Qn Given a number x, you can do 3 different operations on x:

1) Subtract 1 from x
2) if x is divisible by 2, then divide x by 2
3) if x is divisible by 3, then divide x by 3

Find the min no. of operations to reduce x to 1

$x = 7$

$x = 7 \xrightarrow{-1} 6 \xrightarrow{/3} 2 \xrightarrow{/2} 1$

$x = 7$ ans $\rightarrow$ 3

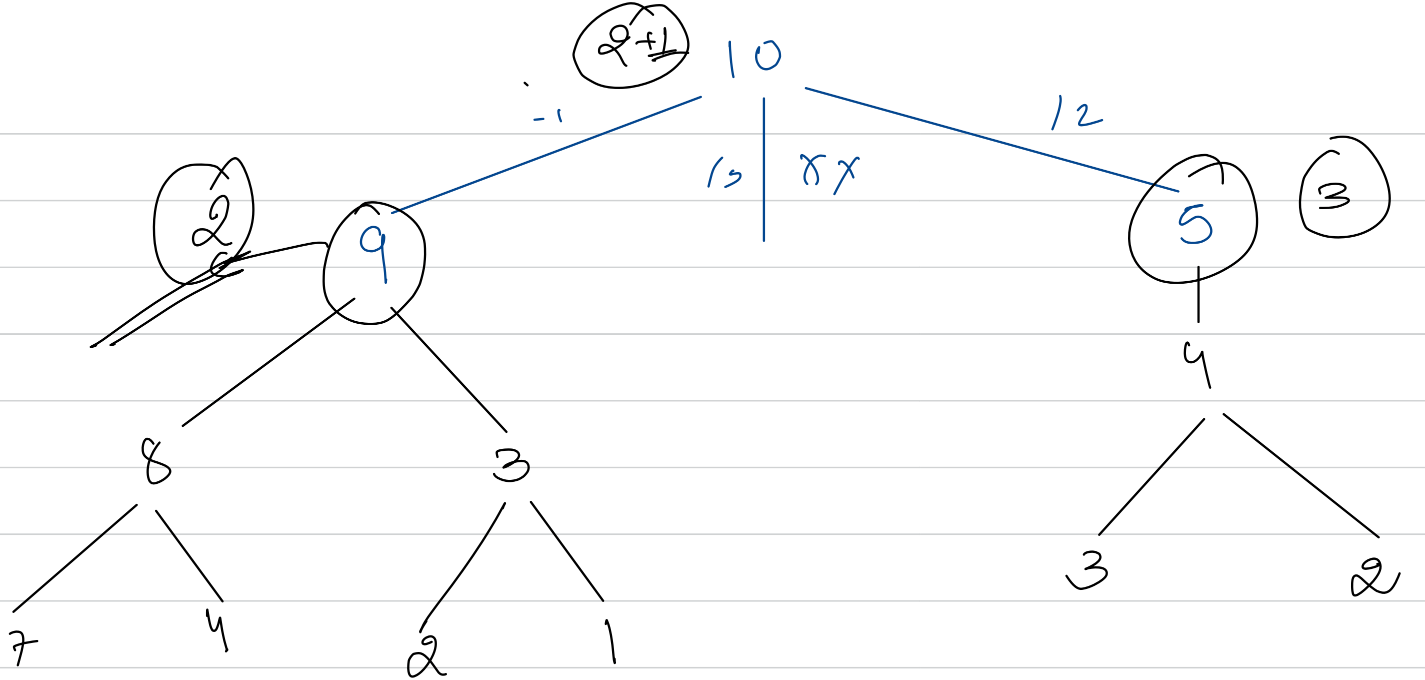
$x = 10$

$$10 \xrightarrow{-} 5 \xrightarrow{-} 4 \xrightarrow{-} 2 \xrightarrow{-} 1$$

4

$$10 \xrightarrow{-} 9 \xrightarrow{-} 3 \xrightarrow{-} 1$$

3



2+1
10
13
~~8~~ ~~7~~
12
2
9
5
3
4
8
3
3
2
7
4
2
1

global optimum

$$f(x) = 1 + \min\{f(x-1),\ f(x/2),\ f(x/3)\}$$

f return
min operation
for $x \to 1$

1D dp

n unique states

1 based index

dp[n+1]

$dp[n]$

dp

∞	0	1	1	2	3	2				
0	1	2	3	4	5	6	–	–	–	n

$dp[i]$

↳ min steps reqd to reach one from i

BU → $O(n)$, $O(n)$

TD → $O(n)$, $O(n)$

Time Complexity = no. of unique states × operations reqd on one state

Q:1

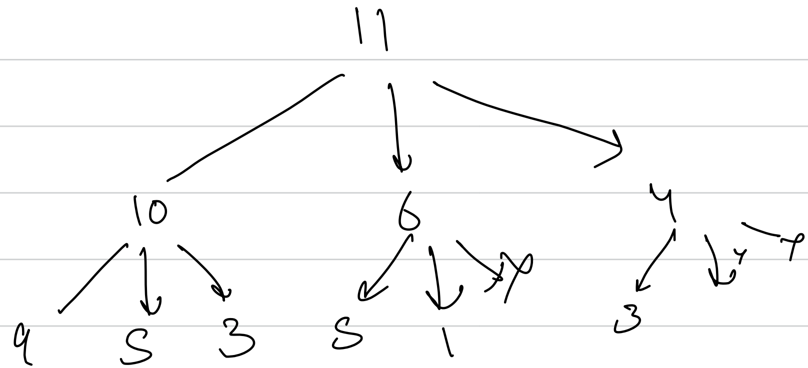
$\{a_1, a_2, a_3\}$

$$\begin{tikzcd} & n \arrow[dl, "a_1"'] \arrow[d, "a_2"] \arrow[dr, "a_3"] & \\ x \quad n-a_1 & y \quad n-a_2 & z \quad n-a_3 \end{tikzcd}$$

$$f(n) = 1 + \min\big(f(n-a_i)\big) \quad \forall\, a_i \in [\text{coins array}]$$

f that return min coins reqd for n

1, 5, 7



Q:- Given an array of integers, find the longest subsequence from the array which is strictly increasing. Return the length

$O(n^2)$

$O(n)$

1, 2, 5

3, 1, 2, 5, 4, 6, 5, 1

(3) (1) (1, 2), 5

Ans → 5

$O(n \log n)$

→ LIS

→ Segm

dp [1 1 2 3 3 4 4 1]

max

$$f(i) = 1 + \max(f(i-j)) \quad \forall j \in [0, i-1]$$

$$\text{if} \quad \underline{\underline{a[i] > a[j]}}$$

for any i^{th} element length of longest increasing subsequence ending at $\underline{\underline{i}}$

$$ans \rightarrow \max(f(i)) \quad \underline{\underline{\forall i \in [0, n-1]}}$$

Q:- Given a number n, find the count of no. of binary strings (strings with only 0 & 1) such that there are no consecutive ones.

n = 3

ans → 5

100
101
010
000
001

$\left.\begin{matrix}100\\101\\010\\000\\001\end{matrix}\right\}$ 5

$n=0 \rightarrow 1$

$n=1 \rightarrow 2$

$n=2 \rightarrow 3$

$n=3 \rightarrow 5$

$n=4 \rightarrow 8$

$n=5 \rightarrow 13$

$\vdots$

$(1, 0)$

$(10, 01, 00)$

Fibonacci

$f(n) = f(n-1) + f(n-2)$

return the no. of binary string with no consecutive one

Q3)

0,0

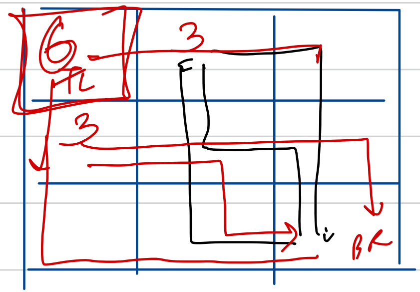
TL 3	3	2	1	#0
2	1	1	1	0
1	#0	#0	1	0
1	1	1	1	#0
#0	0	#0	1	1
0	0	#0	#0	1
0	0	#0	1	1

BR

n-1, m-1

n x m

no. of ways to reach BR from TL with only right or down moves



$$f(i,j) = f(i+1,j) + f(i,j-1)$$