

21BDS0340

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Design and Analysis of Algorithms Lab

Digital Assignment 1

Question 1

Algorithm

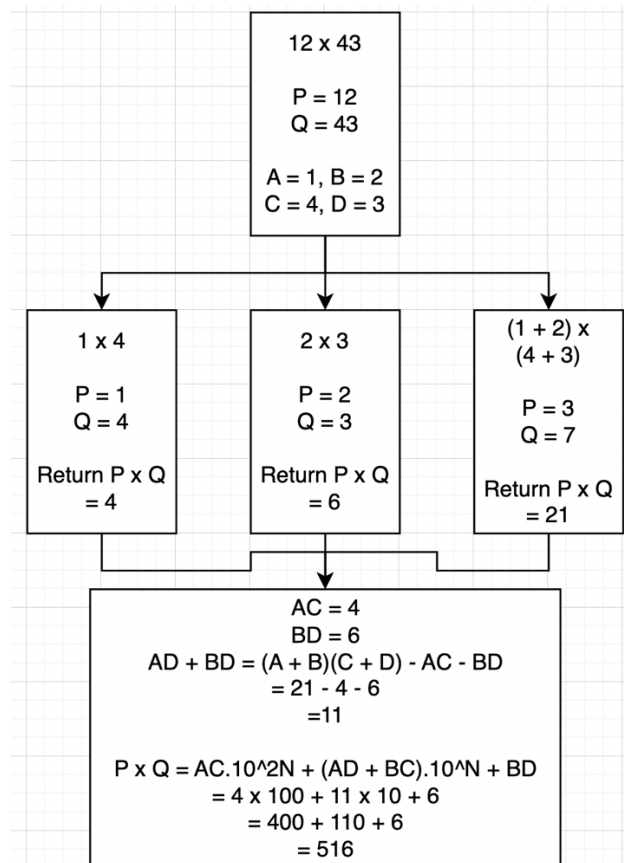
Given two numbers to multiply (P and Q)

1. If P and Q are less than 10, return $P * Q$
2. Split the numbers into two approximate halves as A, B, C and D
3. Find the half of the length of the numbers as N
4. Repeat from step 1 with A and C, B and D, A and D, B and C
5. Put the values together in the formula:

$$AB * 10^{2N} + (AD + BC) * 10^N + BD$$

Problem Solving

Ex. 1. 123×432



Ex. 2. 10010101 x 1010101

Converting to decimal:

$$149 \times 85$$

From the same method above:

$$A = 14, B = 9$$

$$C = 8, D = 5$$

$$AC = 112$$

$$BD = 45$$

$$AD + BC = 142$$

$$P \times Q = 112 \times 10^2 + 142 \times 10 + 45$$

$$= 11200 + 1420 + 45$$

$$= 12665$$

Time Complexity

$$T(n) = 3 \times T(n/2) + cn + d$$

$$T(1) = 1$$

Using master method:

Since $c < \log_a \text{ base } b$, the time complexity is $\Theta(n^{\log_a \text{ base } b}) = \Theta(n^{1.58})$

Question 2

Algorithm

Given an array of activities, with start and end times

1. Sort the array of activities by end times
2. Create a new array called the Solution
3. Add first activity of the sorted array to the Solution
4. Add the next activity which has start time greater than or equal to the last activity's end time in the Solution
5. Repeat step 4 until all the activities are visited
6. Display the Solution

Problem Solving

A.No	1	2	3	4	5
Start Time	4	9	5	15	13
Finish Time	5	10	8	17	14

Sorted by end time:

A.No	1	3	2	5	4
Start Time	4	5	9	13	15
Finish Time	5	8	10	14	17

Creating solution:

Solution = [A1]

Adding elements where start time \geq end time of solution's last activity:

Solution = [A1, A3, A2, A5, A4]

Time Complexity

The time complexity of the selection sort = $O(n^2)$

The time complexity of adding elements to the solution = $O(n)$

Total time complexity with sorting = $O(n^2 + n) = O(n^2)$

Total time complexity without sorting = $O(n)$