0/1 Knapsack Problem

Solved With

FIFO Branch and Bound

by

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Objective Function

Maximize profit..... $\sum p_i x_i$

Coverted to minimization problem

i.e $-\sum p_i x_i$

Bound Algorithm to calculate C

```
Algorithm Bound(cp ,cw, k)
//cp=current profit; cw=current weight;k=index of last
removed item; m is knapsack size;//
{
   b=cp;  c=cw;
    for i=k+1 to n do
      {
            c=c+w[i];
            if(c<m)  then
                        b=b+p[i];
            else
            return  b+  (1-  (c-m)/w[i]  )  *p[i]
        }
return b;
}
```

Ubound Algorithm to calculate u

```
Algorithm Uboud(cp ,cw, k ,m)
//cp=current profit; cw=current weight;k=index of last
removed item; m is knapsack size;//
{
   b=cp;  c=cw;
    for i=k+1 to n do
     {
        if(c+w[i]<=m) then
            {
             c=c+w[i];b=b-p[i];
          }
       }
return b;
}
```

Example

- n=4
- P=[10,10,12,18]
- W=[2,4,6,9]
- m=15

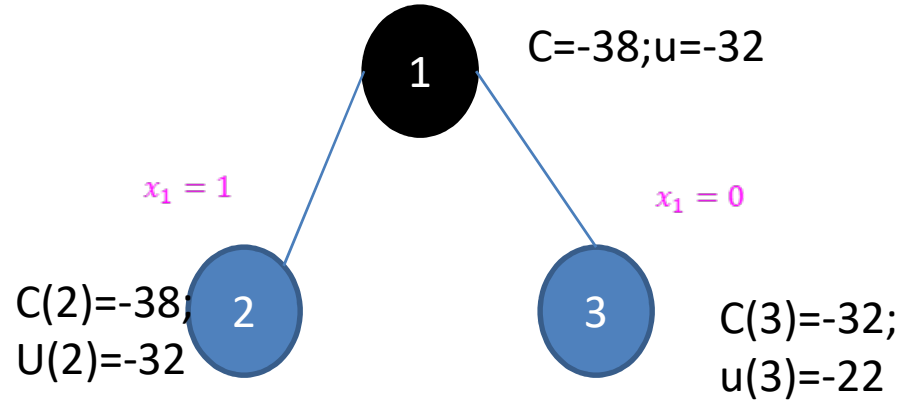
Upper=-32

C(1)=-38;
u(1)=-32

In FIFO search, first we will take E-node as a node 1.

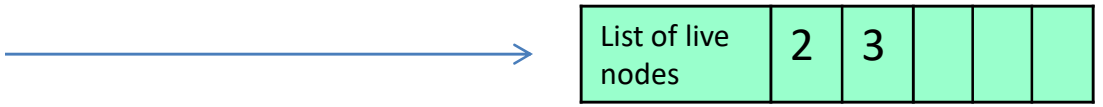
List of live nodes	1				

Upper=-32

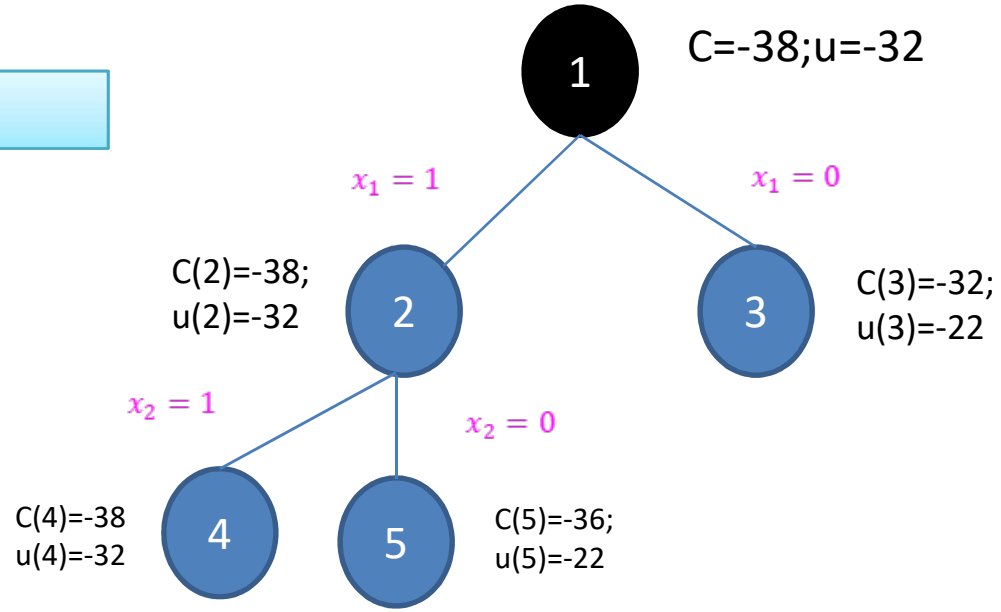


Next we generate the children of node 1.

They are placed in the queue.

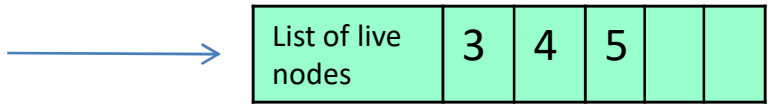


Upper=-32

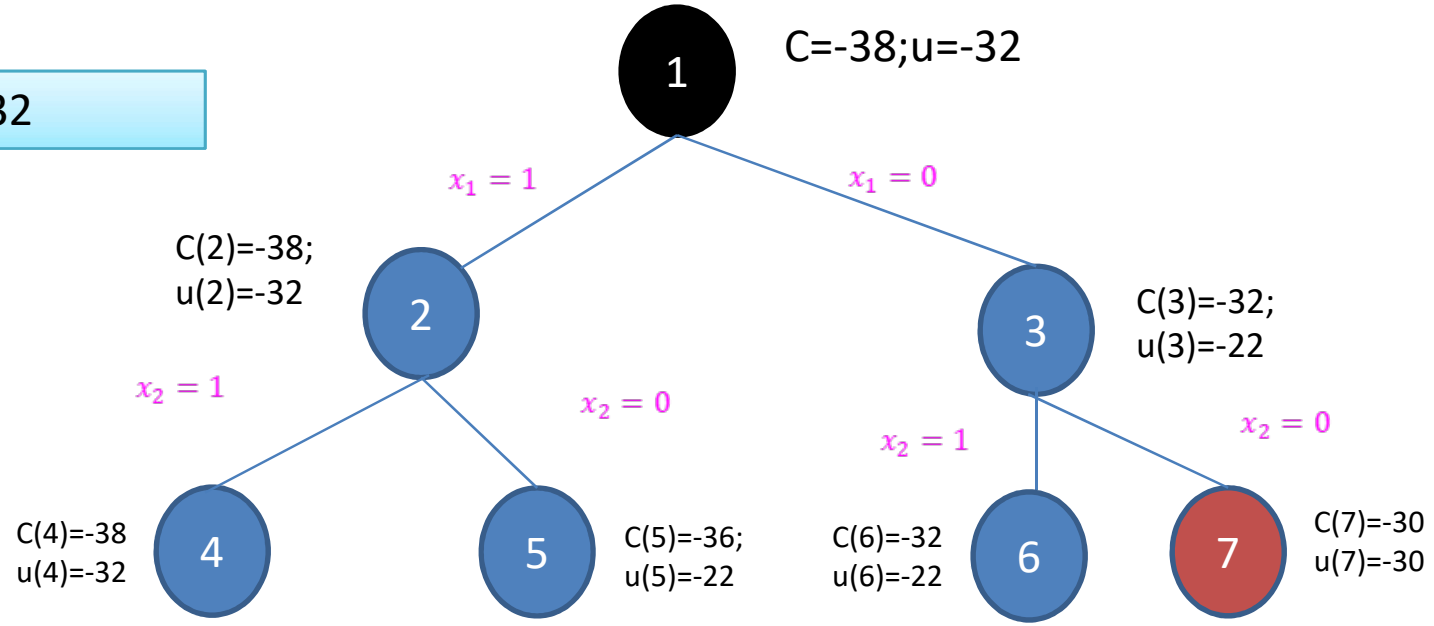


Upper bound doesn't change and no node is deleted.

We will place the generated children of E-node(Node 2) in the Queue i.e Node 4 and 5



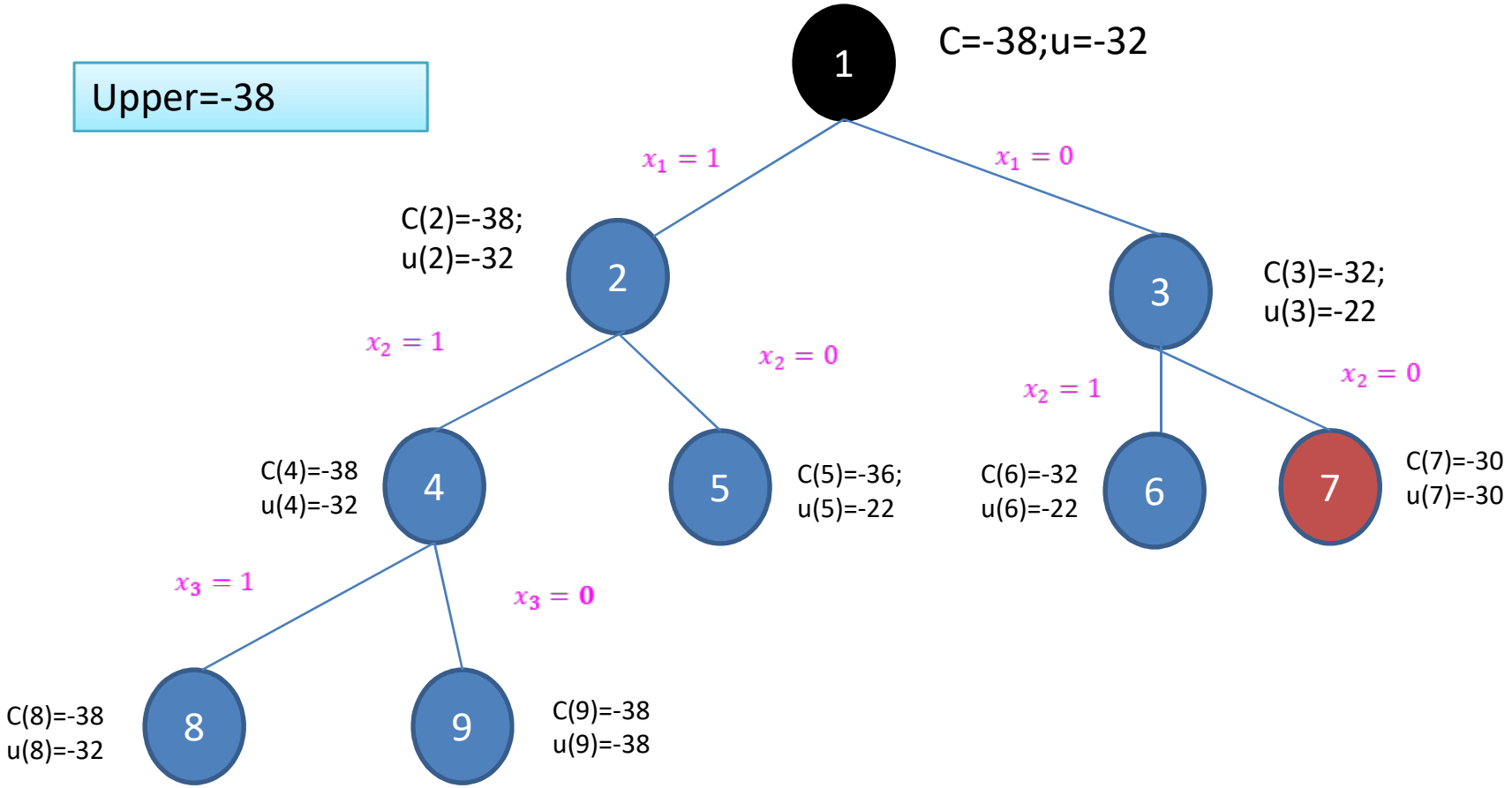
Upper=-32



We will place the generated children of E-node(Node 3) in the Queue i.e Node 6 and 7.

List of live nodes	4	5	6		

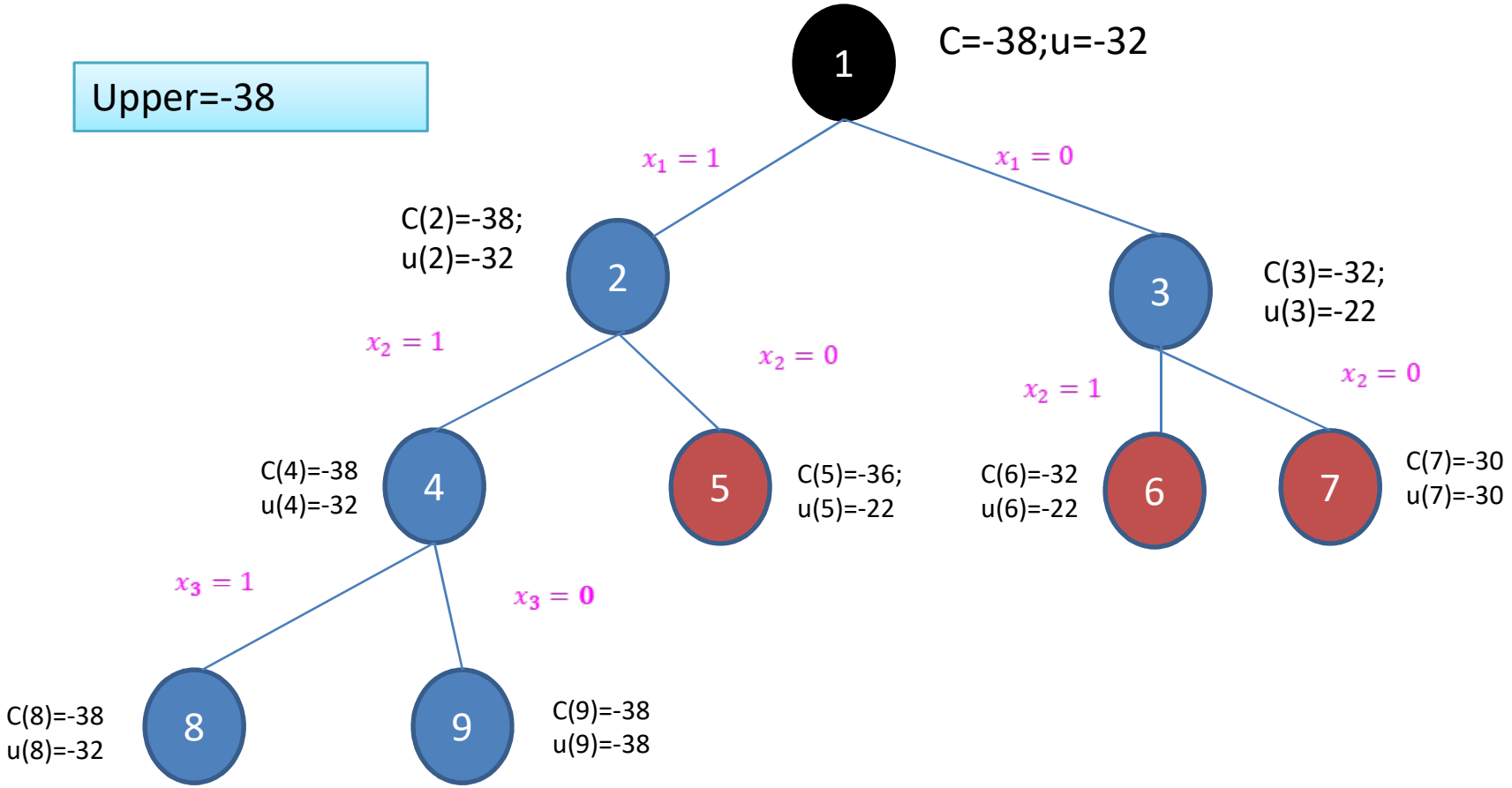
Since c(7)>global upper bound it is killed.



We will place the generated children of E-node(Node 4) in the Queue i.e Node 8 and 9.

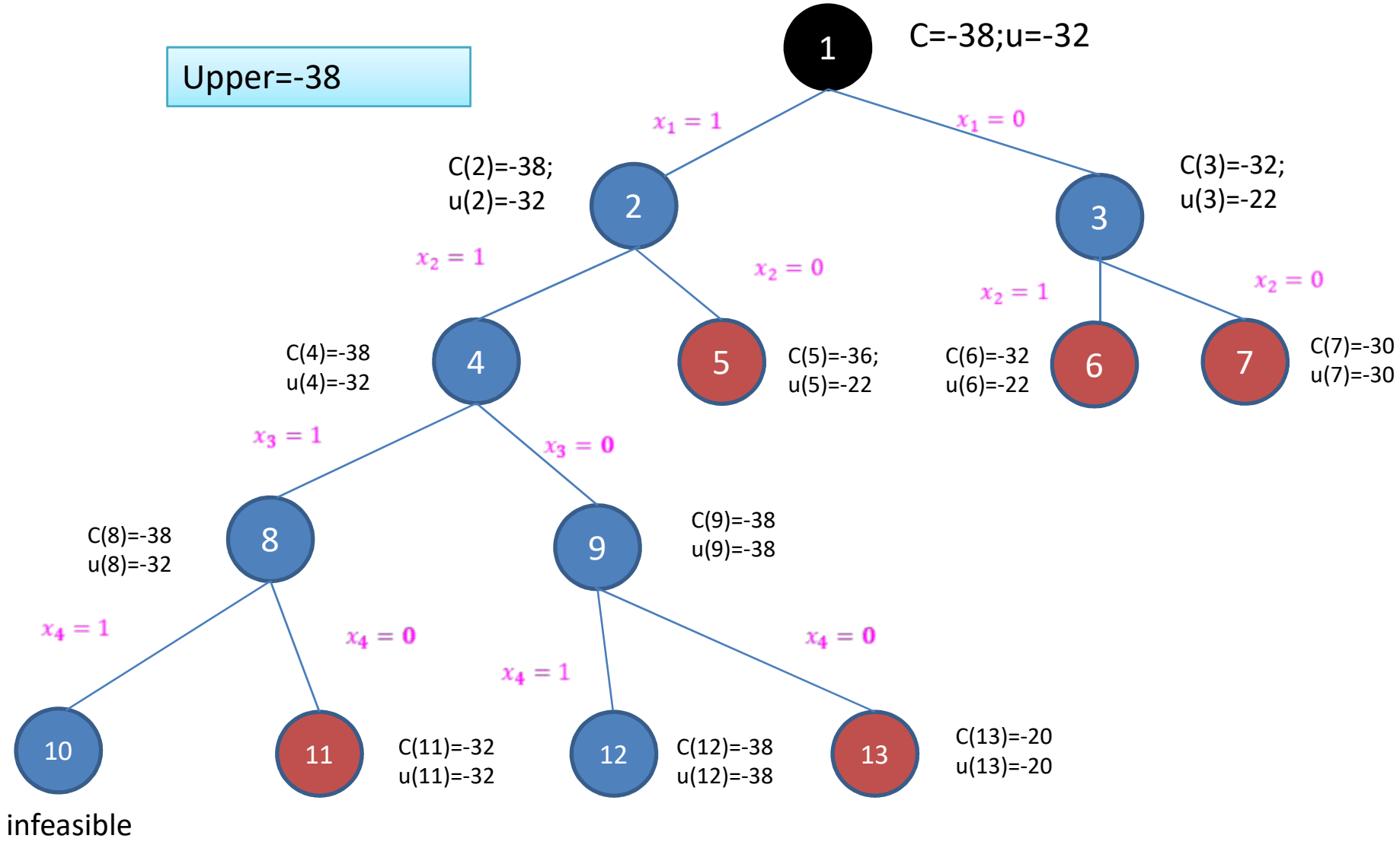
List of live nodes	5	6	8	9	

Global upper bound will be changed to -38.



The nodes 5 and 6 will be killed as c(5),c(6)>upper bound.

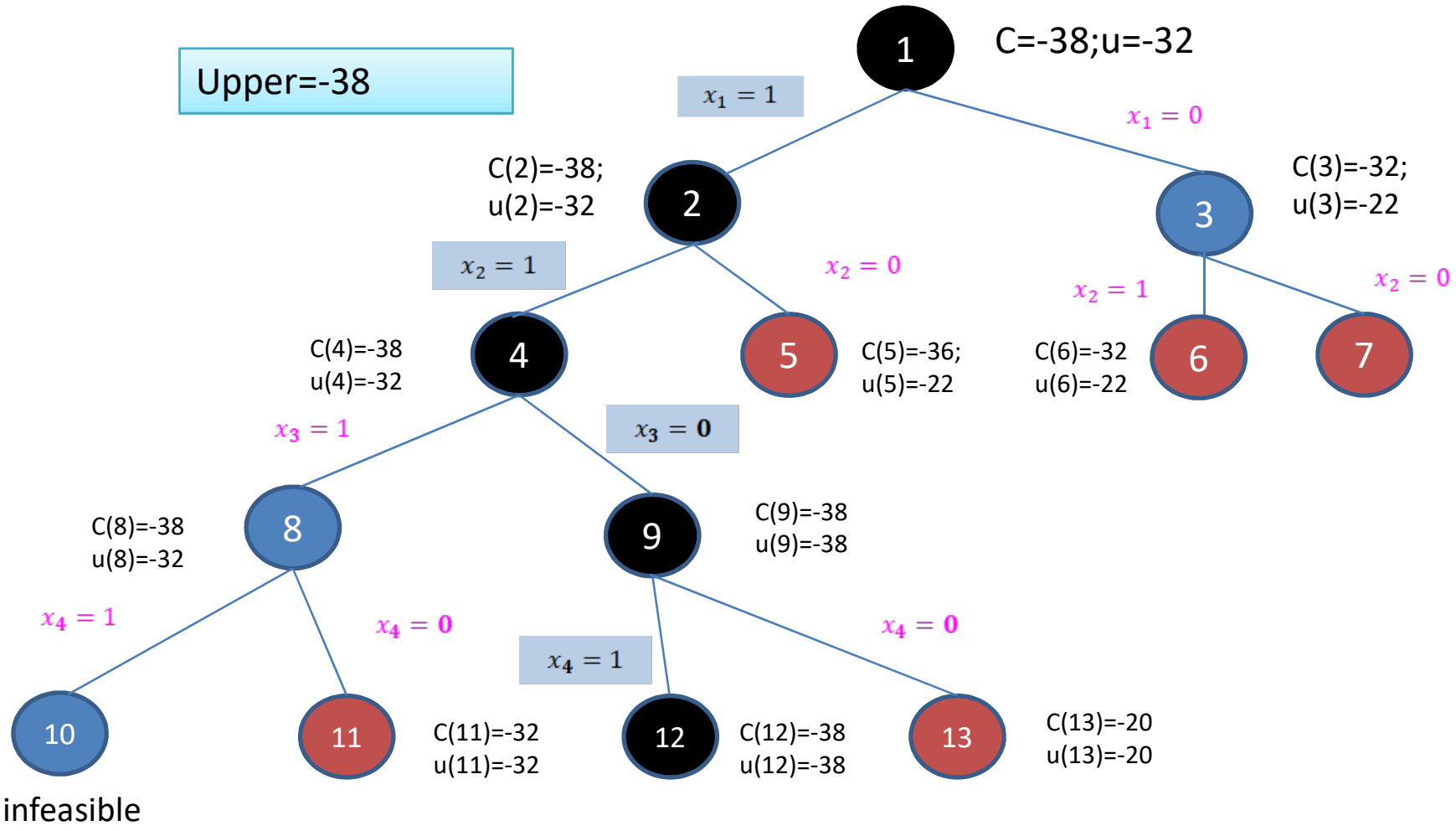
List of live nodes	8	9			



We will now kill nodes 11 and 13.

List of live nodes	10	12			

The only feasible node is node 12.



Since node 12 is the solution.

$x_1 = 1 \quad x_2 = 1 \quad x_3 = 0 \quad x_4 = 1$

Solution vector X = [1,1,0,1]