Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058, India

(Autonomous College Affiliated to University of Mumbai)

Mid Semester Examination

Synoptic

March 2020

Max. Marks: 20

Class: S.E.

Course Code:CE41

Name of the Course: Design and Analysis of Algorithms

Duration: 1 Hr.

Semester: IV

Branch: COMP

Q. No.	Synoptic	Max. Marks	CO-BL-PI

1.a	Define Backtracking , Write and Elaborate general iterative algorithm for backtracking
	Definition : 1M
	Algorithm : 2M
	Description of algorithm: 1M
	procedure BACKTRACK(n)
	integer k, n; local X(1 :n)
	k ←1
	while k > 0 do
	if there remains an untried X(k) such that
	X(k) □ T(X(1), .. .,X(k - 1))and Bk(X(1), ... ,X(k))= True
	then if (X(l), ... , X(k)) is a path to an answer node
	then print (X(l), ... , X(k)) endif
	k←k + 1 //consider the next set//
	else k ←k - 1 //backtrack to previous set//
	endif
	repeat
	end BACKTRACK
		4M	5-2-2.1.2

1.b	Construct a state space tree to solve sum of subset problem for a subset $w=\{3,5,6,7\}$ and $m=15$, describe the bounding functions for sum of subset problem. **Complete state space tree with solution = 2 M** **Bounding function specification= 1 M each**	4M	5-3-2.2.3

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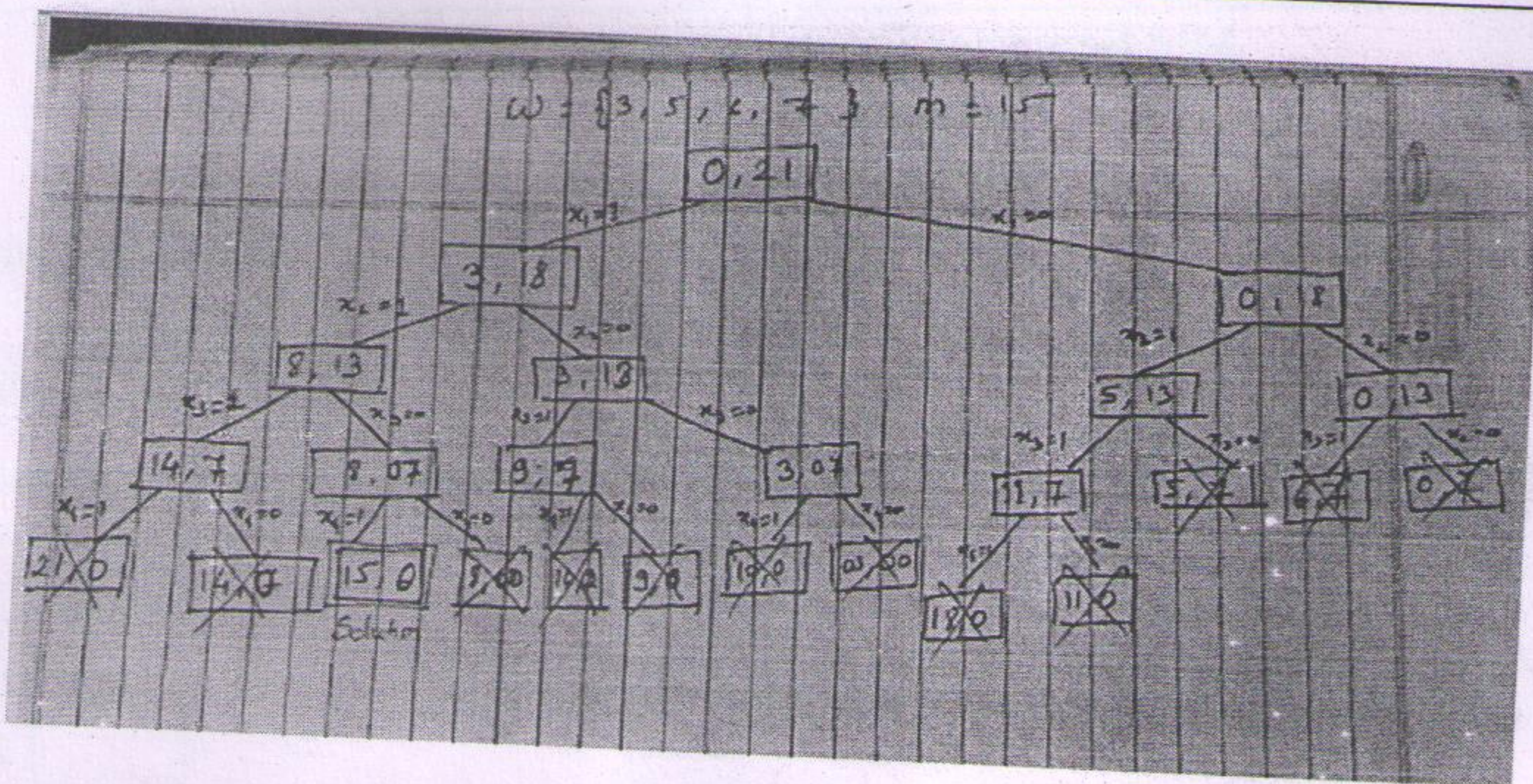

2. a	Solve the following recurrence relation using Master's theorem i) $T(n) = 2^nT(n/2) + n^n$ → Master theorem does not apply as a is not constant **(1.5 Marks)** ii) $T(n)=3T(n/3) - n$.==> Master theorem does not apply as f(n) is neagative **(1.5 Marks)**	3M	1-5-2.4.1

<table>
<tr><td>2.b</td><td>

- The subproblem size for a node at depth i is $n/2^i$.

Thus, the tree has $\lg n + 1$ levels and $1^{\lg n} = 1$ leaf.

The total cost over all nodes at depth i, for $i = 0, 1, 2, \ldots, \lg n - 1$, is $1^i (n/2^i)^2 = (1/4)^i n^2$.

$$\begin{aligned} T(n) &= \sum_{i=0}^{\lg n - 1} \left(\frac{1}{4}\right)^i n^2 + \Theta(1) \\ &< \sum_{i=0}^{\infty} \left(\frac{1}{4}\right)^i n^2 + \Theta(1) \\ &= \frac{1}{1-(1/4)} n^2 + \Theta(1) \\ &= \Theta(n^2). \end{aligned}$$

For recursion tree – 03 Marks

- We guess $T(n) \le cn^2$,

$$\begin{aligned} T(n) &\le c(n/2)^2 + n^2 \\ &= cn^2/4 + n^2 \\ &= (c/4 + 1)n^2 \\ &\le cn^2, \end{aligned}$$

where the last step holds for $c \ge 4/3$.

For substitution method - 03 Marks

</td><td>6M</td><td>1-3-1.3.1</td></tr>
<tr><td>3</td><td>

For formulae of strassens matrix : 2 Marks , For time complexity : 1 Marks

$$W(n) = 7W(n/2) + O(n^2) \implies W(n) = O(n^{\log_2 7}).$$

OR

For Sorting the numbers using quicksort – 02 Marks , for time complexity – 01 Mark

</td><td>3M

3M</td><td>2-2-2.2.4

2-6-2.2.3</td></tr>
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