18CSC204J - DAA

Batch 2 CT3 - Answer Key.

Part A

1. b
2. a
3. c
4. c
5. b
6. a
7. c
8. b
9. a
10. b

Part - B

(4)

11. BFS

~~A~~								

visited : A

~~A~~	~~B~~	C	F					

visited : A, B

~~A~~	~~B~~	~~C~~	F	G				

visited : A, B, C

~~A~~	~~B~~	~~C~~	~~F~~	G	D	E		

visited : A, B, C, F

~~A~~	~~B~~	~~C~~	~~F~~	~~G~~	D	E		

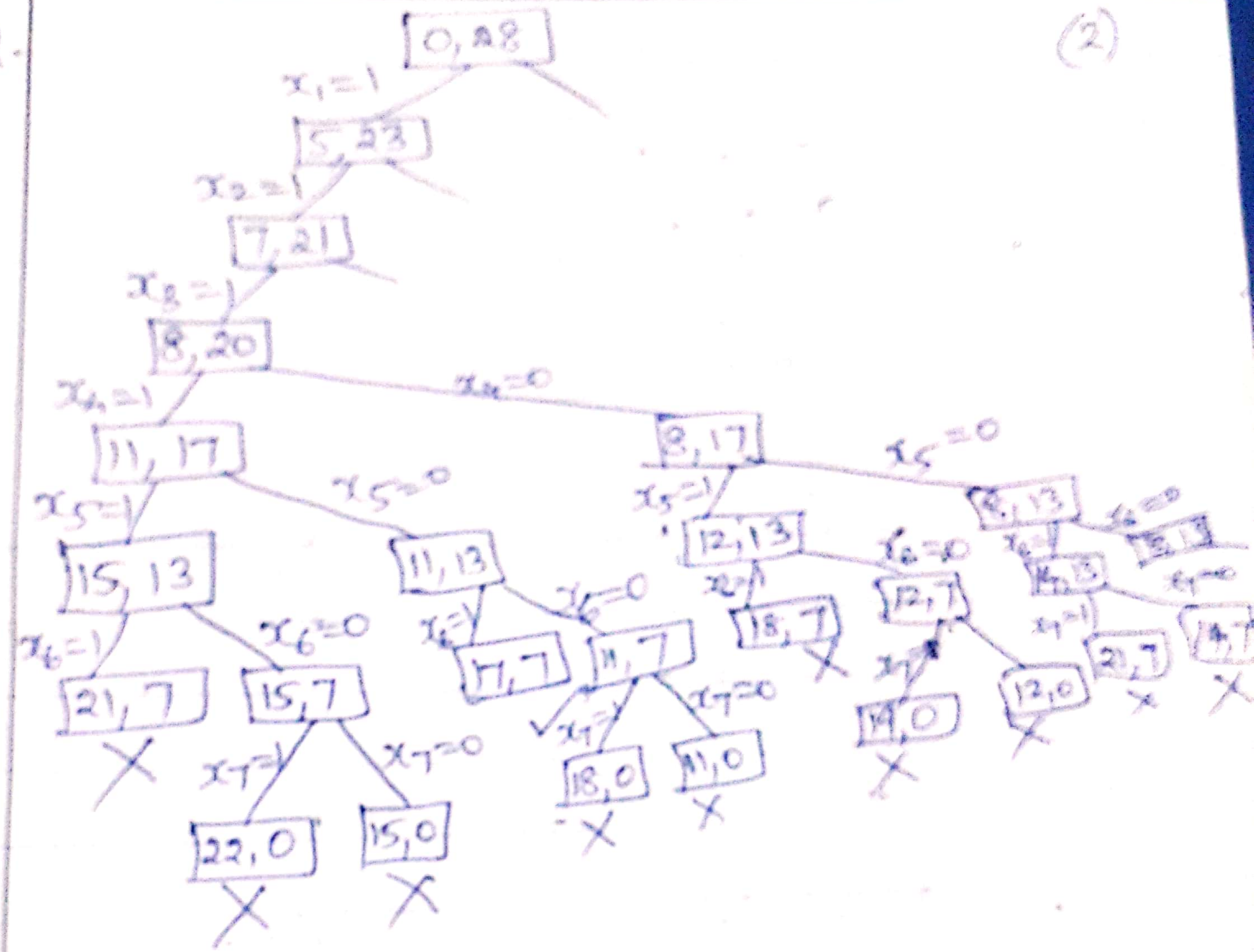
visited : A, B, C, F, G

~~A~~	~~B~~	~~C~~	~~F~~	~~G~~	~~D~~	~~E~~	~~K~~	~~J~~

visited : A, B, C, F, G, D, E, K, J

12.

(2)



(2)

1) $x = \boxed{1}\boxed{1}\boxed{1}\boxed{1}\boxed{0}\boxed{1}\boxed{0}$

2) $x = \{0, 1, 1, 1, 1, 0, 1\}$

3) $x = \{0, 0, 0, 0, 1, 1, 1\}$

4) $x = \{1, 1, 0, 1, 0, 0, 1\}$

5) $x = \{1, 1, 0, 0, 1, 1, 0\}$

6) $x = \{1, 0, 1, 0, 1, 0, 1\}$

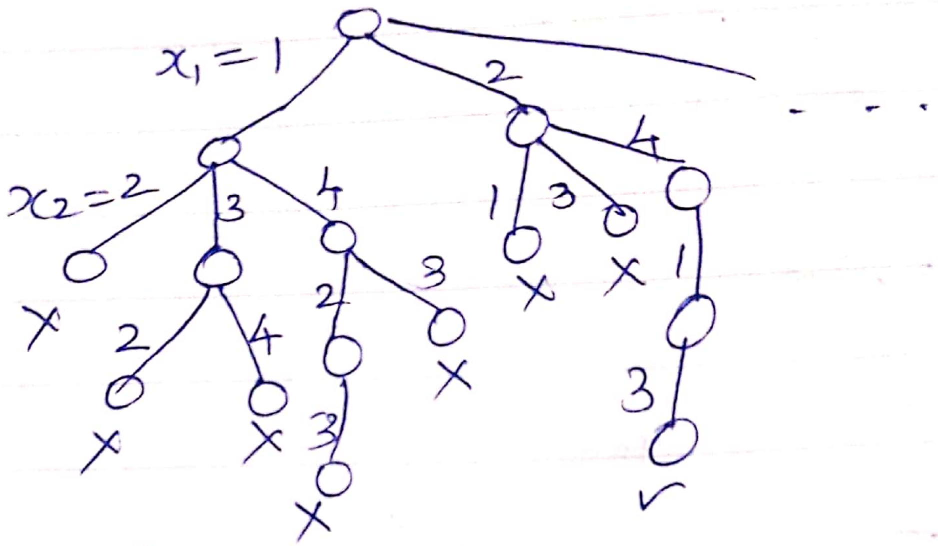
7) $x = \{0, 0, 1, 1, 0, 1, 1\}$

There are 7 subsets.

Scanned with CamScanner

N-Queens

13. (2)



(2)

	1	2	3	4
1		Q_1		
2				Q_2
3	Q_3			
4			Q_4	

&

	1	2	3	4
1			Q_1	
2	Q_2			
3				Q_3
4		Q_4		

$x =$ | 2 | 4 | 1 | 3 | & x | 3 | 1 | 4 | 2 |

14) **Algorithm** (2)

```
Randomized_partition(A, p, r)
{
    i = Random(p, r)
    exchange A[r] with A[i]
    return partition(A, p, r)
}
```

Randomized-Quicksort (A, p, r)
{
  if (p < r)
  {
    q = Randomized-partition (A, p, r)
    Randomized-Quicksort (A, p, q-1)
    Randomized-Quicksort (A, q+1, r)
  }
}

The choice of pivot can be done randomly every time, we divide the array.

Time Complexity (1)

Best case, worst case & Avg case

$T(n) = O(n \log n)$

(1)

It improves time over std quicksort, because worst case for that is $T(n) = O(n^2)$

15. vertices = {1, 3, 5} (2)
size is 3
Explaination – 2 Marks

Part C

Scanned with CamScanner

16. Travelling Salesman Problem

$$\begin{array}{c|cccc|c} & A & B & C & D & \\ \hline A & \infty & 4 & 12 & 7 & 4 \\ B & 5 & \infty & 0 & 18 & 0 \\ C & 11 & 0 & \infty & 6 & 0 \\ D & 10 & 2 & 3 & \infty & 2 \\ \hline & & & & & 6 \end{array}$$

$$\begin{bmatrix} \infty & 0 & 8 & 3 \\ 5 & \infty & 0 & 18 \\ 11 & 0 & \infty & 6 \\ 8 & 0 & 1 & \infty \end{bmatrix}$$

$5 \quad 0 \quad 0 \quad 3 = 8$

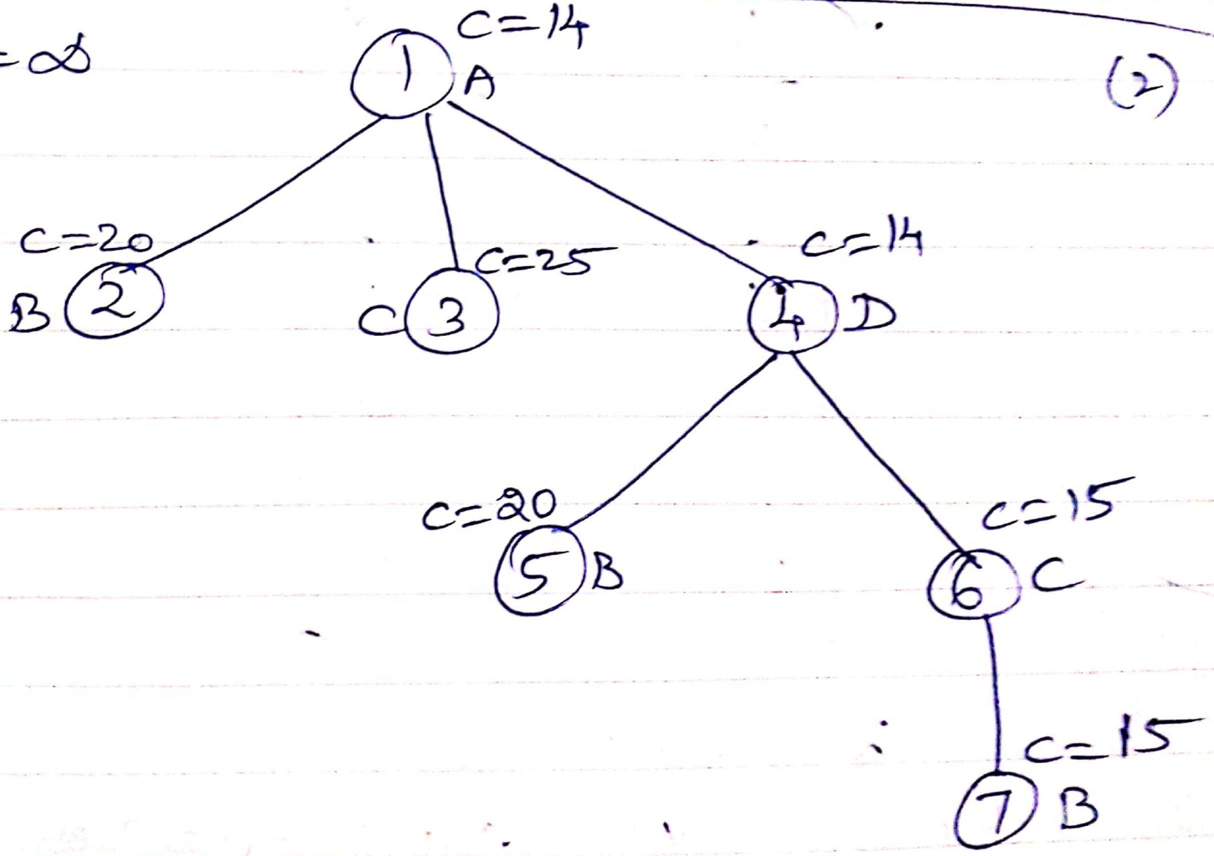
Node1

$$\begin{array}{c|cccc|} & A & B & C & D \\ \hline A & \infty & 0 & 8 & 0 \\ B & 0 & \infty & 0 & 15 \\ C & 6 & 0 & \infty & 3 \\ D & 3 & 0 & 1 & \infty \end{array}$$

$\hat{r} = 6 + 8 = 14.$

upper = ∞

(2)



Scanned with CamScanner

(8)

Node 2

$$\begin{array}{c|cccc|c} & A & B & C & D & \\ A & \infty & \infty & \infty & \infty & 0 \\ B & \infty & \infty & 0 & 15 & 3 \\ C & 6 & \infty & \infty & 3 & 1 \\ D & 3 & \infty & 1 & \infty & \\ & & & & & \overline{4} \end{array}$$

$$\begin{array}{c|cccc|} & A & B & C & D \\ A & \infty & \infty & \infty & \infty \\ B & \infty & \infty & 0 & 15 \\ C & 3 & \infty & \infty & 0 \\ D & 2 & \infty & 0 & \infty \\ & 2 & & 0 & 0 \end{array} = 2$$

$$\begin{bmatrix} \infty & \infty & \infty & \infty \\ \infty & \infty & 0 & 15 \\ 1 & \infty & \infty & 0 \\ 0 & \infty & 0 & \infty \end{bmatrix}$$

$\hat{r} = 4 + 2 = 6$

$C(A,B) + r + \hat{r} = 0 + 14 + 6 = 20$

Node 3

$$\begin{array}{c|cccc|c} & A & B & C & D & \\ \hline A & \infty & \infty & \infty & \infty & \\ B & 0 & \infty & \infty & 15 & 0 \\ C & \infty & 0 & \infty & 3 & 0 \\ D & 3 & 0 & \infty & \infty & 0 \\ \hline & 0 & 0 & & 3 & \end{array}$$

$$\begin{array}{c|cccc|} & A & B & C & D \\ \hline A & \infty & \infty & \infty & \infty \\ B & 0 & \infty & \infty & 12 \\ C & \infty & 0 & \infty & 0 \\ D & 3 & 0 & \infty & \infty \\ \hline \end{array}$$

$\hat{r} = 0 + 3 = 3$

$c(A,C) + r + \hat{r} = 8 + 14 + 3 = 25$

Node 4

$$\begin{array}{c|cccc|c} & A & B & C & D & \\ \hline A & \infty & \infty & \infty & \infty & \\ B & 0 & \infty & 0 & \infty & 0 \\ C & 6 & 0 & \infty & \infty & 0 \\ D & \infty & 0 & 1 & \infty & 0 \\ \hline & 0 & 0 & 0 & & \end{array}$$

$\hat{r} = 0$

$c(A,D)+r+\hat{r}=0+14+0=14$

Node 5

$$\begin{array}{c|cccc|c} & A & B & C & D & \\ A & \infty & \infty & \infty & \infty & \\ B & \infty & \infty & 0 & \infty & 0 \\ C & 6 & \infty & \infty & \infty & 6 \\ D & \infty & \infty & \infty & \infty & \\ \end{array}$$

$\overline{6}$

$$\begin{array}{c|cccc|} & A & B & C & D \\ A & \infty & \infty & \infty & \infty \\ B & \infty & \infty & 0 & \infty \\ C & 0 & \infty & \infty & \infty \\ D & \infty & \infty & \infty & \infty \\ \hline & 0 & & 0 & \end{array} = 0$$

$\hat{r}=6+0=6.$

$c(D,B)+r+\hat{r}=0+14+6=20$

Node 6

$$\begin{array}{c|cccc|c} & A & B & C & D & \\ \hline A & \infty & \infty & \infty & \infty & \\ B & 0 & \infty & \infty & \infty & 0 \\ C & \infty & 0 & \infty & \infty & 0 \\ D & \infty & \infty & \infty & \infty & \\ \hline & 0 & 0 & & & \end{array}$$

$\hat{r} = 0$

$c(D, C) + r + \hat{r} = 1 + 14 + 0 = 15$

Node 7

$$\begin{array}{c|cccc|} & A & B & C & D \\ \hline A & \infty & \infty & \infty & \infty \\ B & \infty & \infty & \infty & \infty \\ C & \infty & \infty & \infty & \infty \\ D & \infty & \infty & \infty & \infty \\ \hline \end{array}$$

$\hat{r} = 0$

$c(C, B) + r + \hat{r} = 0 + 15 + 0 = 15$

Cost of the Tour $= 15$ (2)

Tour is $A - D - C - B - A$

Time complexity $= O(n!)$

17. All pairs shortest Path.

Floyd warshall Algorithm.

(2)

$$A^0 = \begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 3 & \infty & 7 \\ 2 & 8 & 0 & 2 & \infty \\ 3 & 5 & \infty & 0 & 1 \\ 4 & 2 & \infty & \infty & 0 \end{array}$$

(2)

$$A^1 = \begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 3 & \infty & 7 \\ 2 & 8 & 0 & 2 & 15 \\ 3 & 5 & 8 & 0 & 1 \\ 4 & 2 & 5 & \infty & 0 \end{array}$$

(2)

$$A^2 = \begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 3 & 5 & 7 \\ 2 & 8 & 0 & 2 & 15 \\ 3 & 5 & 8 & 0 & 1 \\ 4 & 2 & 5 & 7 & 0 \end{array}$$

(2)

$$A^3 = \begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 3 & 5 & 6 \\ 2 & 7 & 0 & 2 & 3 \\ 3 & 5 & 8 & 0 & 1 \\ 4 & 2 & 5 & 7 & 0 \end{array}$$

$$
A^4 = \begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 3 & 5 & 6 \\ 2 & 5 & 0 & 2 & 3 \\ 3 & 3 & 6 & 0 & 1 \\ 4 & 2 & 5 & 7 & 0 \end{array}
$$
(2)

$T(n) = O(n^3)$ (2)

18) Rabin Karp Algorithm

A - 1
B - 2
C - 3
D - 4
E - 5
F - 6
G - 7
H - 8
I - 9
J - 10

Pattern:

1	2	3
C	D	D

m=3

$3\times10^2 + 4\times10^1 + 4\times10^0 = \boxed{344}$

Text:

1	2	3	4	5	6	7	8	9	10
A	B	C	C	D	D	A	E	F	G

n=10

(i) $\overset{1}{A}$ $\overset{2}{B}$ $\overset{3}{C}$

$1\times10^2 + 2\times10^1 + 3\times10^0 = 123 \neq 344$

(ii) $\overset{2}{B}$ $\overset{3}{C}$ $\overset{4}{C}$

$123 - 100 = 23\times10 = 230 + 3 = 233 \neq 344$

(iii) $\overset{3}{C}$ $\overset{4}{C}$ $\overset{5}{D}$

$233 - 200 = 33\times10 = 330 + 4 = 334 \neq 344$

(iv) C D D (4 5 6)

334 - 300 = 34 × 10 = 340 + 4 = 344 ≡ 344

The pattern is matched.

Time

$T(n) = \Theta(n-m+1) \Rightarrow$ Average case

Worst case

$T(n) = \Theta(mn)$

19 a) Non-deterministic Polynomial class problems with NP hard and NP-Complete (6)

b) satisfiability problems with example (6)