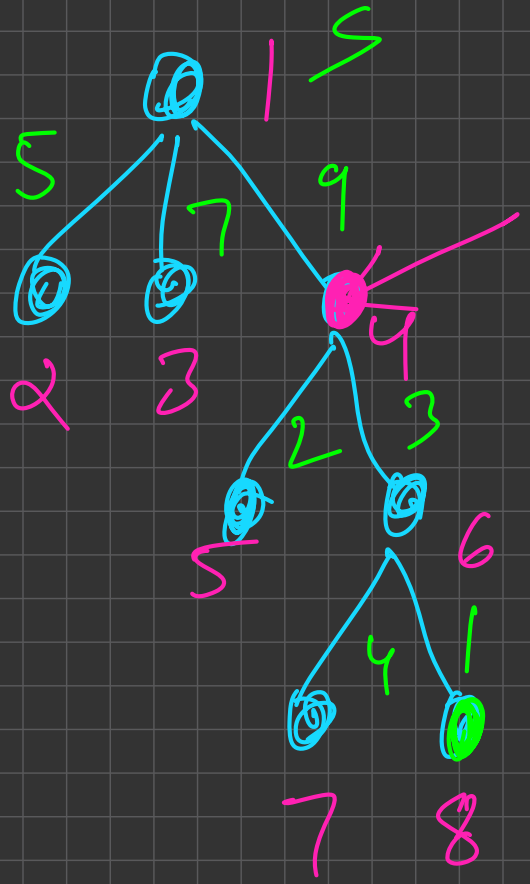
Df on DAG

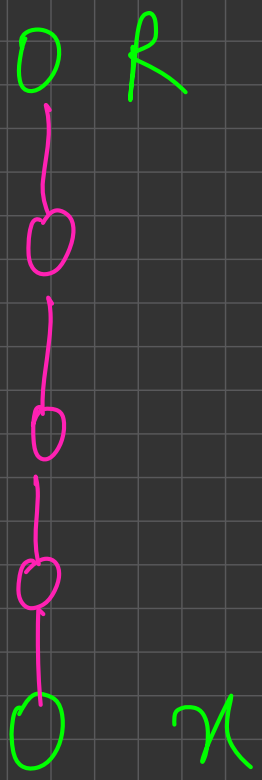
Graph Theory

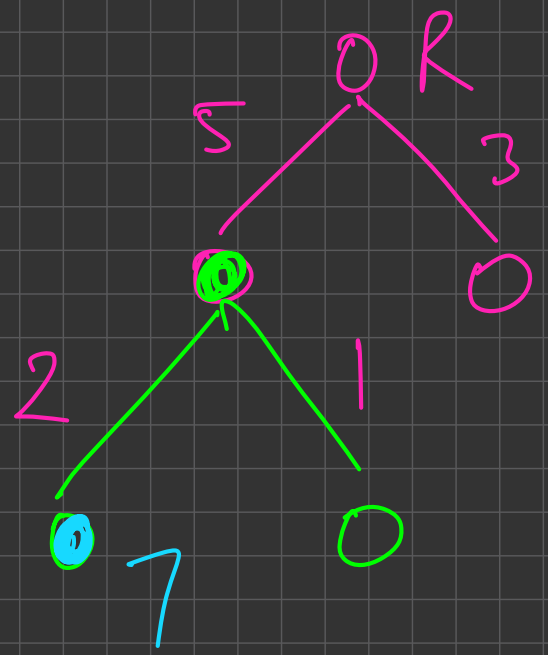
DP on Directed Graphs

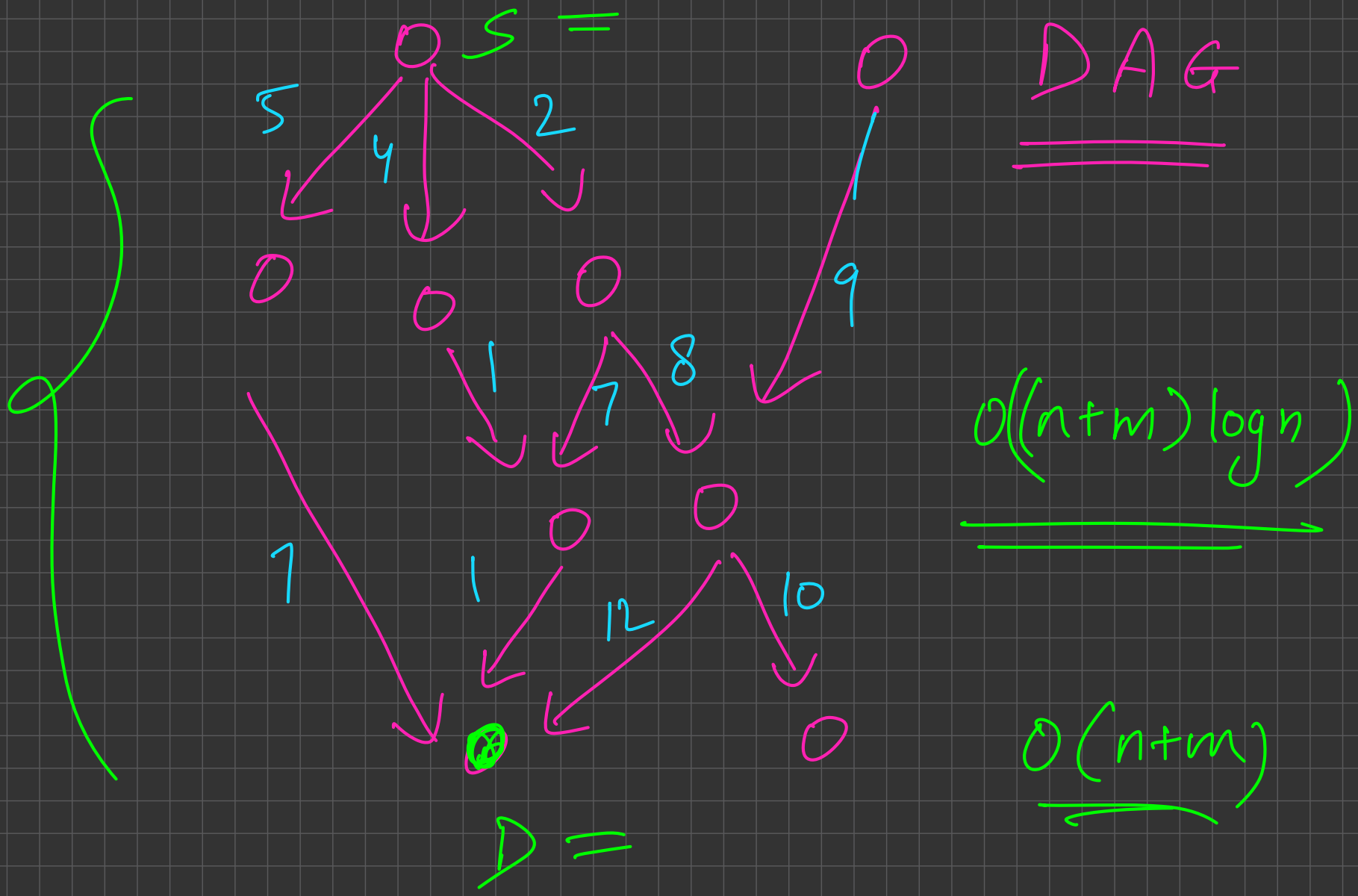


DP on Trees

$$Ans(4) = f(Ans[5], Ans[6])$$


R
n

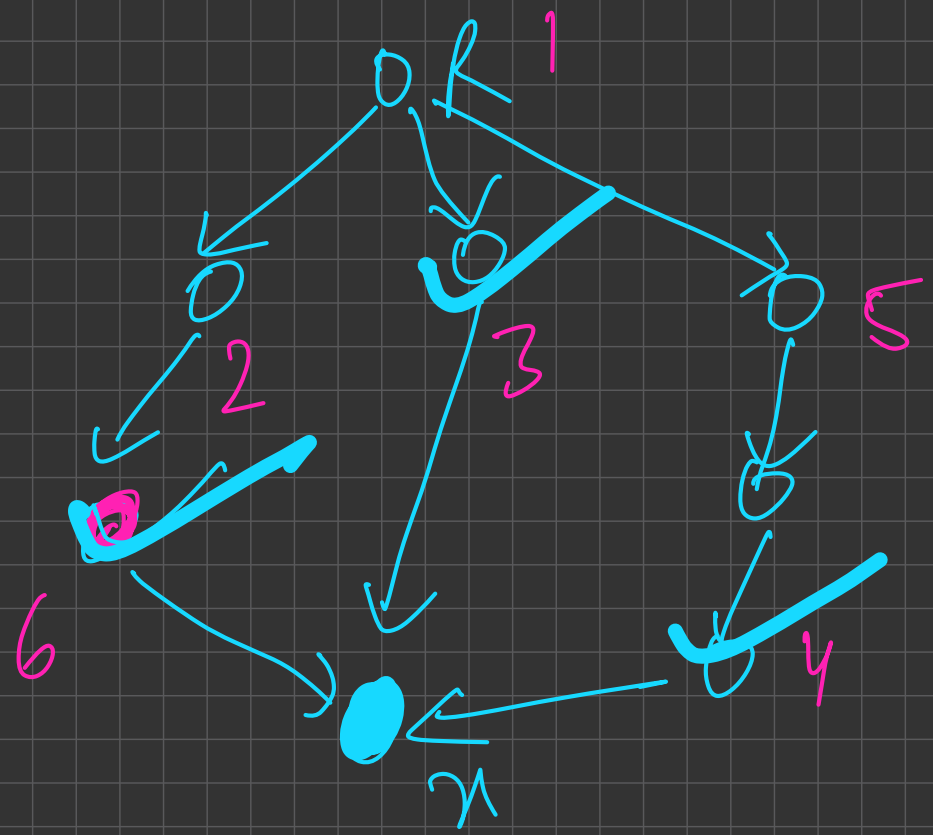

R
5
3
2
1
7



DAG

$O((n+m)\log n)$

$O(n+m)$

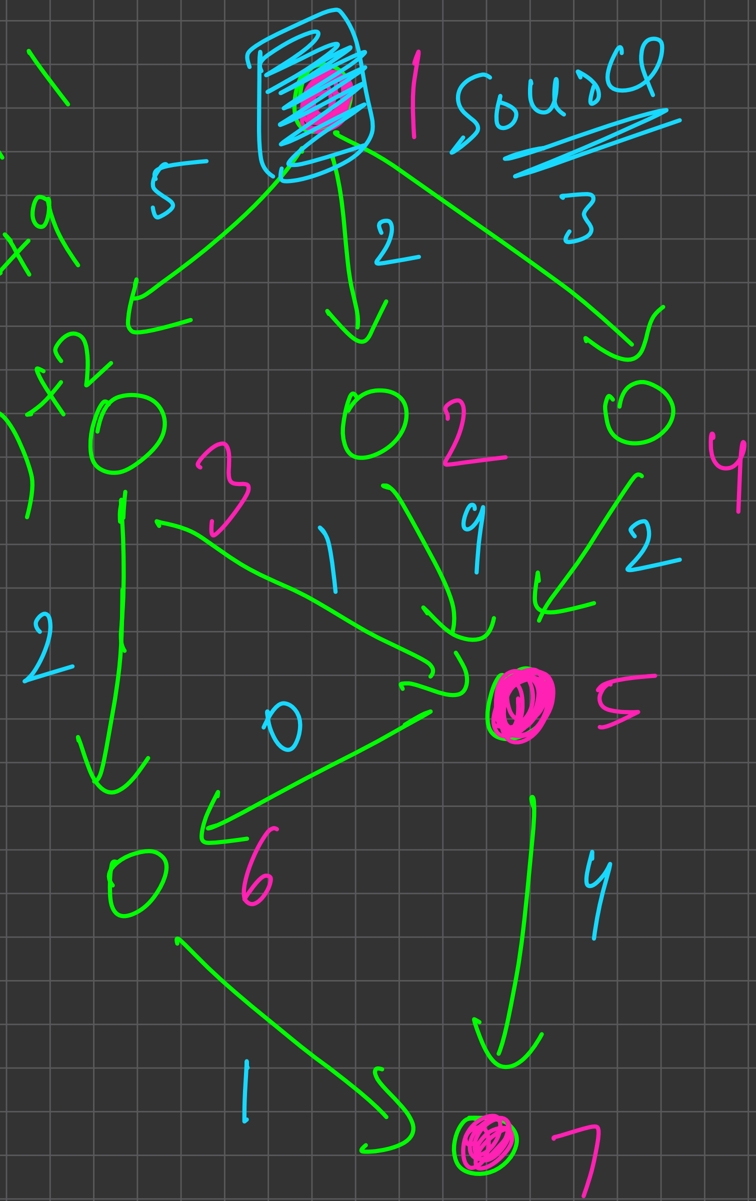


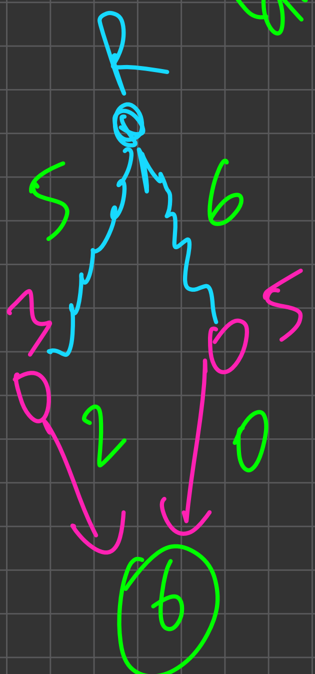
DAG

dist[6] , dist[3], dist[4]

$$dist(x) = \min \begin{cases} dist[6] + edge(6 \text{ to } x) \\ dist[3] + edge(3 \text{ to } x) \\ dist[4] + edge(4 \text{ to } x) \end{cases}$$

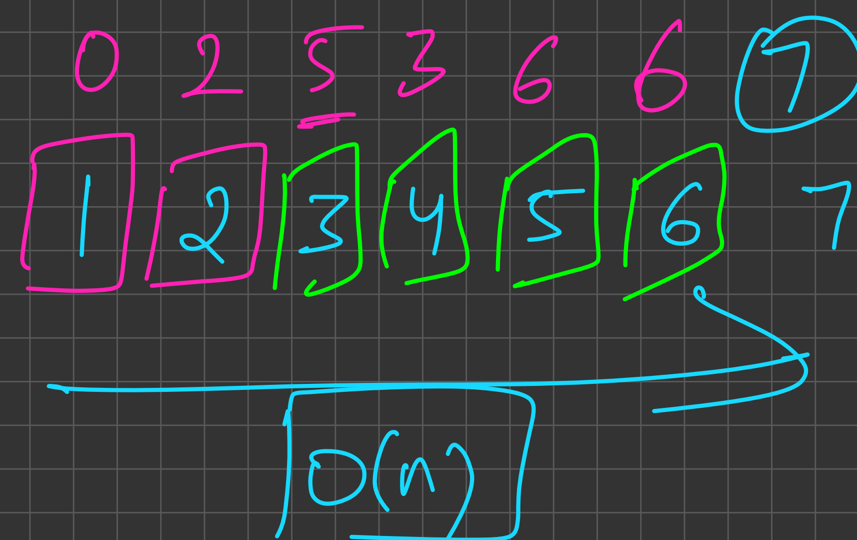
$$dist[5] = \min \begin{cases} dist[3] + 1 \\ dist[2] + 9 \\ dist[4] + 2 \end{cases}$$





$O((n+m)\log n)$

$O(n+m)$

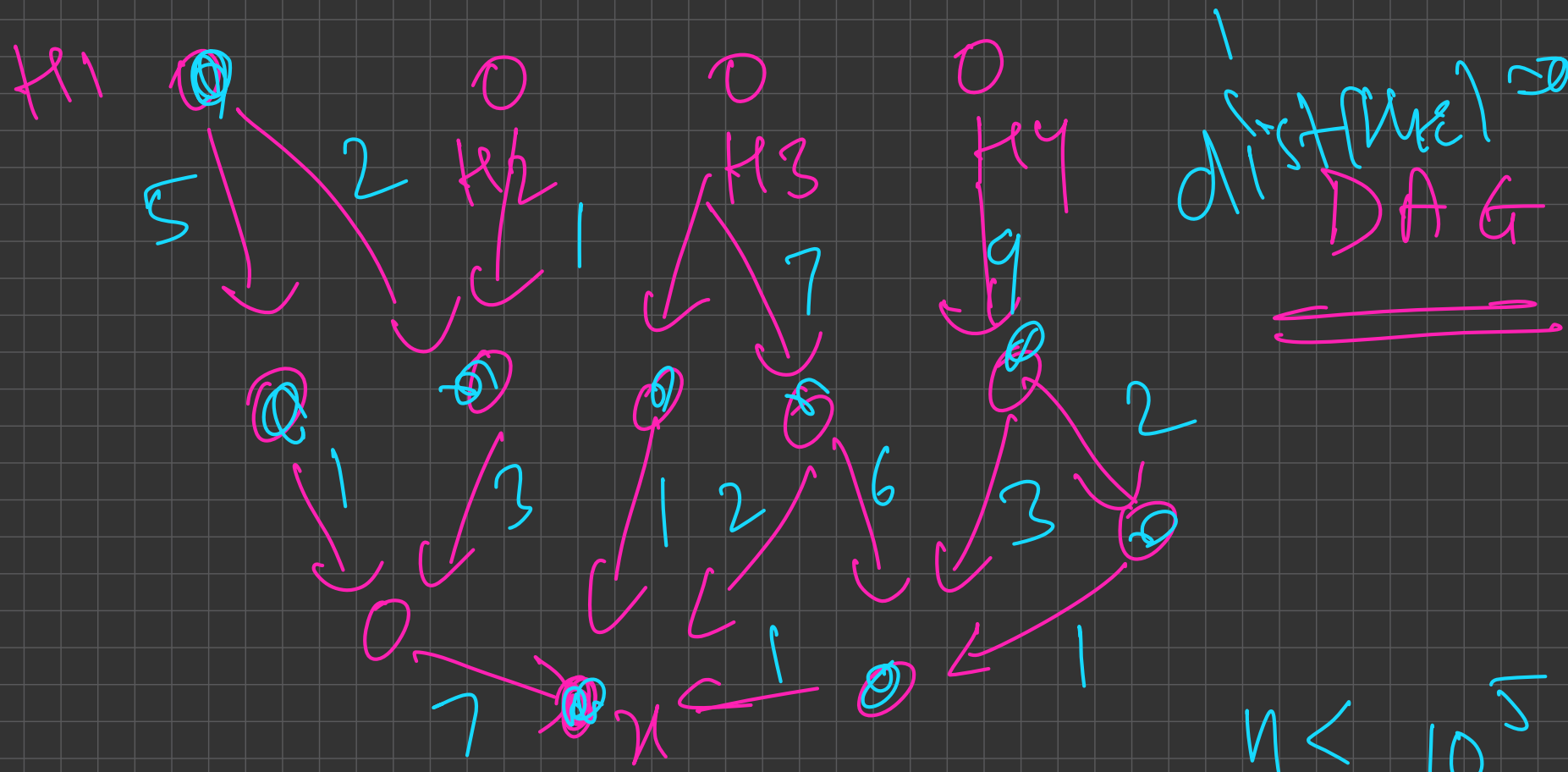


$O(n+m) + O(n+m)$

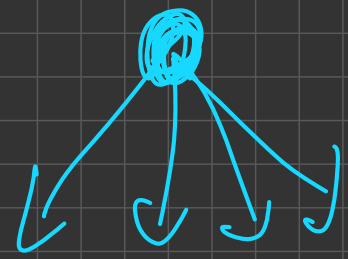
$dist[s] = 0$

$dist[u] = \infty$

$dist[s] = 0$

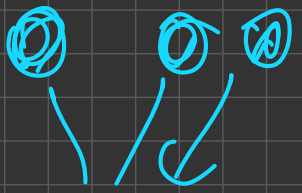


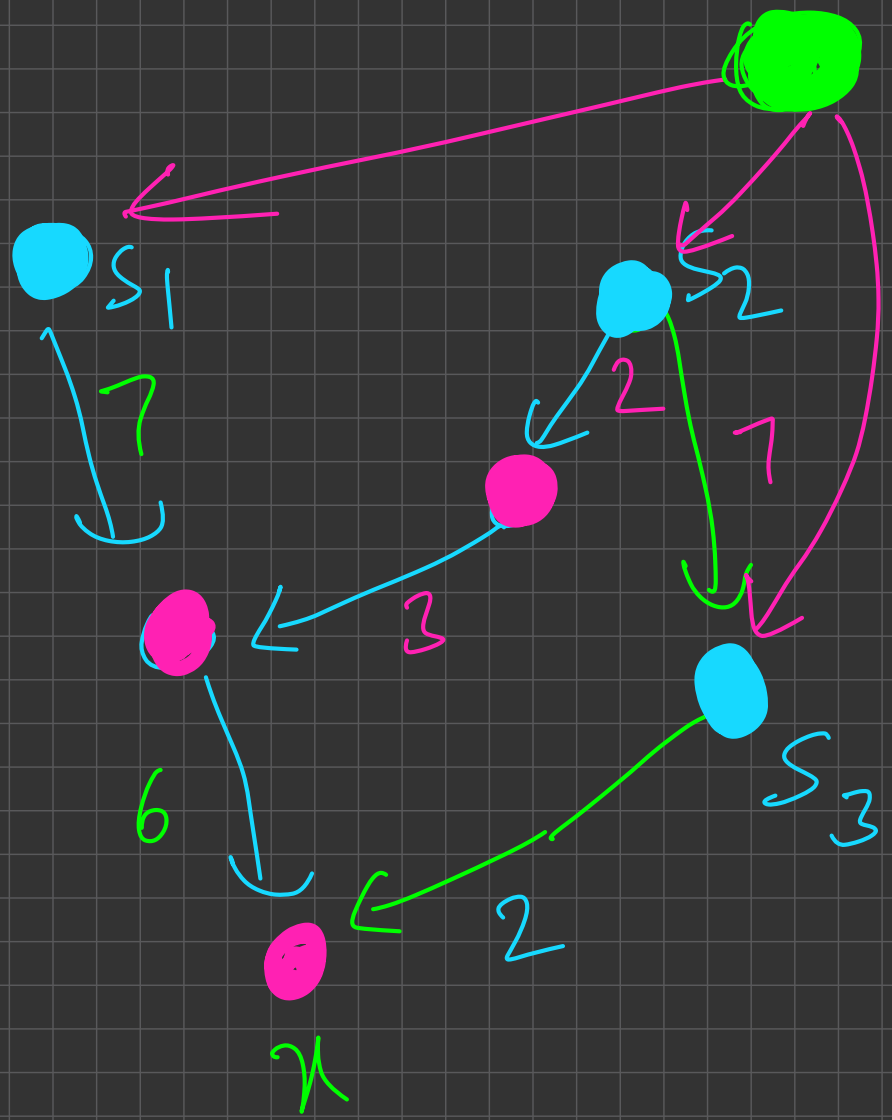
multi-source BFS



$n \leq 10^5$

$k \leq n$




s_1
s_2
s_3
7
2
7
3
6
2
n

Problem 1

Shortest Path from Source to Destination in O(n+m) in DAG

Problem Part 1 - DAG

A game has n rooms and m tunnels between them. Each room has a certain number of coins. What is the maximum number of coins you can collect while moving through the tunnels when you can freely choose your starting and ending room?

DAG

Input:

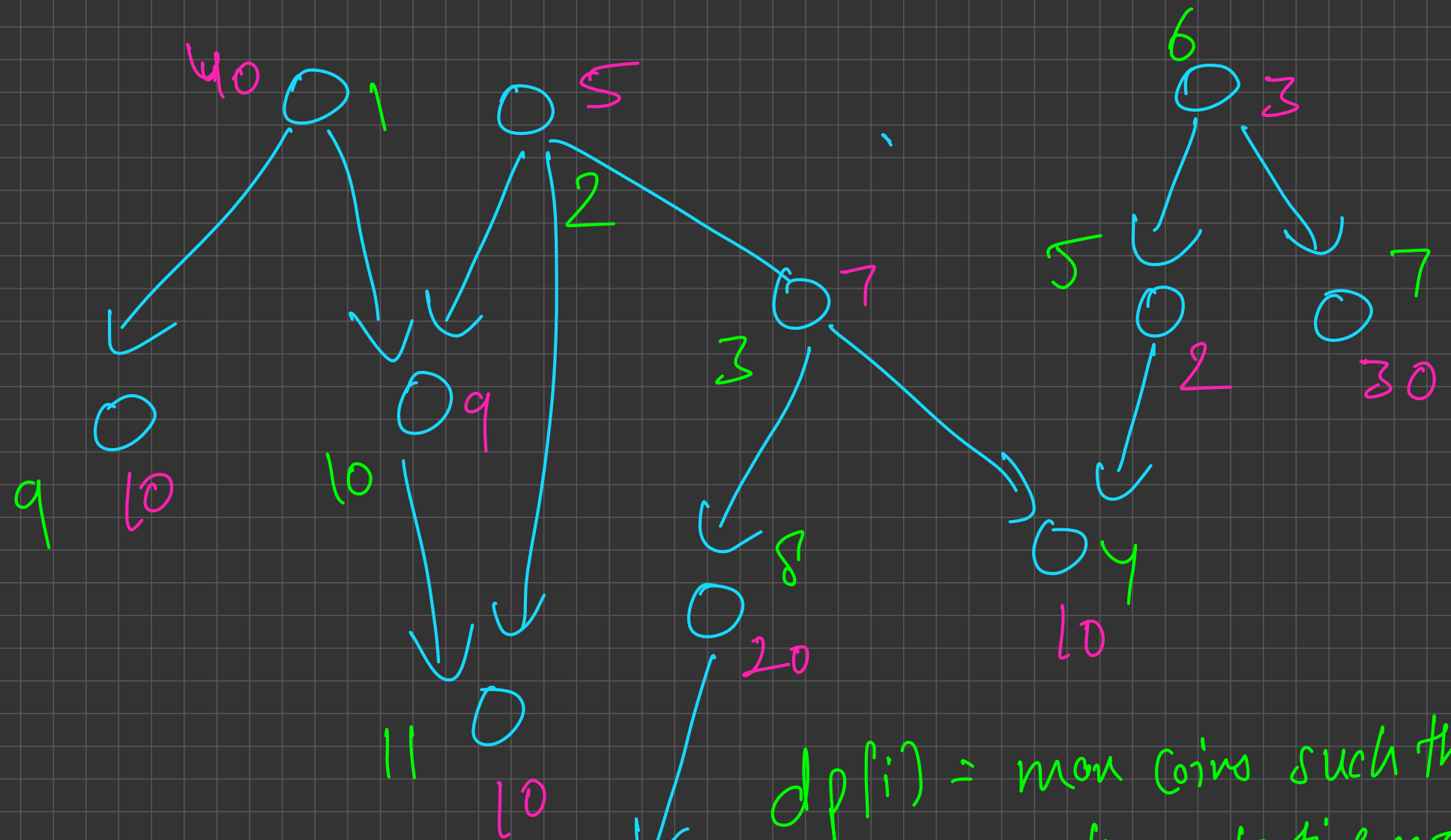
The first input line has two integers n and m: the number of rooms and tunnels. The rooms are numbered 1,2,…,n.

Then, there are n integers k1,k2,…,kn: the number of coins in each room.

Finally, there are m lines describing the tunnels. Each line has two integers a and b: there is a tunnel from room a to room b. Each tunnel is a one-way tunnel.

Output:
Print one integer: the maximum number of coins you can

collect. Problem Source: CSES-1686



dp(i) = max coins such that i is the starting node

dp(i) = max coins such that i is the ending node

dp[i] = max coins you can pick s.t. i is the starting node.

$$dp(i) = coins[i] + \max\{dp[child]\}$$

T

B.C.

$dp[i] = coins[i]$ for i not having any children

F.S.

mean of dp(i) y

Problem Part 2 - Normal Graph

A game has n rooms and m tunnels between them. Each room has a certain number of coins. What is the maximum number of coins you can collect while moving through the tunnels when you can freely choose your starting and ending room?

Input:

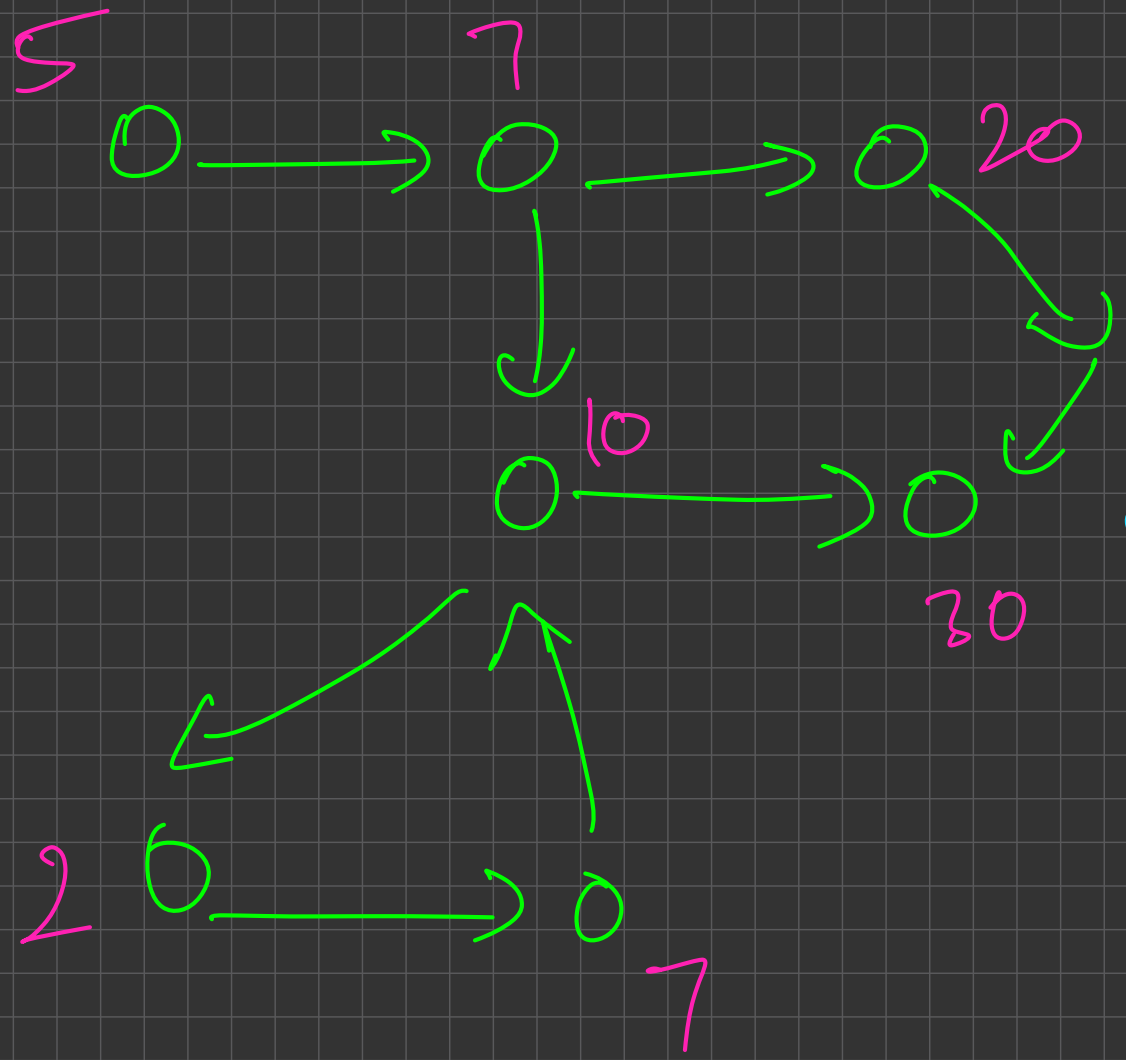
The first input line has two integers n and m: the number of rooms and tunnels. The rooms are numbered 1,2,…,n.

Then, there are n integers k1,k2,…,kn: the number of coins in each room.

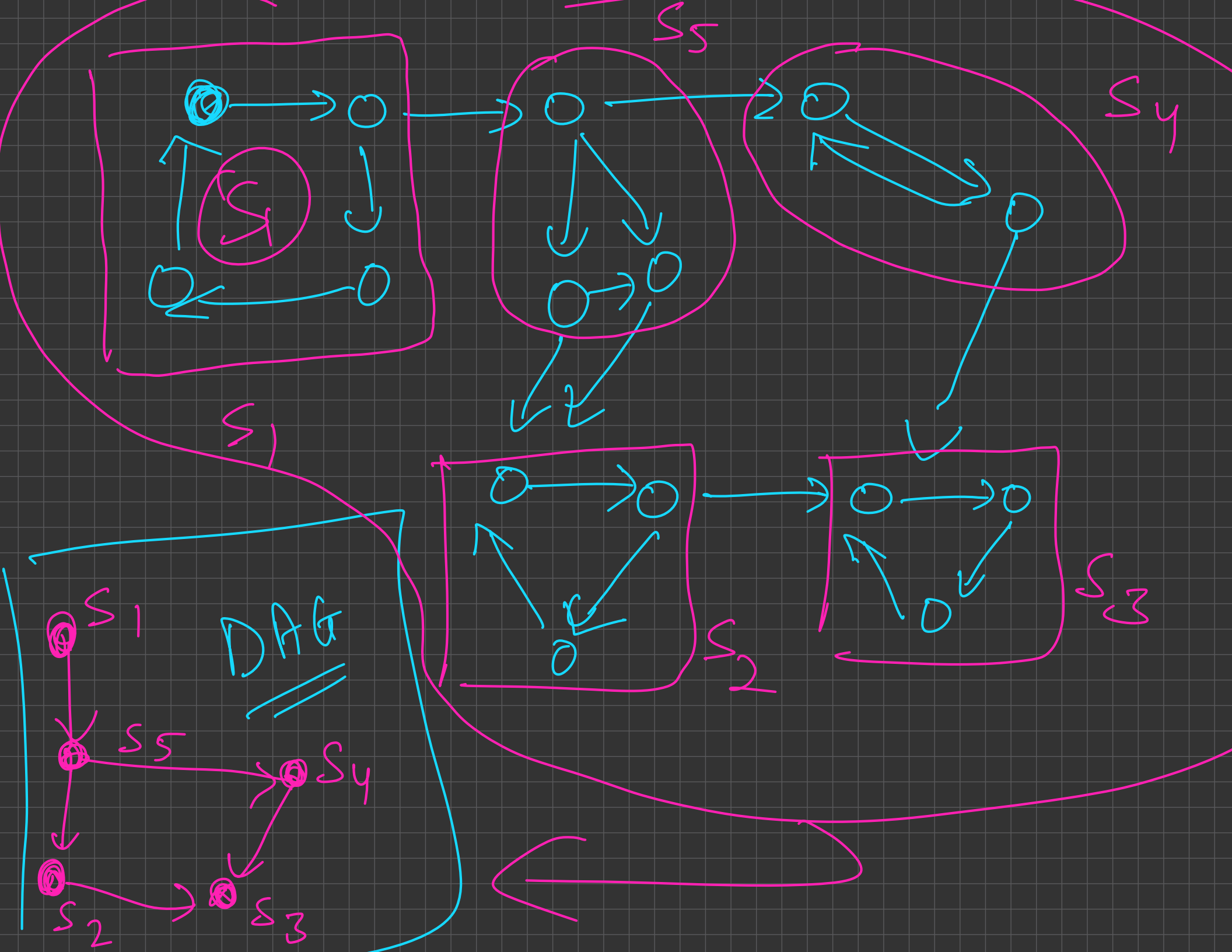
Finally, there are m lines describing the tunnels. Each line has two integers a and b: there is a tunnel from room a to room b. Each tunnel is a one-way tunnel.

Output:
Print one integer: the maximum number of coins you can

collect. Problem Source: CSES-1686



coins ≥ 0


S1
S5
S4
S2
S3
DAG
S1
S5
S4
S2
S3

Second best minimum spanning tree