CMPS 2200 – Fall 17

Analyzing Algorithms

Carola Wenk

Algorithm

What is an algorithm?

- A tool for solving a well-defined problem
- It takes input and produces output

How does one describe an algorithm?

1. Define the problem. (What is the input, what is the output?)
2. Describe the algorithm in words and in pseudo-code
3. Proof of correctness (Convince the reader of correctness)
4. Analysis (Runtime, space)

Insertion sort

Runtime	Reps	
c_1	n	`for j=2 to n {`
c_2	n-1	`  key = A[j]`
		`  // insert A[j] into sorted sequence A[1..j-1]`
c_3	n-1	`  i=j-1`
c_4	$\Sigma_{j=2..n} (t_j+1)$	`  while(i>0 && A[i]>key){`
c_5	$\Sigma_{j=2..n} t_j$	`    A[i+1]=A[i]`
c_6	$\Sigma_{j=2..n} t_j$	`    i--`
		`  }`
c_7	n-1	`  A[i+1]=key`
		`}`

t_j = #times the body of the while loop is executed for that value of j

Insertion sort

```
for j=2 to n {
    // I1: A[1..j-1] is sorted and A[1..j-1] consists of
    // elements originally in A[1..j-1]
    key = A[j]
    // insert A[j] into sorted sequence A[1..j-1]
    i=j-1
    while(i>0 && A[i]>key){
      A[i+1]=A[i]
      i--
    }
    A[i+1]=key
}
```