

## CSA0602 - DESIGN AND ANALYSIS

## OF ALGORITHMS FOR DYNAMIC PROGRAMMING

Name : Polyadharshini.B

Reg No : 192311337

Assignment - 2

## Divide And Conquer

### 1. Finding the maximum And Minimum

A methodology department recorded the temperature (in  $^{\circ}\text{C}$ ) of a city from the last 15 days: 32, 35, 31, 28, 36, 38, 34, 29, 33, 37, 30, 35, 32, 31, 36. The department wants to find out the hottest day & the coldest day & Temperature during this period.

Determine the maximum and minimum values.

A Farmer harvested 12 pumpkins and weighted each one in kilograms: 4.5, 3.2, 5.0, 2.8, 3.9, 4.2, 3.1, 4.8, 2.9, 5.1, 4.4, 3.6. Before sending them to market, he wants to know which pumpkins are the heaviest and which one is the lightest. Find these values.

### Temperature Data ( $^{\circ}\text{C}$ )

Data: 32, 35, 31, 28, 36, 38, 34, 29, 33, 37, 30, 35, 32, 31, 36

Maximum (hottest day) =  $38^{\circ}\text{C}$

minimum (coldest day) =  $28^{\circ}\text{C}$

### pumpkin weights (kg)

Data: 4.5, 3.2, 5.0, 2.8, 3.9, 4.2, 3.1, 4.8, 2.9, 5.1, 4.4, 3.6

Maximum (heaviest pumpkin) = 5.1 kg

minimum (coldest day) = 2.8 kg

3

### a) Merge sort

A Retail store has recorded its daily sales for 12 days in Rupees as follows 320, 280, 450, 500, 290, 470, 310, 340, 400, 370, 430, 390. The manager wants to arrange these sales figures in Ascending order for Analysis using the merge sort Algorithm.

Provide the sorted Result.

### Merge sort Algorithm

Divide the list into two halves

Recursively sort each half

merge the two sorted halves into sorted list.

### Given data :

[320, 280, 450, 500, 290, 470, 310, 340, 400, 370, 430, 390]

### Final sorted sales data :

280, 290, 310, 320, 340, 370, 390, 400, 430, 450, 470, 500

### 3. Binary search

A Library maintains a sorted list of books

IDs: 102, 110, 115, 120, 125, 130, 135, 140, 145

A Librarian wants to quickly check if book ID 135 exists in the collection without scanning through all entries.

Use binary search to verify and show the steps.

Find the middle element of the list.

Compare the target value (135) with the middle element

Repeat until the element is found or the search space is empty

#### Step-by-step

Step	Low index	High index	Middle index	Action
1	0	9	$0+9/2=4$	search right half
2	5	9	$5+9/2=7$	search left half
3	5	6	$5+6/2=5$	search right half
4	6	6	$6+6/2=6$	found

BOOK ID is found at index 6.

#### 4. Karatsuba Algorithm for multiplication

A cryptographic program needs to multiply two large integers: 1111 and 1111. Using Karatsuba's multiplication technique, calculate the result step by step

$$n=4 \Rightarrow m=n/2=2$$

so,

$$1111 = 11 \times 10^2 + 11$$

$$a = 11, b = 11 \text{ (from first 1111)}$$

$$c = 11, d = 11 \text{ (from second 1111)}$$

Karatsuba formula:

$$xy = ax10^{2m} + ((a+b)(c+d) - ac - bd)x10^m + bd$$

$$ac = 11 \times 11 = 121$$

$$bd = 11 \times 11 = 121$$

$$(a+b)(c+d) = (11+11)(11+11) = 22 \times 22 \\ = 484$$

$$xy = 121 \times 10^4 + 484 \times 10^2 + 121$$

$$xy = 1210000 + 48400 + 121$$

$$xy = 1234321$$

## 5. closest pair of points

A Delivery company has warehouses located at coordinates  $(2,3), (12,30), (40,50), (5,1), (12,10)$  and  $(3,4)$

They need to find the two warehouses that are closest to each other to optimize their Transport Rules. Identify the closest pair and the distance between them.

six mobile towers are positioned at  $(0,0), (5,5), (3,4), (7,1), (8,2)$  and  $(4,3)$ . the Telecom provider wants to know which two towers are nearest to improve signal coverage between them. Find the closest pair and the minimum distance.

a) For the Delivery company

coordinates :

$(2,3), (12,30), (40,50), (5,1), (12,10), (3,4)$

closest pair :  $(2,3)$  and  $(3,4)$

Minimum Distance :  $\sqrt{2} \approx 1.41$  units

b) For The Telecom Towers

coordinates :

(0,0) (5,5) (3,4) (7,1) (8,2) (4,3)

closest pair : (3,4) and (4,3)

Minimum Distance :  $\sqrt{2} = 1.41$  units.