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Q2)b) Consider 0/1 knapsack instance : $n = 4$, $M = 17$ and $(P_1, P_2, P_3, P_4) = (10, 20, 12, 18)$; $(W_1, W_2, W_3, W_4) = (2, 4, 6, 9)$ find max. profit using FIFO BB. Use fixed size formation of state space.

Ans) Let us compute $u(1)$ and $\hat{c}(1)$

$u(1) = -\Sigma P_i$ such that $\Sigma W_i \leq M$

$= -(10 + 10 + 12) = -32$

$\therefore$ upper $= u(1) = -32$

$$\hat{c}(1) = u(1) - \left\{ \frac{M - \text{wt. of selected item}}{\text{wt. of remaining time}} \right\}$$

$$\hat{c}(1) = -32 - \left\{ \frac{15 - (2+4+6)}{9} \right\} \times 18 = -38$$

Node 2: Inclusion of Node 2

$u(2) = -(10 + (10 + 12)) = -32$

$$\hat{c}(2) = -32 - \left\{ \frac{15 - (2+4+6)}{9} \right\} \times 18 = -38$$

Node 3: Exclusion of item 1 at node 1.

$u(3) = -(10+12) = -22$

$$\hat{c}(2) = -22 - \left\{ \frac{15 - (4+6)}{9} \right\} * 18 = -32$$

Node 4: Inclusion of item 2 at node 2.

$u(4) = -(10+10+12) = -32$

$$\hat{c}(4) = -32 - \left\{ \frac{15 - (2+4+6)}{9} \right\} \times 18 = -38$$

Node 5: Inclusion of item 2 at node 2

$u(5) = -(10+12) = -22$

$$\hat{c}(5) = -22 - \left\{ \frac{15 - (4+6)}{9} \right\} \times 18 = -32$$

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Node 6 : Inclusion of item 2 at node 3

$u(6) = -(P_2 + P_3) = -(10+12) = -22$

$\hat{c}(6) = -22 - \left\{ \frac{15-(4+6)}{9} \right\} \times 18 = -32$

Node 7 : Exclusion of item 2 at node 3

$u(7) = -(P_3 + P_4) = -(12+18) = -30$

$\hat{c}(7) = -30 - 0 = -30$

Node 8 : Exclusion of item 3 at node 4

$u(8) = -(10+10+12) = -32$

$\hat{c}(8) = -32 - \left\{ \frac{15-(2+4+6)}{9} \right\} \times 18 = -38$

Node 9 : Exclusion of ~~node~~ item 3 at node 4

$u(9) = -(10+10+18) = -38$

$\hat{c}(9) = -38 - 0 = -38$

$\therefore$ Upper $= u(9) = -38$

Solution vector :- $\{x_1, x_2, x_4\}$

Profit :- $10+10+18 = 38$

Q.3) a) Explain the following

Ans) 1. Computational complexity :

Computational problem have infinite instances. Each ~~set~~ instance in the set contains the solution. Typically the solution is Boolean, i.e, Yes or No.

2. Decision problem :

If the problem produces output yes or no for given

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input. An algorithm which solves decision problem is called as decision algorithm

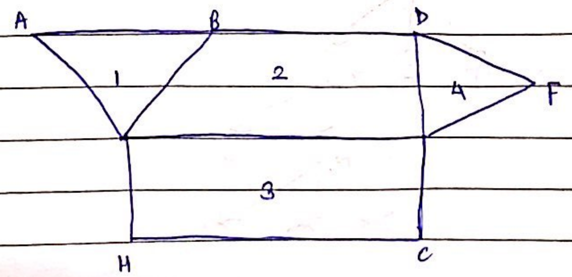
3. Deterministic and Non-deterministic algorithm :
Typically represented by a static member where machine moves from one state to another on a specific input

The non-deterministic algorithm works on guessing for same input these algorithms may produce different results every time.

4. Complex classes :
It has 2 types → i) p-class
ii) np - class
p- problems are a set of problems that can be sorted in polynomial time
np- problem are the set of problems that can be solved in non deterministic polynomial time

5. ~~Intr~~ Intractability :
Problem which takes primarily unacceptable time, i.e, very long time to be solved.

Q.1) a) Write a backtracking algorithm to solve graph coloring problem. Define chromatic number of a graph. Find the chromatic no. of the graph and draw the necessary state space tree.



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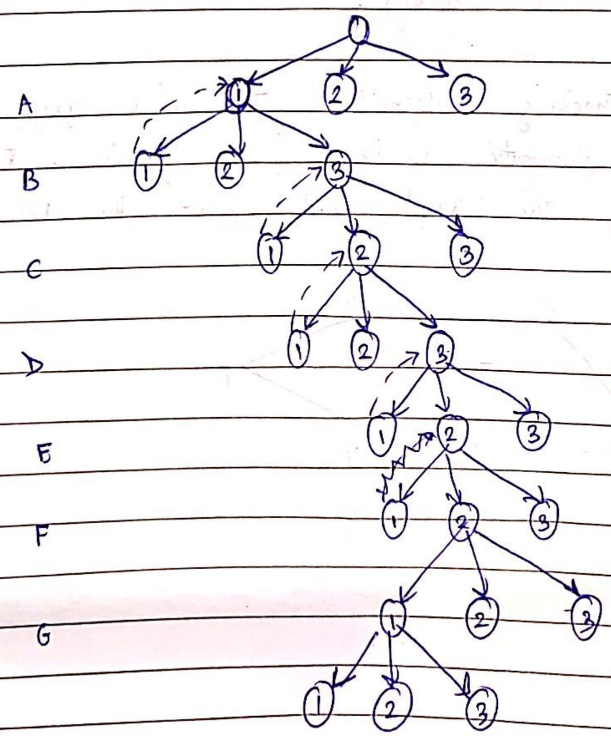
Algorithm GRAPH_COLOURING (G, color, i)

```
if CHECK_VERTX (i == 1) then
   if i == N then
      print color [1...n]
         else
            j ← i
         while (j ≤ M) do
            color(i+1) ← j
         end
```

Function CHECK_VERTEX (i)

```
For j ← 1 to i-1 do
if adjust (i, j) then
    return 0
 end
end
    return 1
```

Chromatic number : The smallest number of colors required to color the graph is called the chromatic number



State space Tree