. $c_n = \alpha^n \binom{k}{n}$
4. $d_n = n - 1$
5. $e_n = (n+1)^2$