

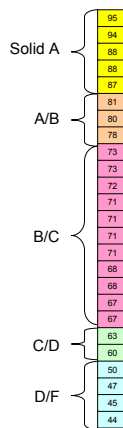
Discrete Mathematical Structures  
CS 3233 Lecture 13

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October 10, 2006

## Business

- Read section 3.1 for Thursday
- Homework 5  
Due Tuesday 17 October
  - 3.1: 2, 4, 12, 18, 24
  - 3.2: 2, 4
- Midterm Results Today

## Results of Midterm 1



## Algorithms

- Definition
  - An *algorithm* is a finite collection of precise instructions for performing a computation to solve a problem
  - Input and output values are elements of specified sets
- Desirable characteristics:
  - Definiteness: Steps are precisely defined
    - To be really precise, must use a formal *computational model*, such as a Turing machine or the lambda calculus
  - Effectiveness: It must be possible to perform each step using a bounded amount of time and storage space
    - Bounded means there is an amount of time that is always sufficient
  - Correctness, Termination (Finiteness), Generality

## Examples

- Searching: Determine whether a given value is contained in an input sequence of integers

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5

## Linear Search

```
proc linear search(x:int; a1,a2,...,an; distinct ints)
  i := 1
  while (i ≤ n and x ≠ ai)
    i := i + 1
  if i ≤ n then location := i else location := 0
```

- How many comparisons are performed?

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6

## Binary Search

```
proc binary search(x: int; a1, a2, ..., an; increasing ints)
  i:=1 {left end of search interval}
  j:=n {right end of search interval}
  while i<j begin
    m:= ⌊(i+j)/2⌋
    if x > am then i:=m+1 else j:= m
  end
  if x=ai then location := i else location := 0
```

- How many comparisons are performed?
  - This will be studied in Section 3.3

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7