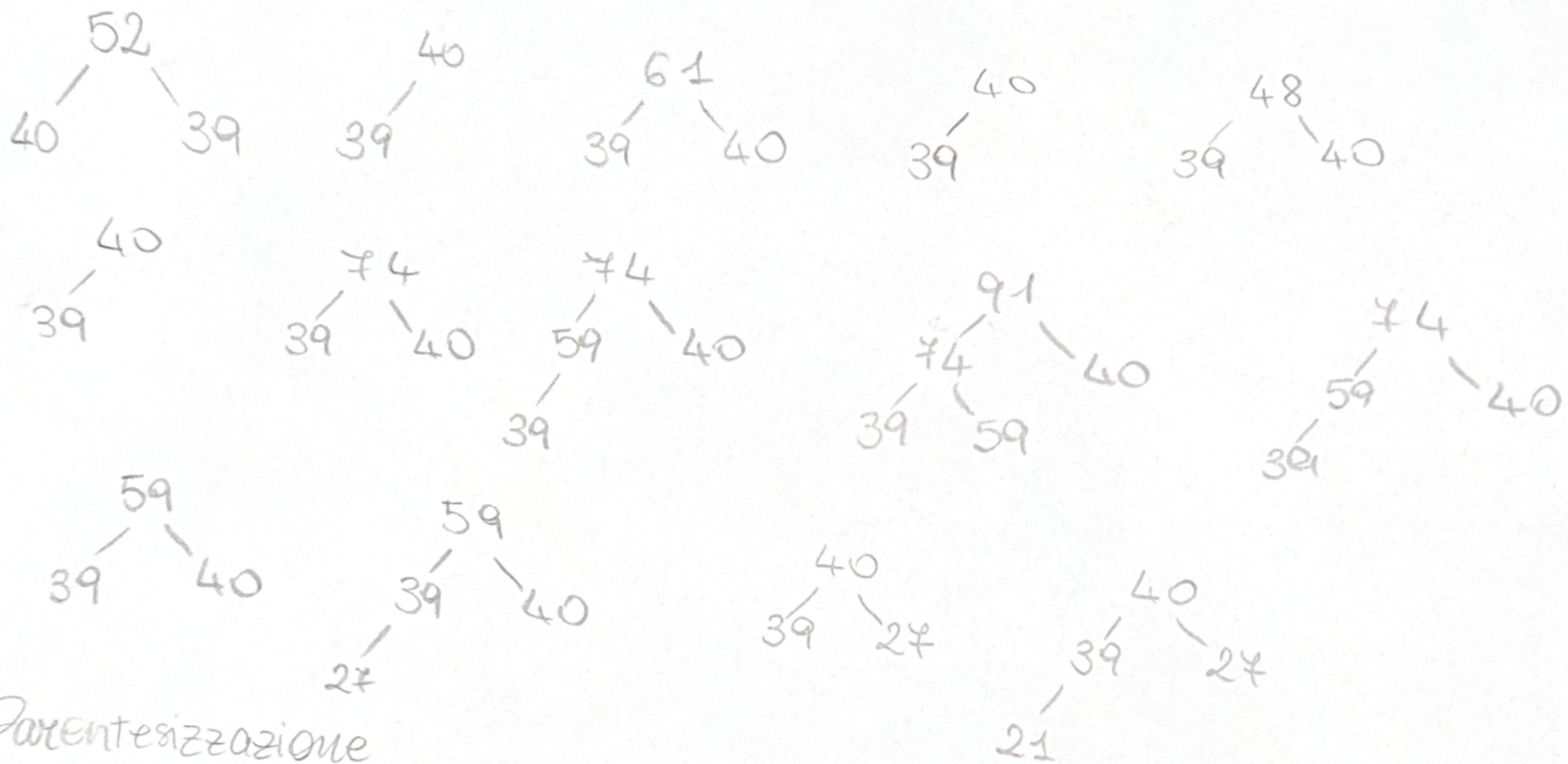


I APPELLO 2024

① Coda a priorità

40 52 39 * 61 * 48 * 74 59 91 * * 27 * 21

* ~ cancellazione MAX



② Parentesiizzazione

$$\vartheta = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5, 6, 3, 4, 5 \end{bmatrix}$$

$$m[1,2] = p_0 p_1 p_2 = \boxed{90 \quad k=1}$$

$$m[2,3] = p_1 p_2 p_3 = \boxed{72 \quad k=2}$$

$$m[3,4] = p_2 p_3 p_4 = \boxed{60 \quad k=3}$$

$$m[1,3] = m[1,1] + m[2,3] + p_0 p_1 p_3 = 192 \quad k=1$$

$$m[1,3] = m[1,2] + m[3,3] + p_0 p_2 p_3 = \boxed{150 \quad k=2}$$

$$m[2,4] = m[2,2] + m[3,4] + p_1 p_2 p_4 = \boxed{135 \quad k=2}$$

$$m[2,4] = m[2,3] + m[4,4] + p_1 p_3 p_4 = 192 \quad k=3$$

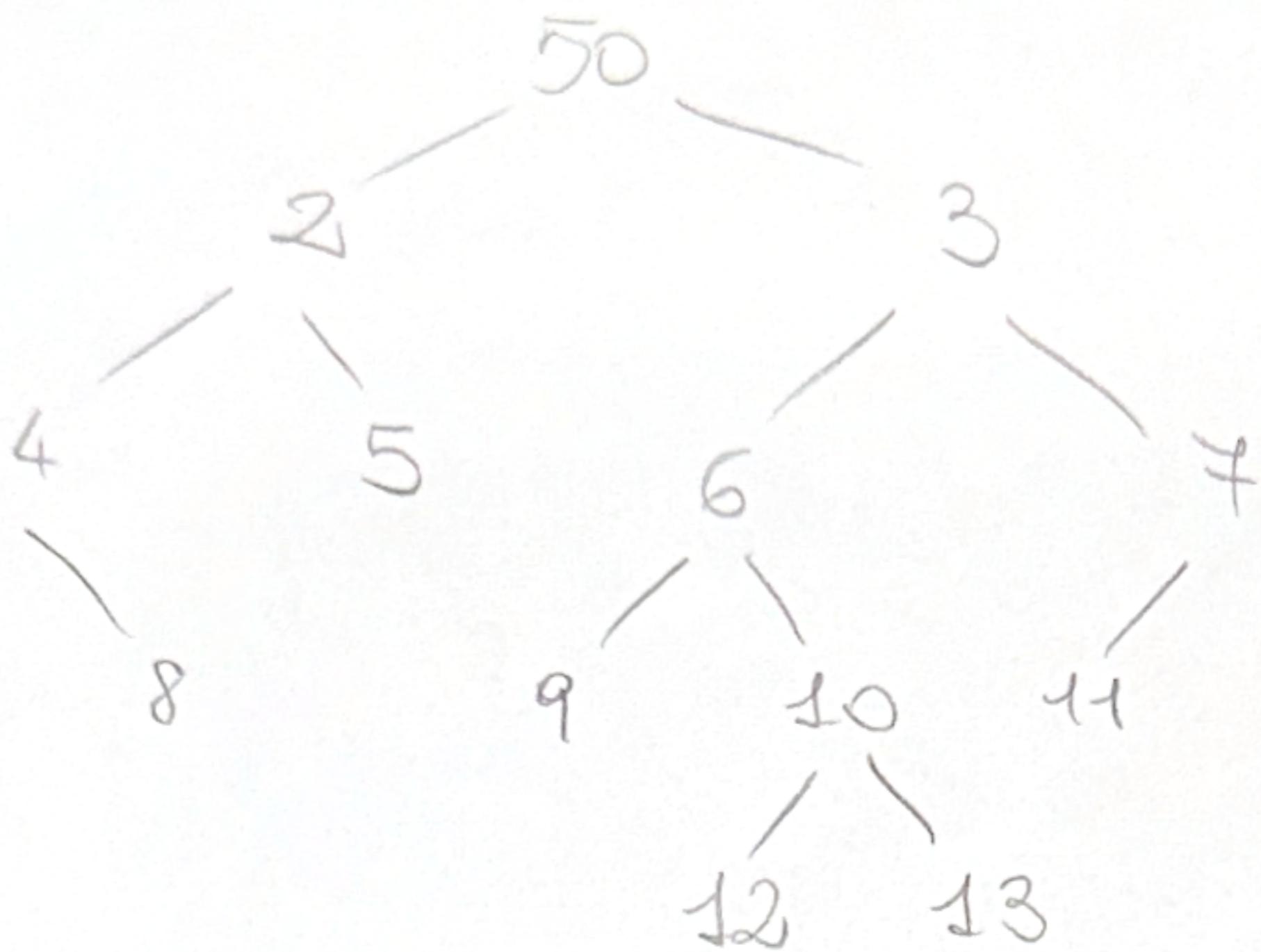
$$m[1,4] = m[1,1] + m[2,4] + p_0 p_1 p_4 = 282 \quad k=1$$

$$m[1,4] = m[1,2] + m[3,4] + p_0 p_2 p_4 = \boxed{225 \quad k=2}$$

$$m[1,4] = m[1,3] + m[4,4] + p_0 p_3 p_4 = \boxed{250 \quad k=3}$$

TXT

③



BAC

IN-ORDER:

4 8 2 5 50 9 6 12 10 13 3 11 ♀

ABC

PRE-ORDER:

50 2 4 8 5 3 6 9 10 12 13 3 11 ♀

BCA

POST-ORDER:

8 4 5 2 9 12 13 10 6 11 ♀ 3 50

④ N=♀

$$\frac{N}{M} < \frac{1}{2} \quad M > 14 \quad M = 15$$

138 48 103 60 213 28 98

Open addressing
con double hashing

M=1♀

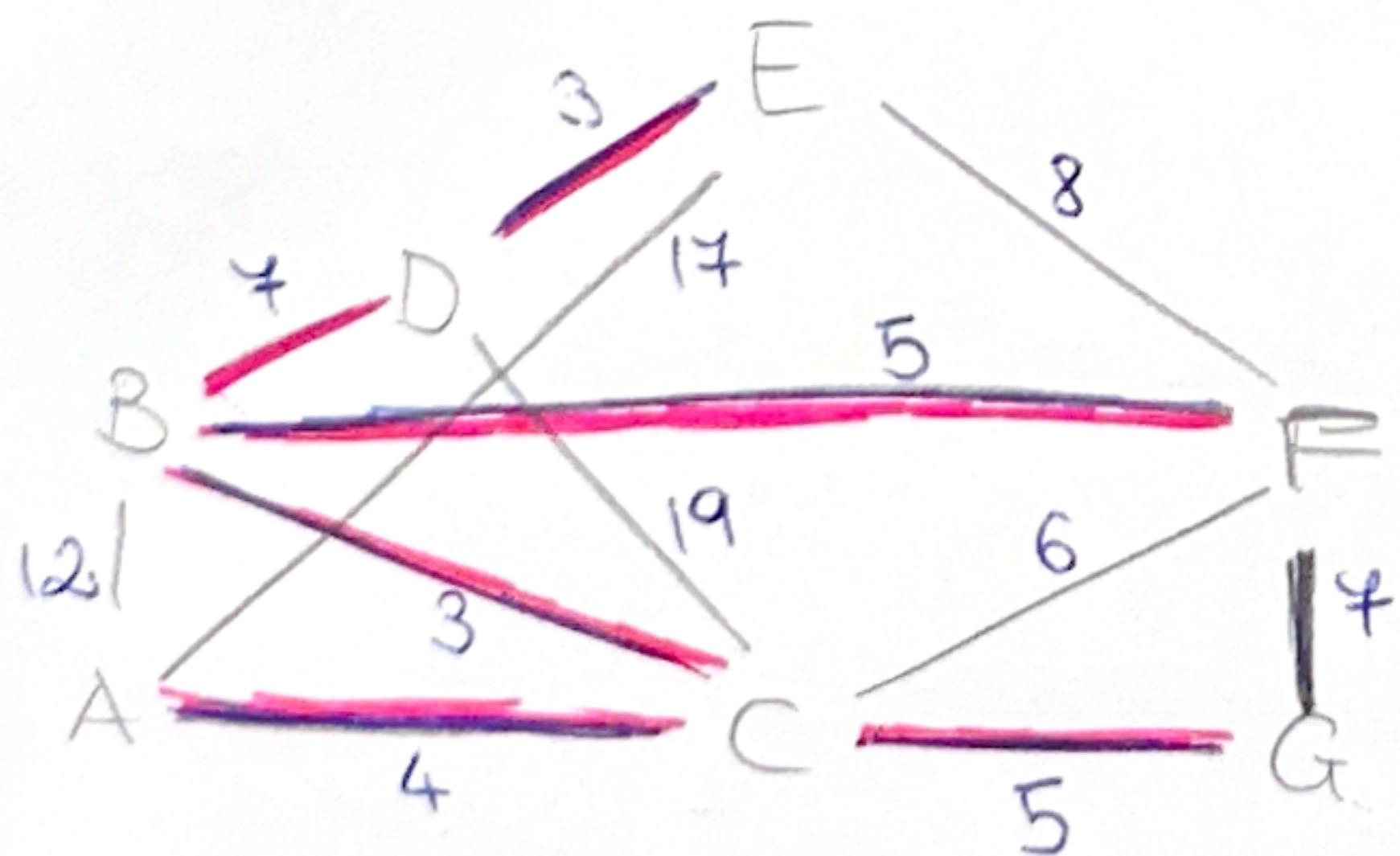
0	
1	103
2	138
3	
4	
5	
6	
7	
8	
9	60
10	
11	28
12	213
13	98
14	48
15	
16	

213 → 9 ×

$$(9 + (1 + 9 \% 9) \% 14) \% 14 = 2 \times$$

$$(2 + (1 + 9 \% 9) \% 14 \% 14 = 12$$

⑤

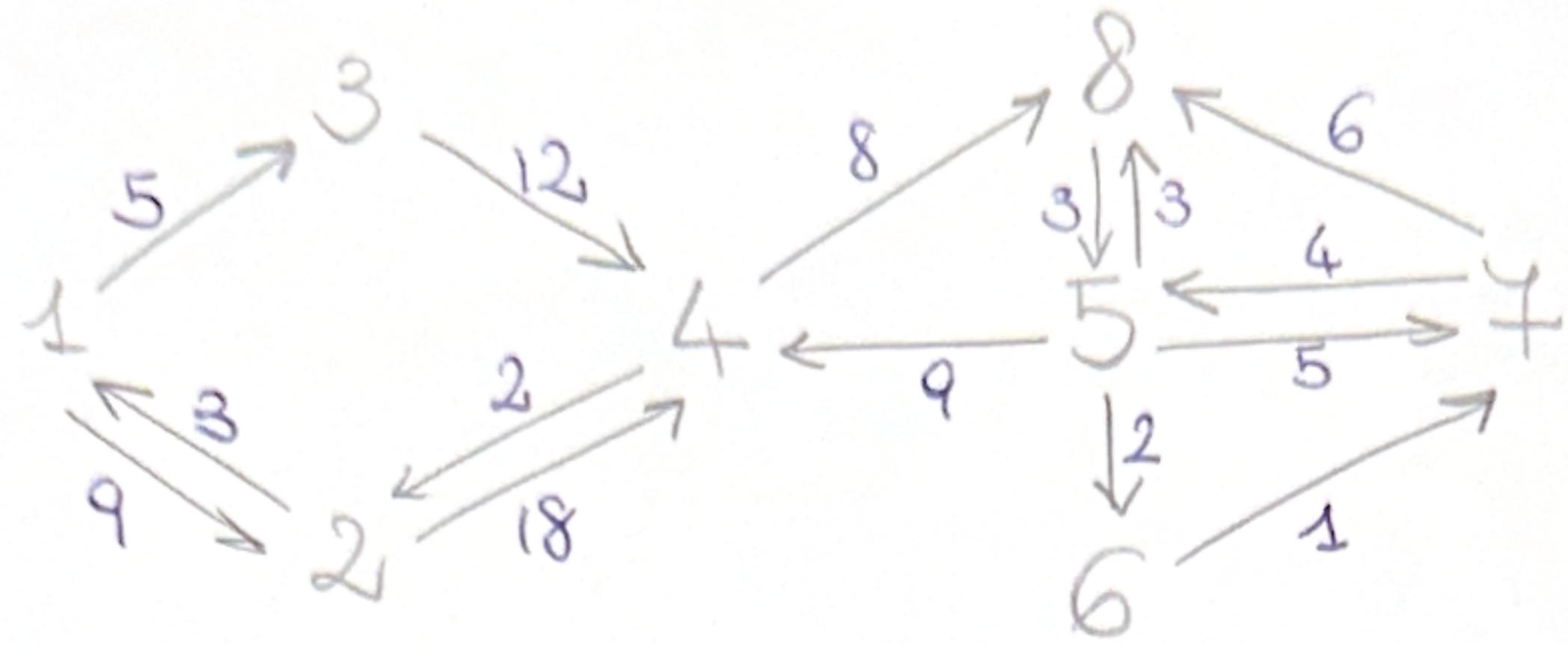


Kruskal

Per albero ricoprente minimo

$$\text{Peso} = 3 + 3 + 5 + 5 + 4 - 7 = 27$$

⑥



Cammini minimi a partire da 1

Dijkstra

	P_0	P_1	P_2	P_3	P_4	P_5	P_6
1	∞	∞	∞	∞	18	18	18
2	∞	∞	∞	15	15	15	15
3	∞	∞	∞	∞	∞	23	23
4	∞	∞	13	13	13	13	13
5	∞	4	4	4	4	4	4
6	∞	∞	6	6	6	6	6
7	0	0	0	0	0	0	0
8	∞	6	6	6	6	6	6

$(1,2)$ $(1,3)$ $(2,1)$ $(2,4)$ $(3,4)$ $(4,2)$ $(4,8)$ $(5,4)$ $(5,6)$ $(5,7)$ $(5,8)$
 ~~$(6,1)$~~ $(7,5)$ $(7,8)$ $(8,5)$

II APPELLO 2024

- ① $\left[\begin{smallmatrix} \times \\ 0,6 \end{smallmatrix}\right) \left[\begin{smallmatrix} \times \\ 1,4 \end{smallmatrix}\right) \left[\begin{smallmatrix} \times \\ 6,10 \end{smallmatrix}\right) \left[\begin{smallmatrix} \times \\ 12,14 \end{smallmatrix}\right) \left[\begin{smallmatrix} \times \\ 8,12 \end{smallmatrix}\right) \left[\begin{smallmatrix} \times \\ 8,11 \end{smallmatrix}\right) \left[\begin{smallmatrix} \times \\ 3,8 \end{smallmatrix}\right) \left[\begin{smallmatrix} \times \\ 3,5 \end{smallmatrix}\right) \left[\begin{smallmatrix} \times \\ 2,3 \end{smallmatrix}\right) \left[\begin{smallmatrix} \times \\ 5,9 \end{smallmatrix}\right) \left[\begin{smallmatrix} \times \\ 5,4 \end{smallmatrix}\right)$

Algoritmo greedy

- ② Ordino in ordine di fine:

$\left[\begin{smallmatrix} \times \\ 1,4 \end{smallmatrix}\right)$	✓✓
$3,5$	
$0,6$	
$5,7$	✓✓
$5,9$	
$6,10$	
$8,11$	✓✓
$8,12$	
$2,13$	
$12,14$	✓✓

a $i=6$ considero $[2,14]$

$[8,12)$ NON fa parete

Insieme:

$[1,4), [5,7), [8,11), [12,14)$

- ③ LIS

$8, 5, 7, 4, 9, 10, 3, 11, 6.$

	0	1	2	3	4	5	6	7	8
8	5	7	4	9	10	3	11	6	
L	1	1	2	1	3	4	1	5	2
prev	-1	-1	1	-1	2	4	-1	5	#1

Dunque la sequenza è di lunghezza 5:

$11 \rightarrow 10 \rightarrow 9 \rightarrow 7 \rightarrow 5$

$5, 7, 9, 10, 11$

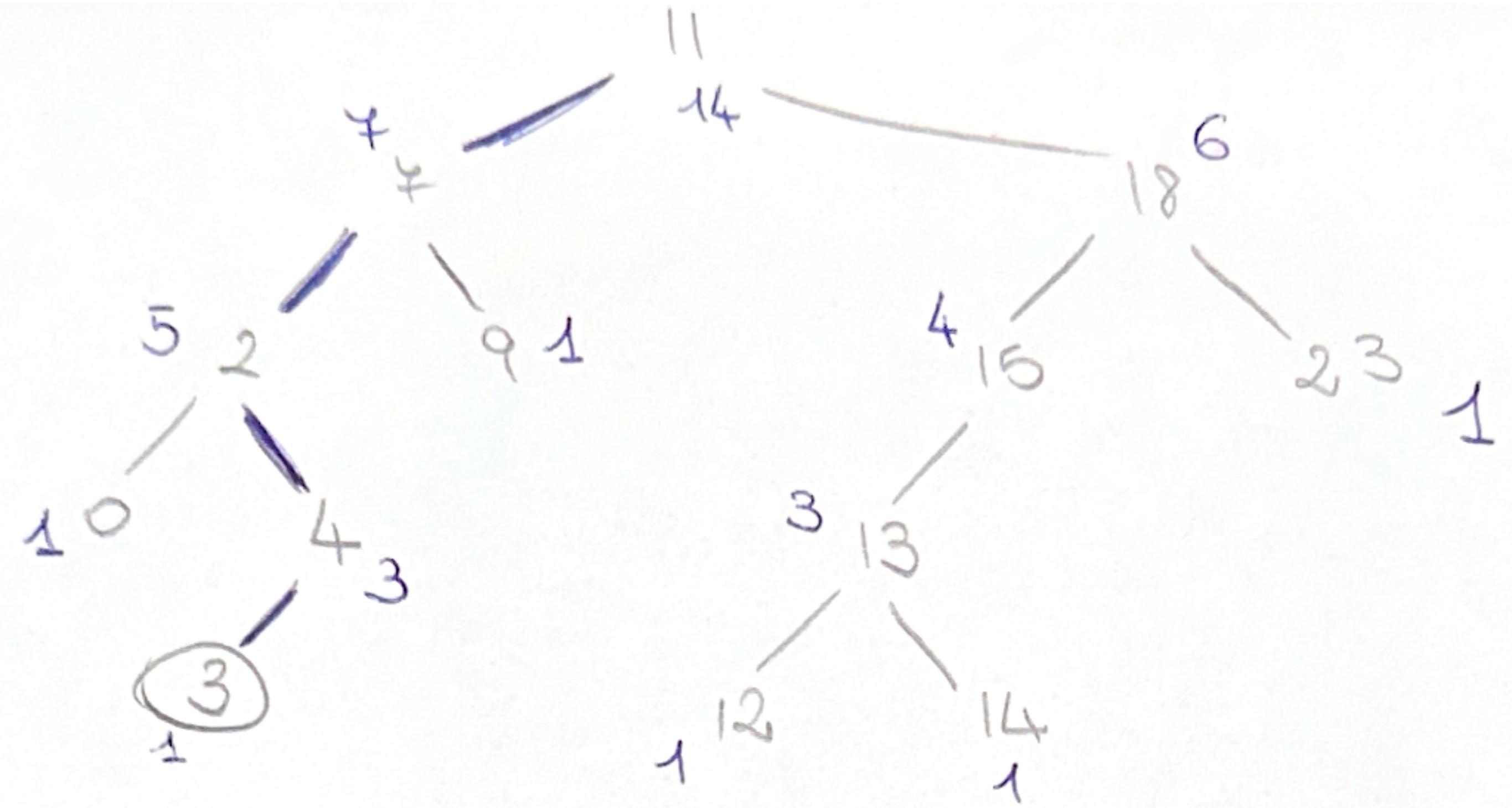
Per ogni elemento i , confronta con tutti i precedenti $j < i$: (la i è quella più a dx)



$A[i] > A[j]$

se ~~$A[i] \geq A[j]$~~

$L[i] = \max(L[i], L[j+1])$
 $\text{e } \text{prev}[i] = j$



Al nodo 18 aggiungo 6

BSTselect per chiave di range 4 ($K=4$)

$$K=4$$

$$t = 4 > K \quad (\text{arco } 11\text{-}14)$$

$$K=4$$

$$t = 5 > K \quad (\text{arco } 11\text{-}18)$$

$$K=4$$

$$t = 1 < K \quad (\text{arco } 11\text{-}14)$$

$$K_{\text{NEW}} = 4 - 1 - 1 = 2$$

$$K=2$$

$$t = 1 < K \quad (\text{arco } 11\text{-}14)$$

$$K_{\text{NEW}} = 2 - 1 - 1 = 0$$

$$K=0 \quad \left. \begin{array}{l} \{ \text{trovato} \Rightarrow \text{NODO 3} \end{array} \right.$$

④ Quicksort ordinamento crescente

9 4 8 11 5 69 13 20 10 43 0 + 33 12

Pivot=12

9 4 8 11 5 69 13 20 10 43 0 + 33 12
 9 4 8 11 5 + 13 20 10 43 69 33 12
 9 4 8 11 5 + 0 20 10 43 13 69 33 12
 9 4 8 11 5 + 0 10 20 43 13 69 33 12
 9 4 8 11 5 + 0 10 12 43 13 69 33 20

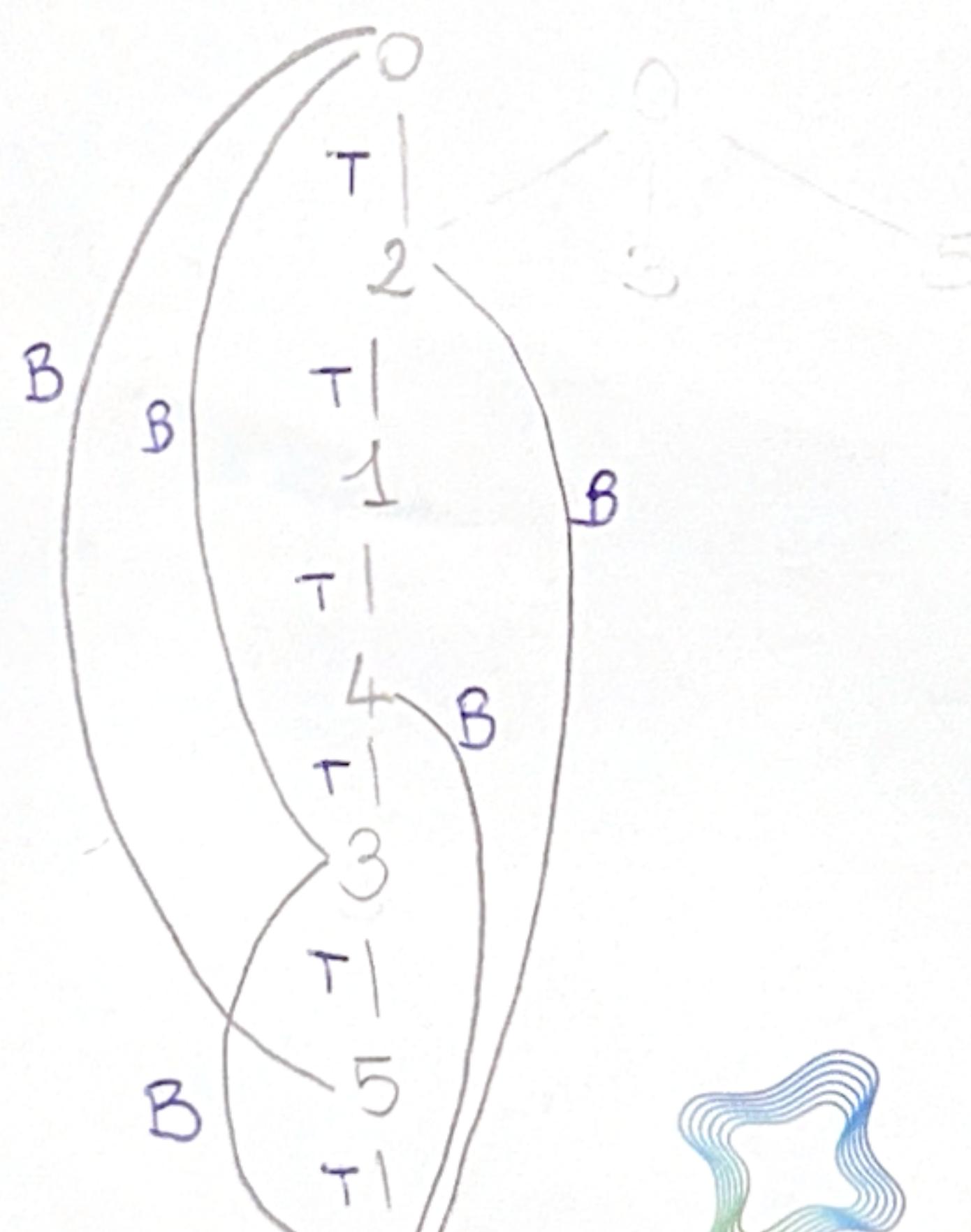
Pivot=10

9 4 8 11 5 + 0 10
 9 4 8 0 5 + 11 10
 9 4 8 0 5 + 10 11
 0/13 2/11
 0 T 1 T
 1/2 T 2 T
 2 T 3 T
 3 T 4 T
 4 T 5 T
 5 T 6 T
 5/8 6 6/4

Pivot=20

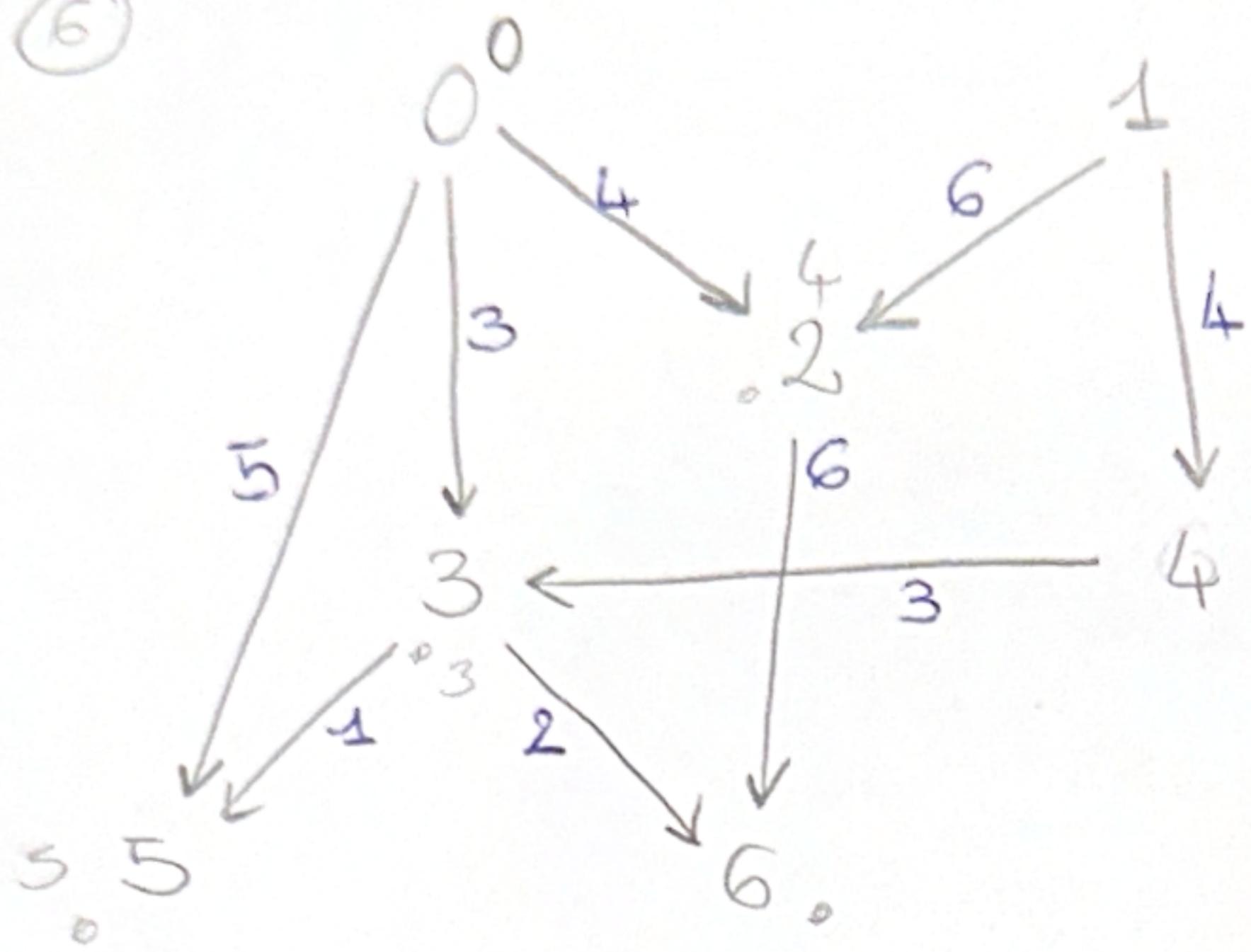
43 13 69 33 20
 13 43 69 33 20
 13 20 69 33 43

A partire da \emptyset
 Punti di articolazione: nessuno
 Archi B : 0-3, 0-5, 2-6, 4-6, 3-6



TXT

⑥

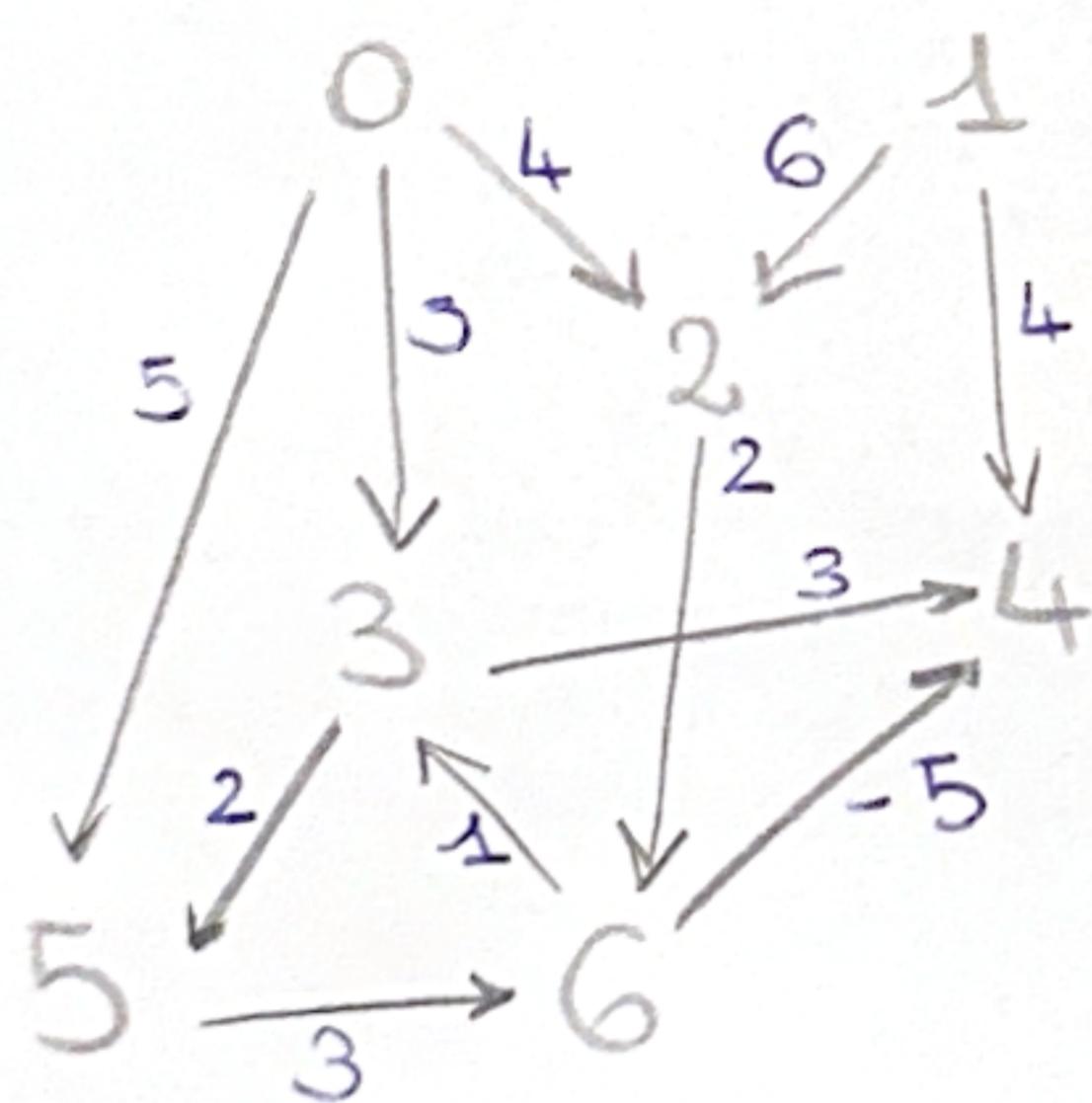


Cammini MASSIMI

Cammini massimi che collegano il vertice 0

	P_0	P_1	P_2	
0	0	0	0	0
1	∞	∞	∞	
2	∞	4	4	
3	∞	3	3	
4	∞	∞	∞	
5	∞	5	5	
6	∞	∞	10	

⑦ Cammini MINIMI Bellman-Ford



A partire da 1

	P_0	P_1	P_2	P_3	P_4	P_5	P_6	P_7
0	∞							
1	0	0	0	0	0	0	0	0
2	∞	∞	6	6	6	6	6	6
3	∞							
4	∞	∞	3	3	3	3	3	3
5	∞							
6	∞	∞	8	8	8	8	8	8

Ordine lessico-grafico

~~0-2, 0-3, 0-5, 1-2, 1-4, 2-6, 3-4, 3-5, 5-6, 6-4~~

~~4 3 5 6 1 2 3 4 2 3 5 3 6 4~~

III APPELLO 2024

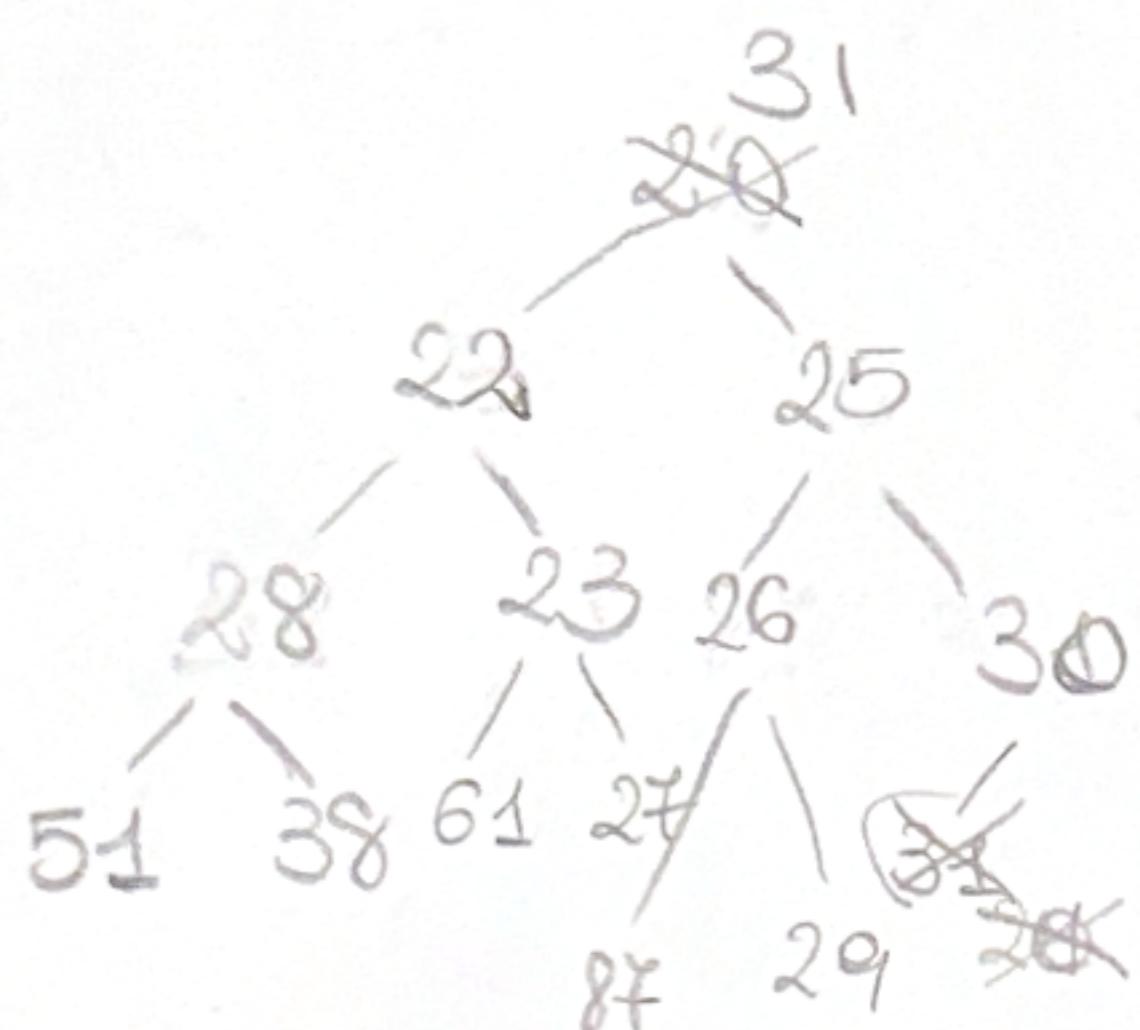
①

heap di dati

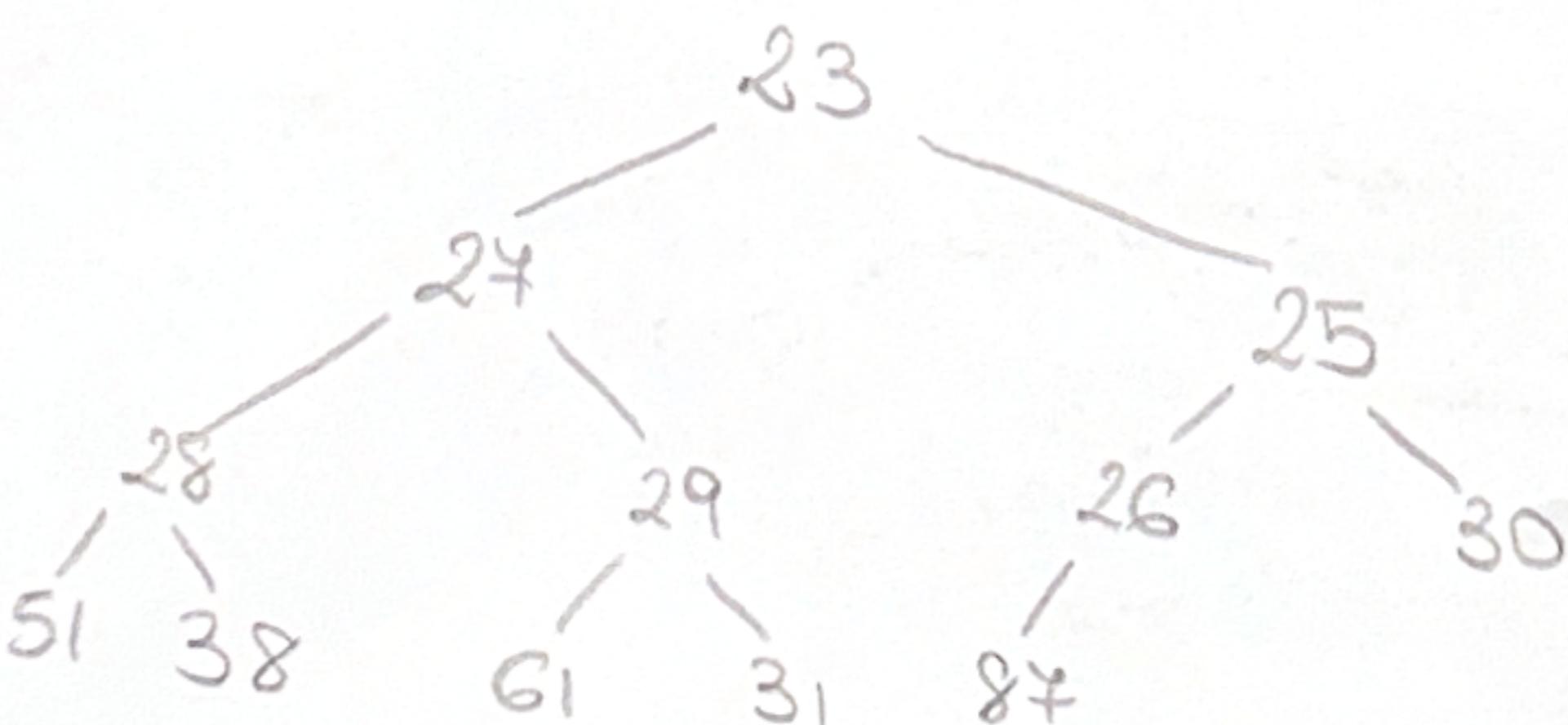
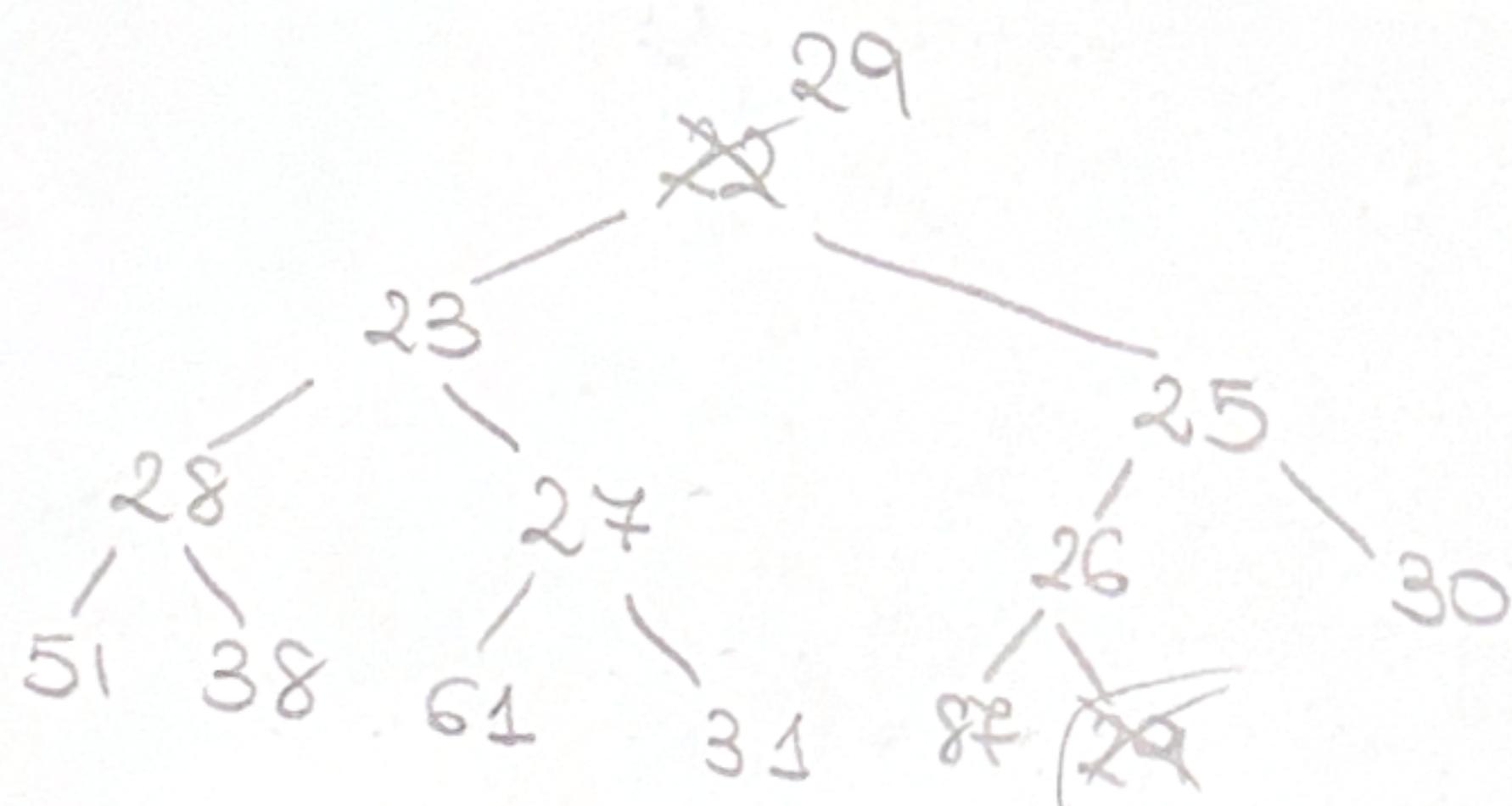
Primi due passi di heap sort

Nella radice val min

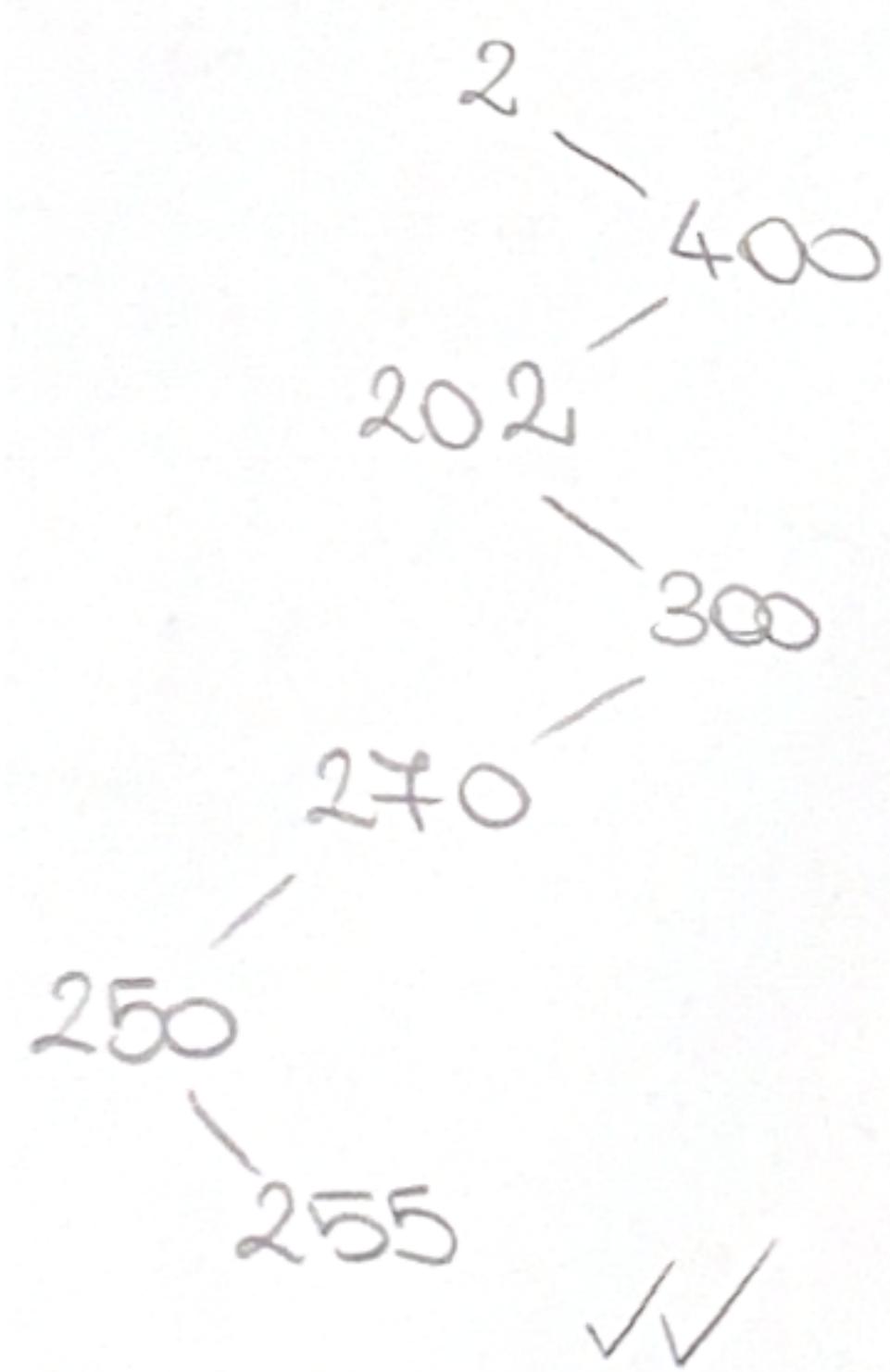
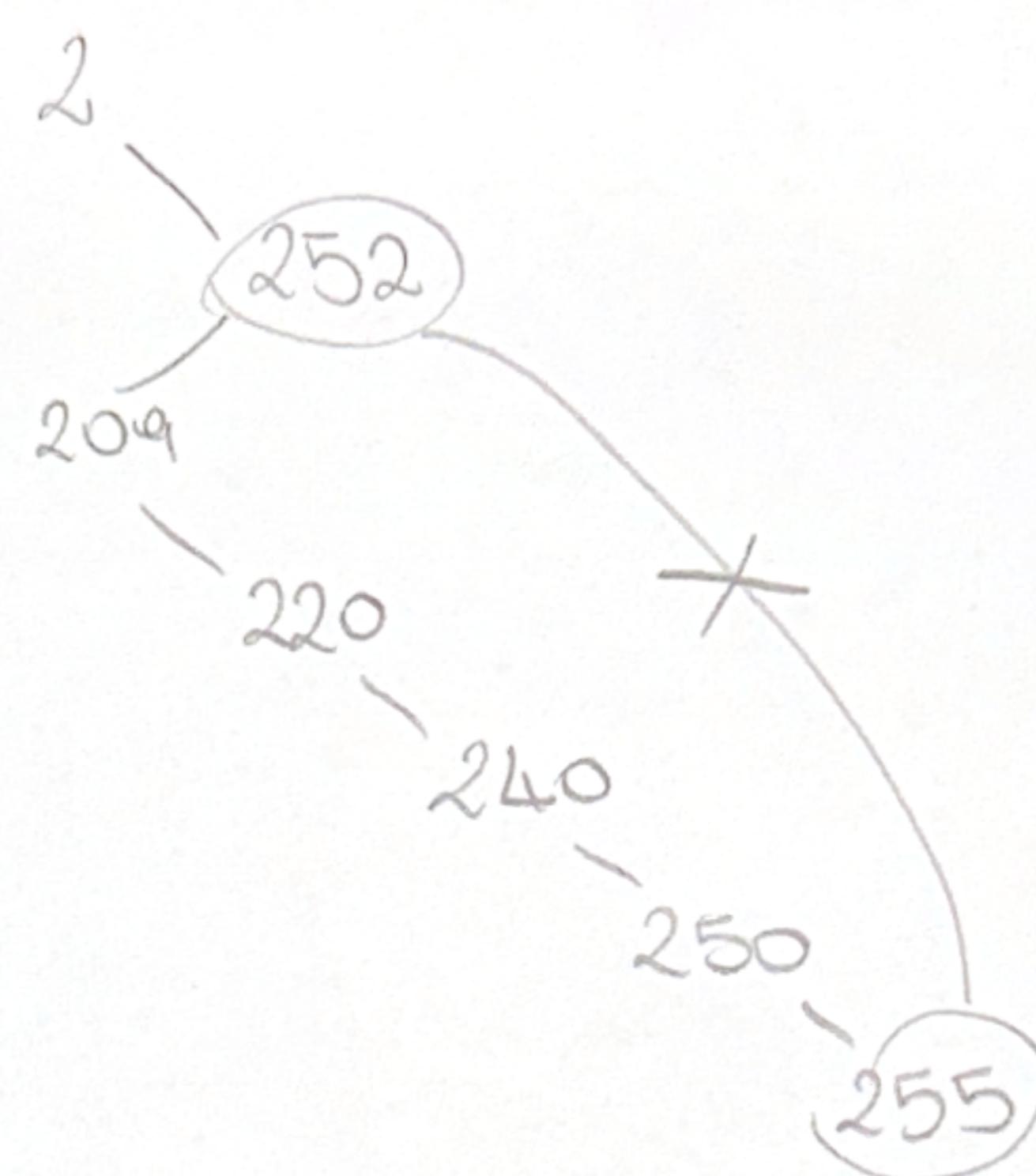
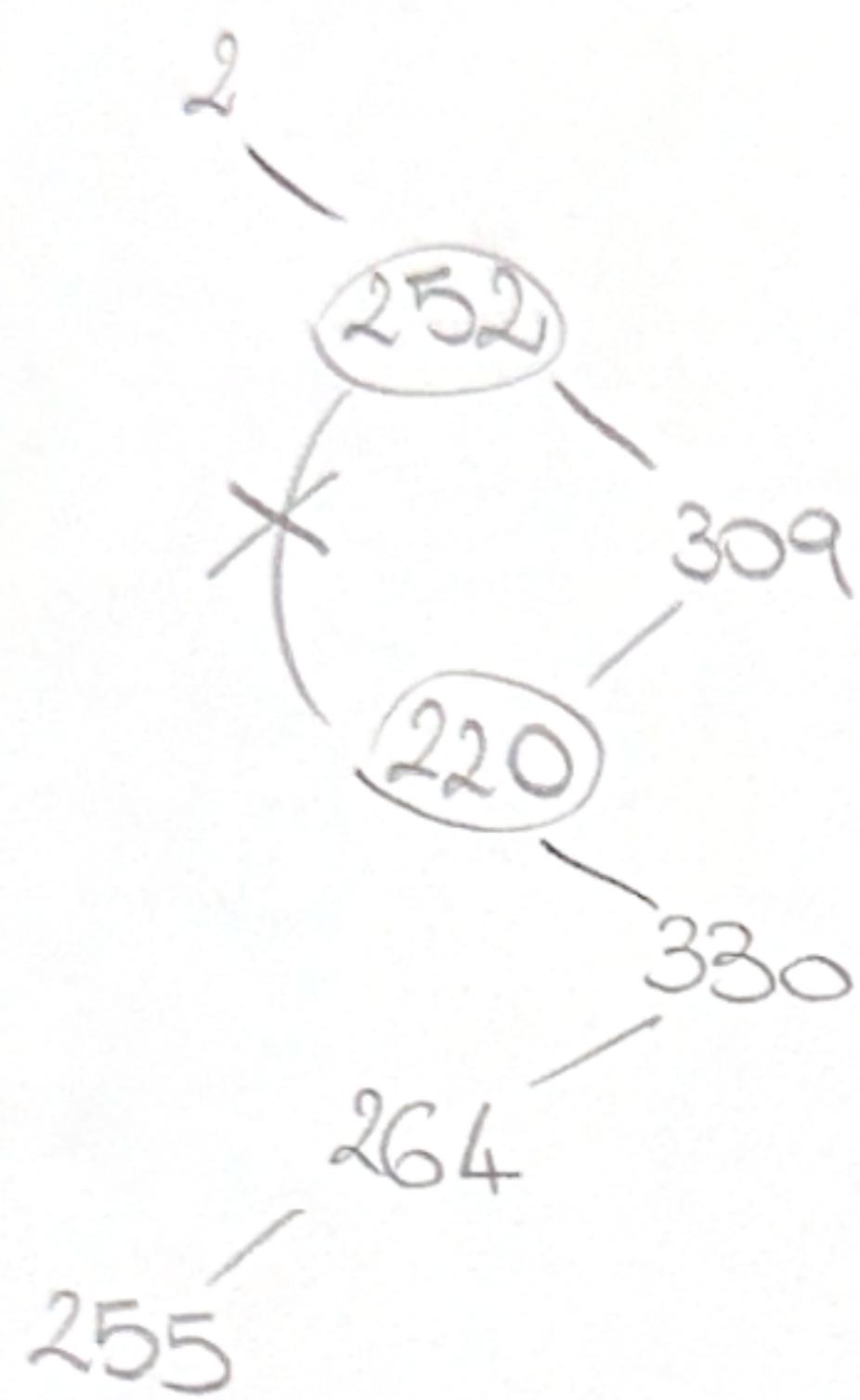
27 22 26 51 23 87 31 38 28 61 20 25 29 30



20 22



② Si cerca la chiave 255



③ 211, 26, 49, 46, 154, 14, 43, 230, 16

$$N = 9$$

$$\alpha < 0.4 = \frac{2}{5}$$

$$\frac{N}{M} < 0.4$$

$$\frac{9}{M} < \frac{2}{5}$$

$$M > 9 \cdot \frac{5}{2} = \frac{45}{2} = 22.5$$

$$M = 23$$

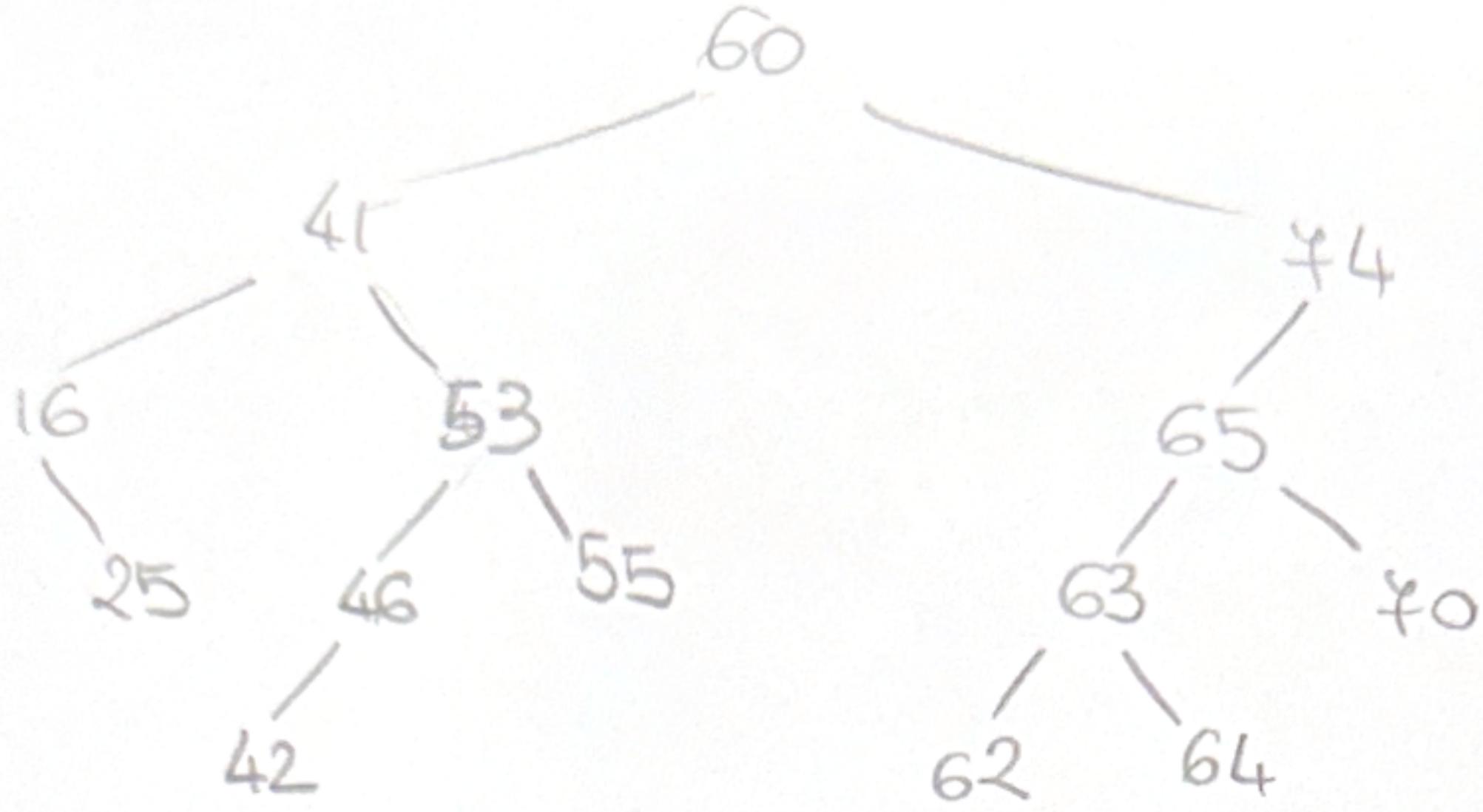
Open addressing con linear probing

0	>> 46	4	14	21
1	>> 230	8	15	22
2		9	16 >> 154	
3	>> 26	10 >> 49	14 >> 14	
4	>> 211	11	18 >> 16	
5		12	19	
6		13	20 >> 43	

230 → 0 NO
1 ✓✓

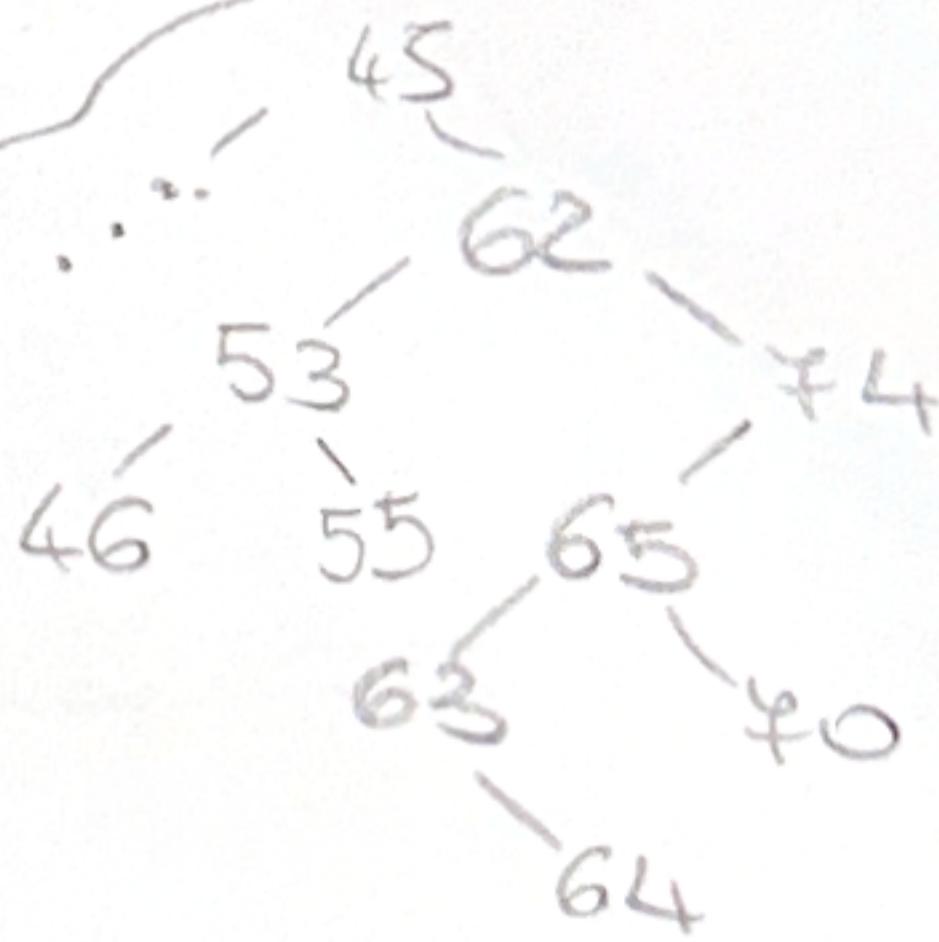
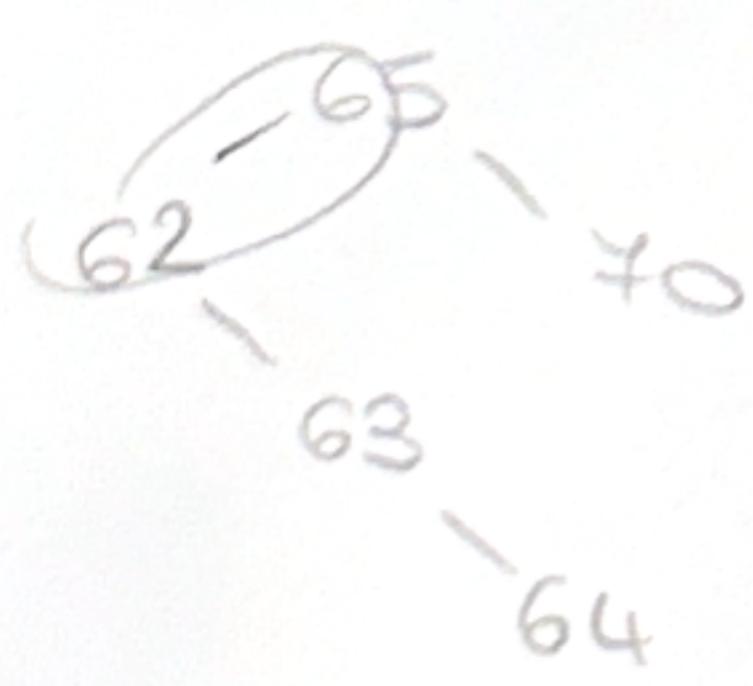
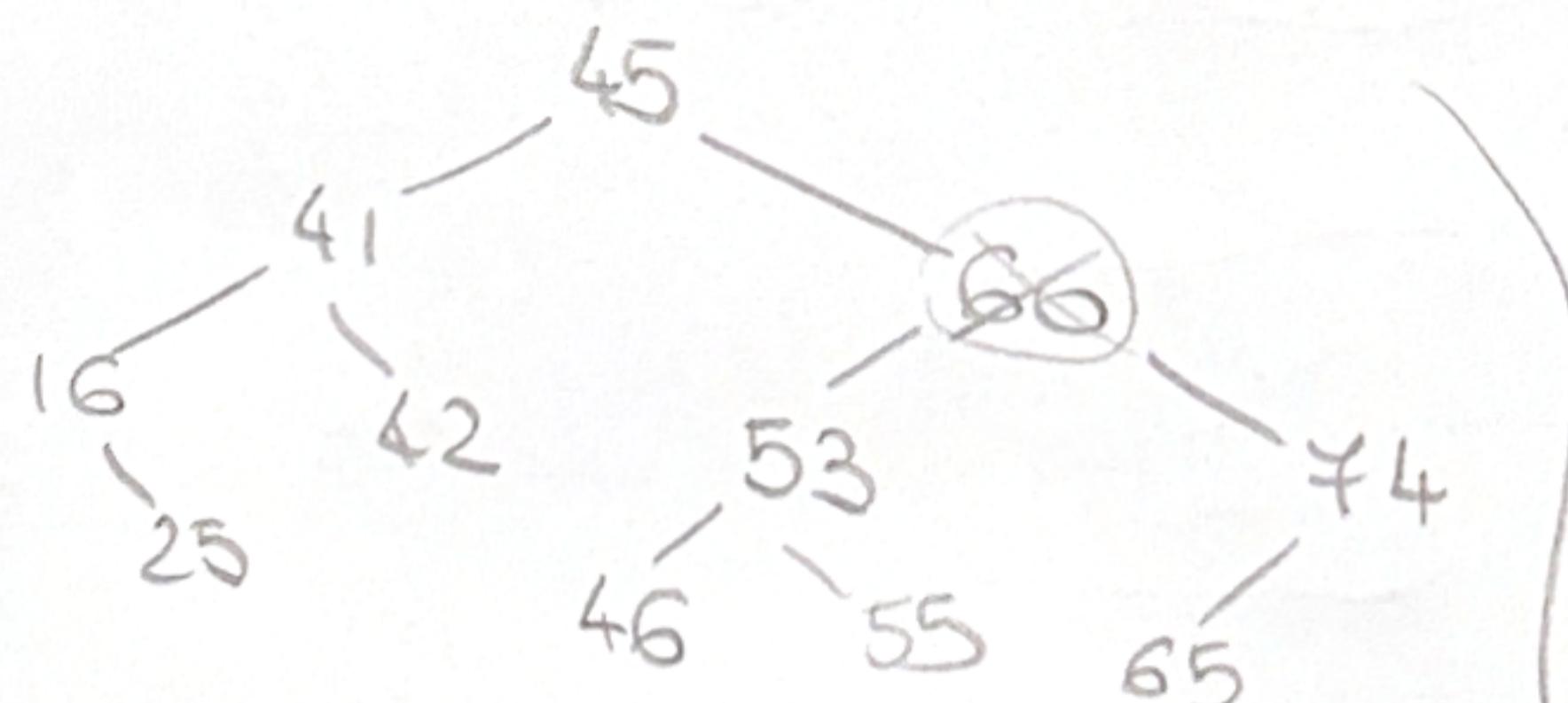
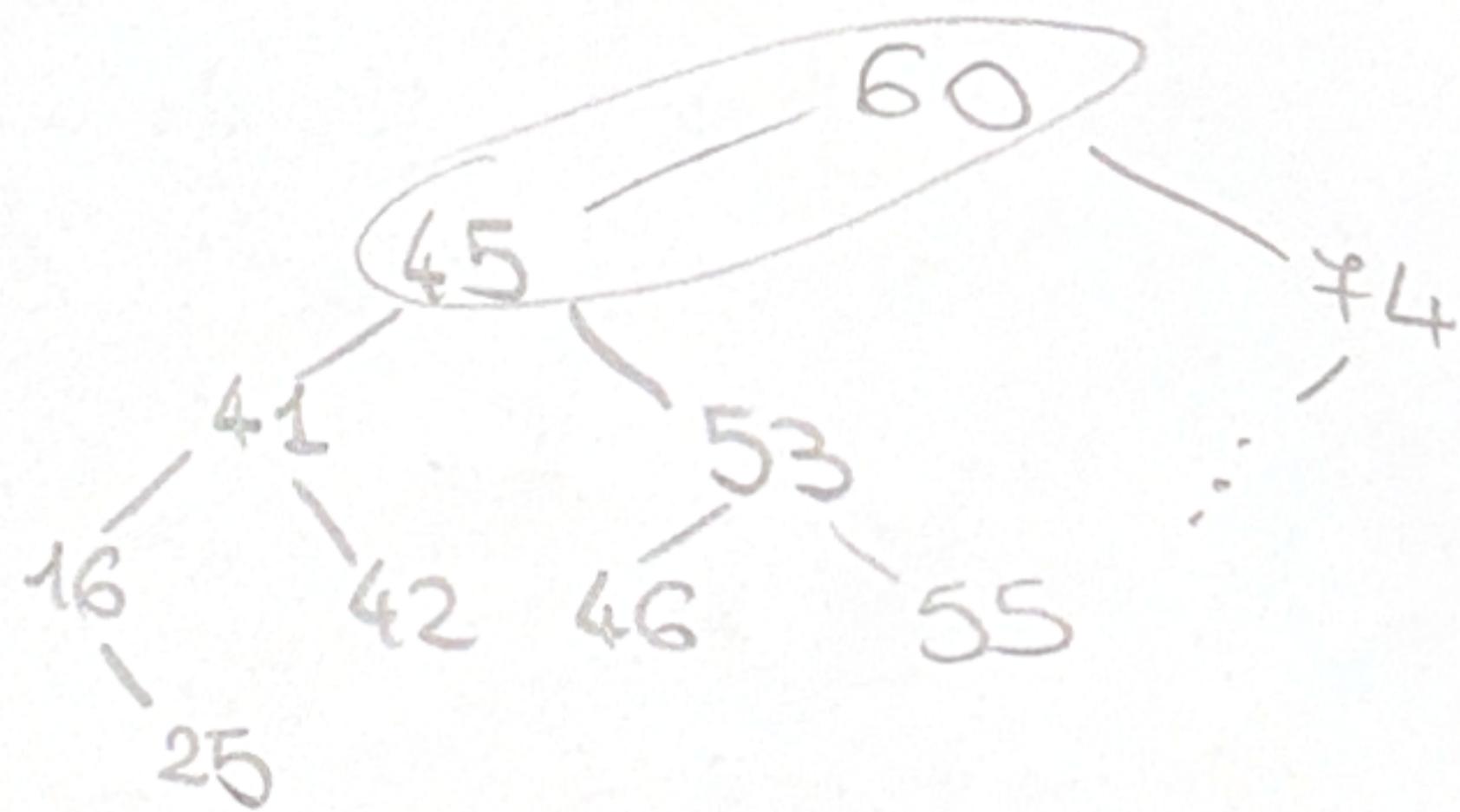
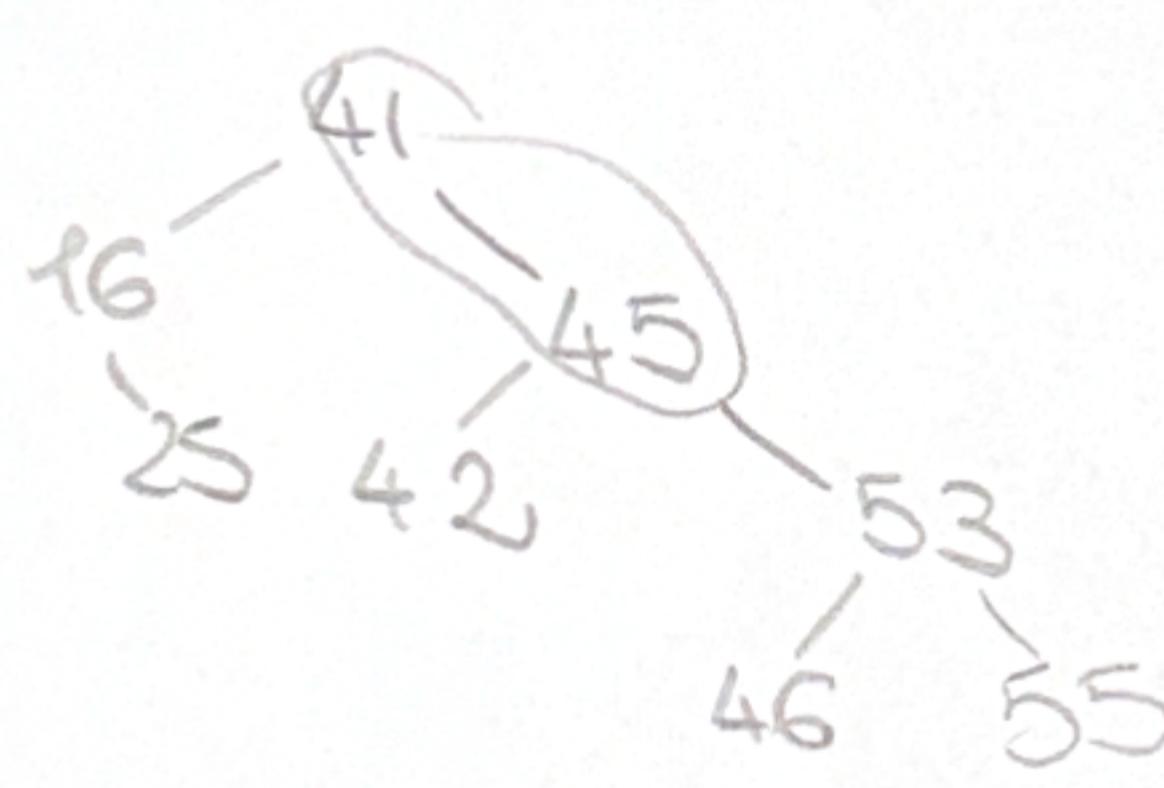
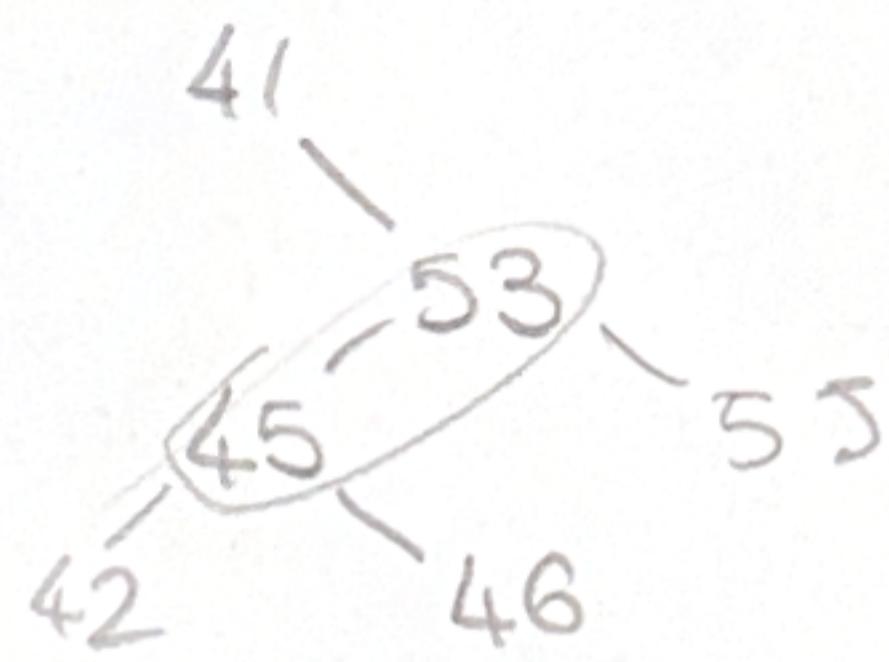
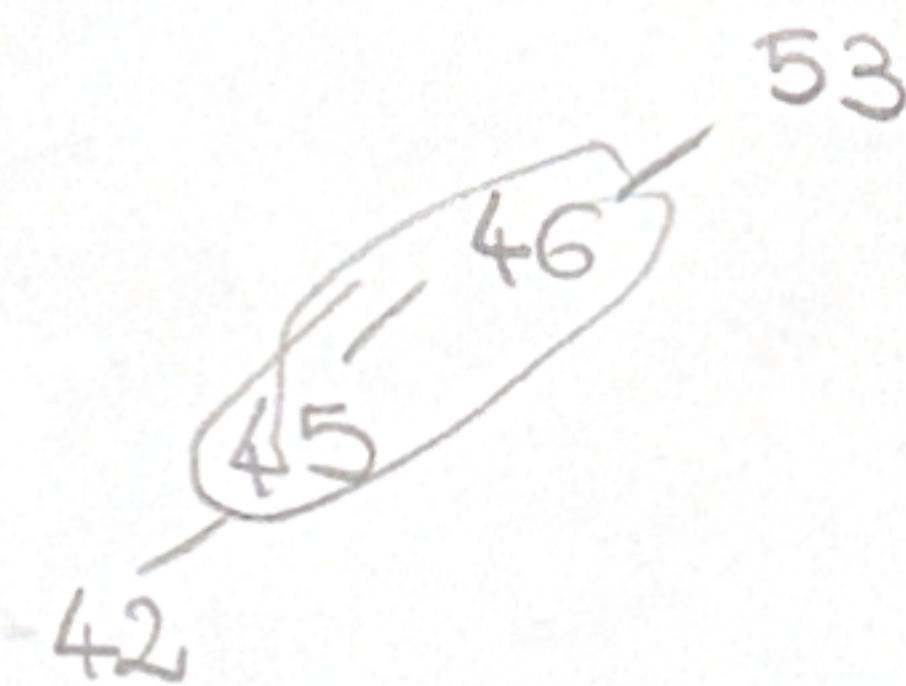
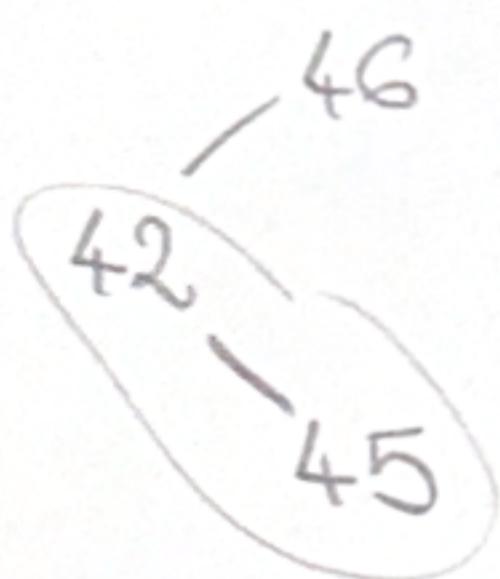
16 → 16 NO
14 NO
18 ✓✓

④



Inserzione in radice di 45

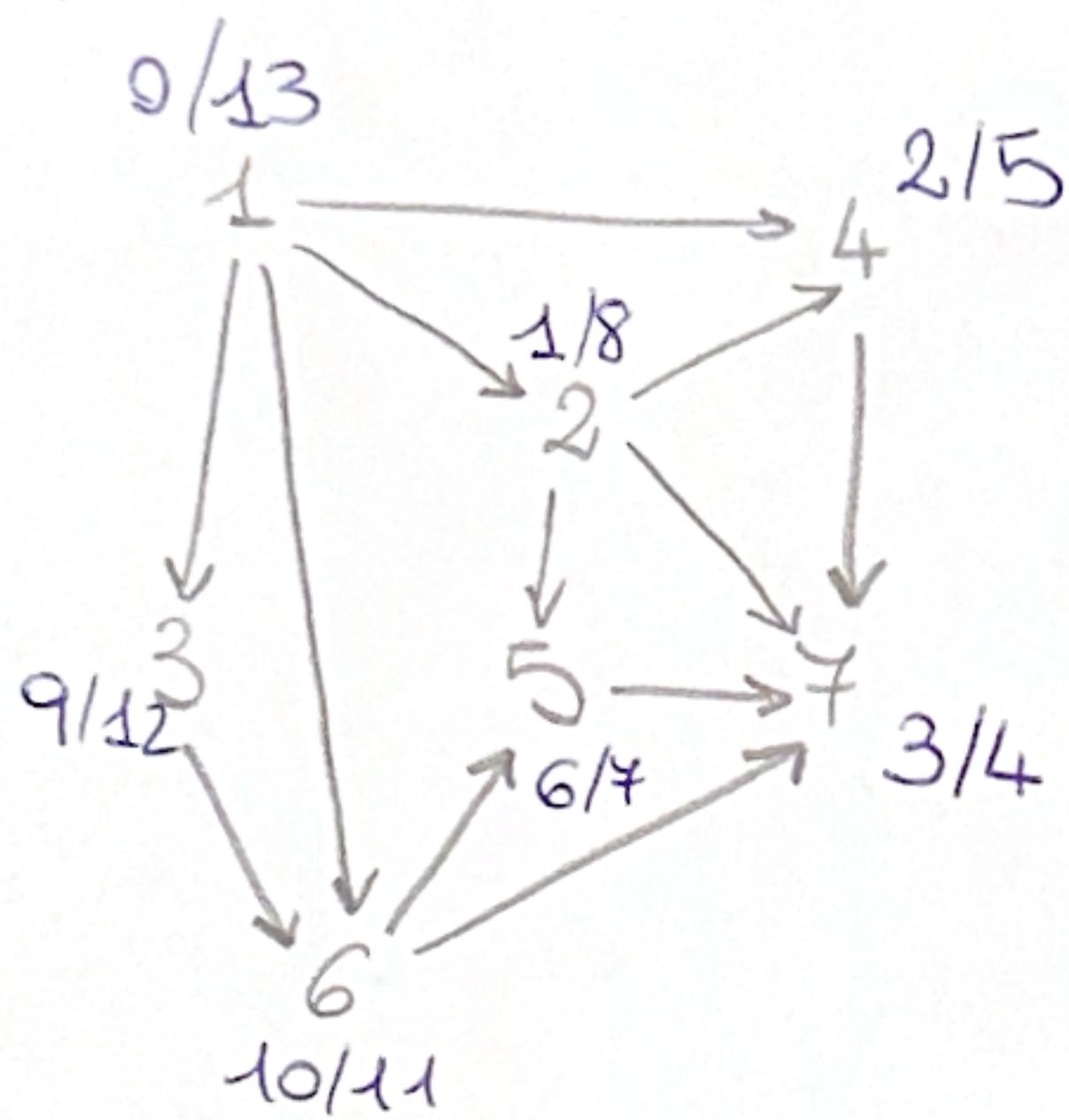
Cancellazione di 60



TXT

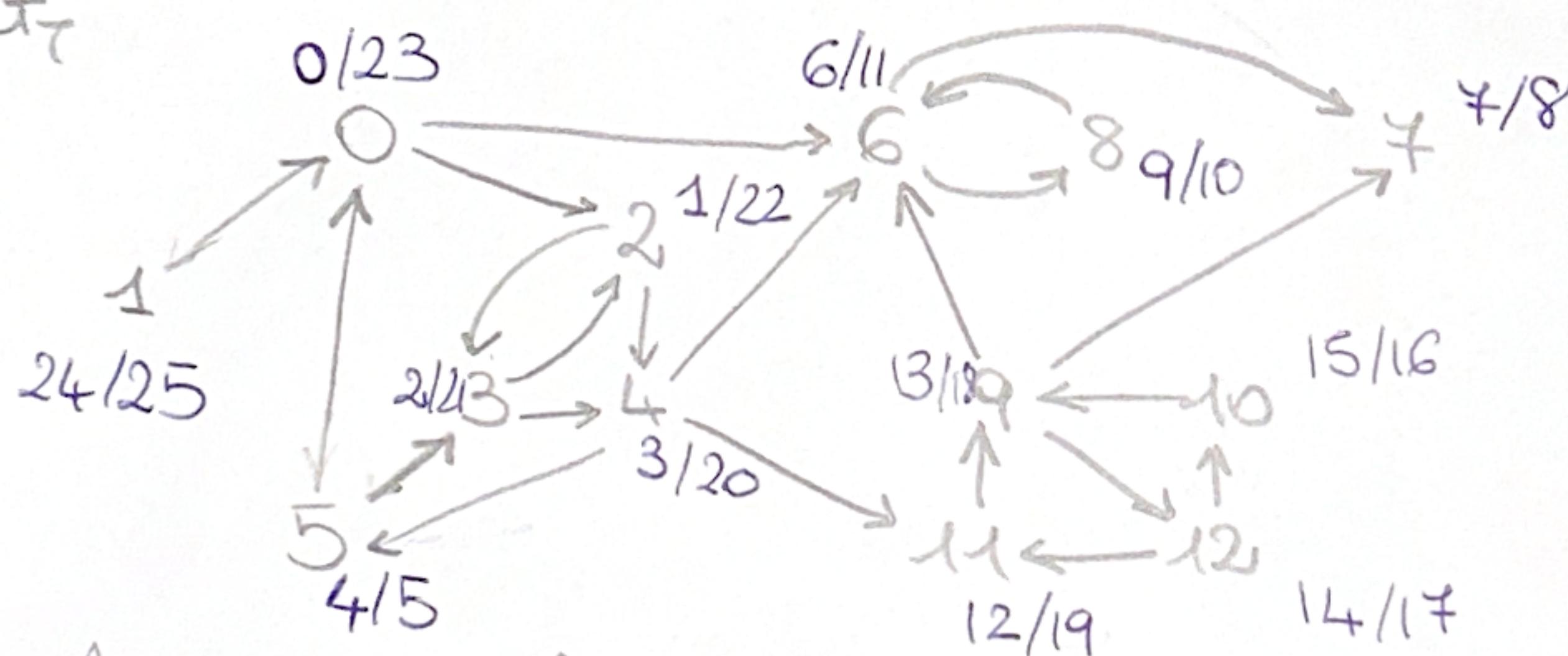
⑤ Ordinamento topologico

A partire da 1



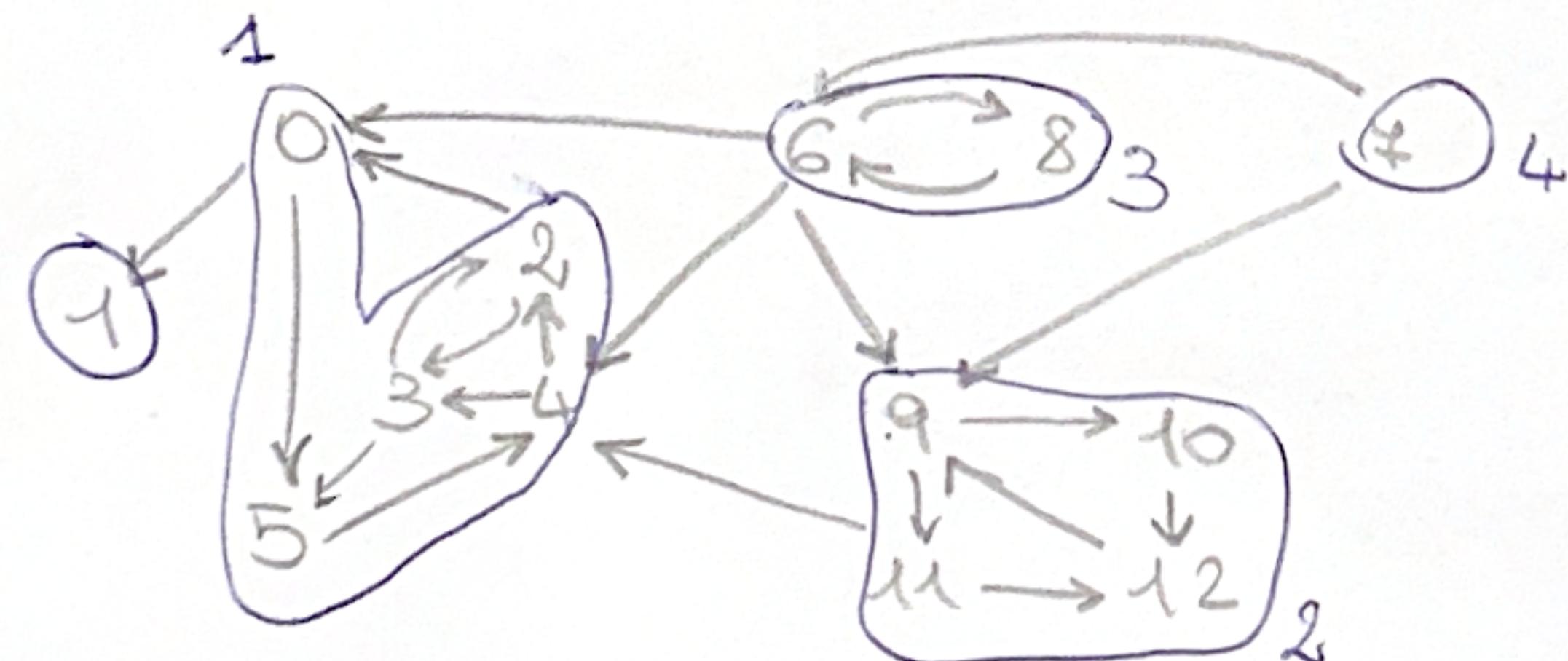
⑥ Kosaraju x fortemente connesse

G_T



A partire dal vertice 0

G



IV APPELLO 2024

① A:5 B:12 C:13 D:2 E:15 F:17 G:9 H:4 I:4

D:2 H:4 A:5 I:4 G:9 B:12 C:13 E:15 F:17

A:5 6 I:4 G:9 B:12 C:13 E:15 F:17
 D // H

I:4 G:9 11 B:12 C:13 E:15 F:17
 D // H

B:12 C:13 E:15 16 F:17
 A // G D // H

C:13 E:15 16 F:17

23
 A // G D // H

Decodifica D: 00010

" E: 111

100.00,100.00 100.00
 A F F C T F G S H

AFIGH

16 F:17

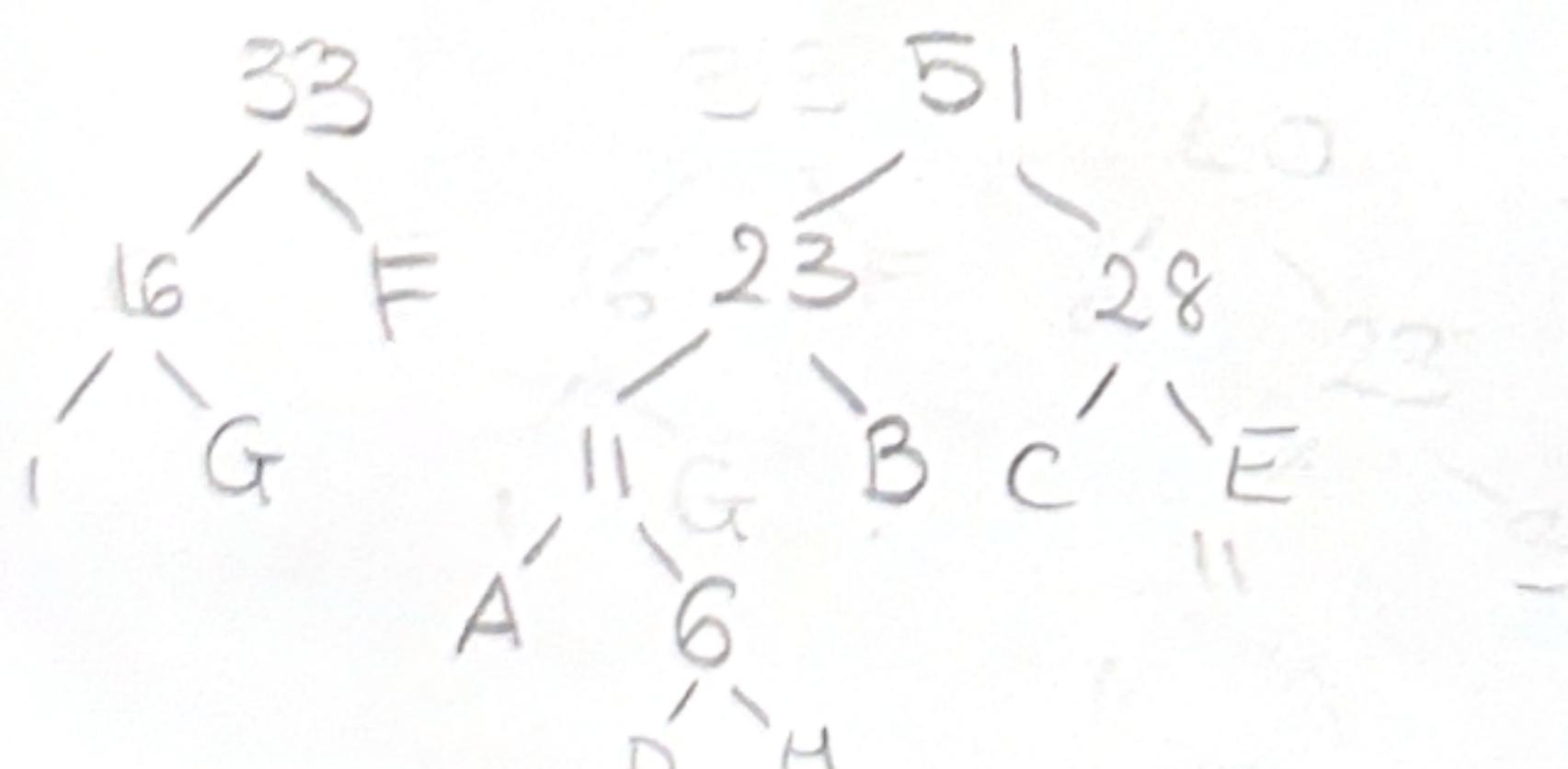
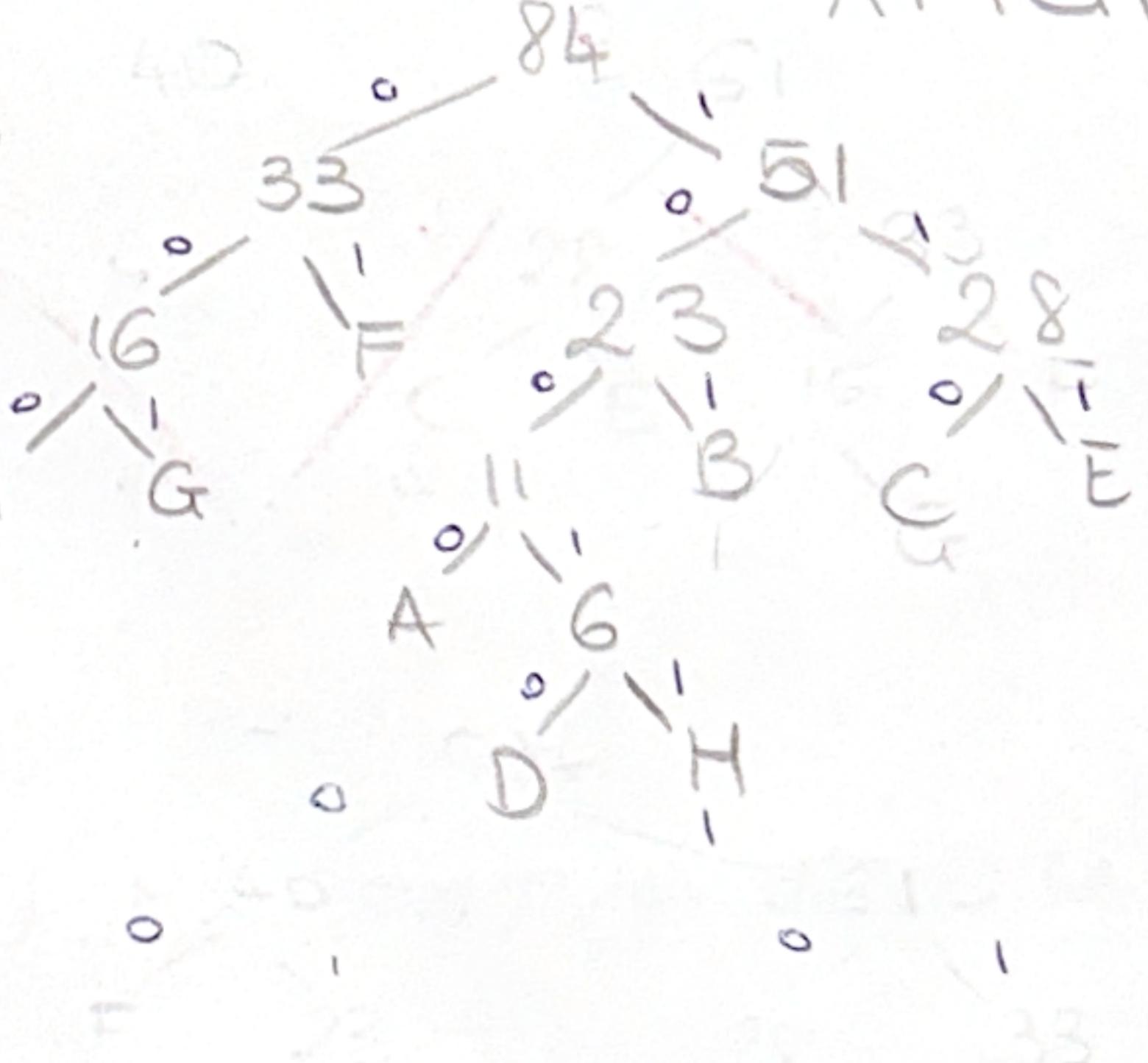
23

50000

23 B
 A // C D // H

28 C // E

33 16 F
 G



② Catene di montaggio

	0	1	2	3	4	
0	4	9	3	4	3	+ lavorazione
1	8	5	6	4	4	

	0	1	2	3	
0	2	3	1	3	
1	2	1	2	2	

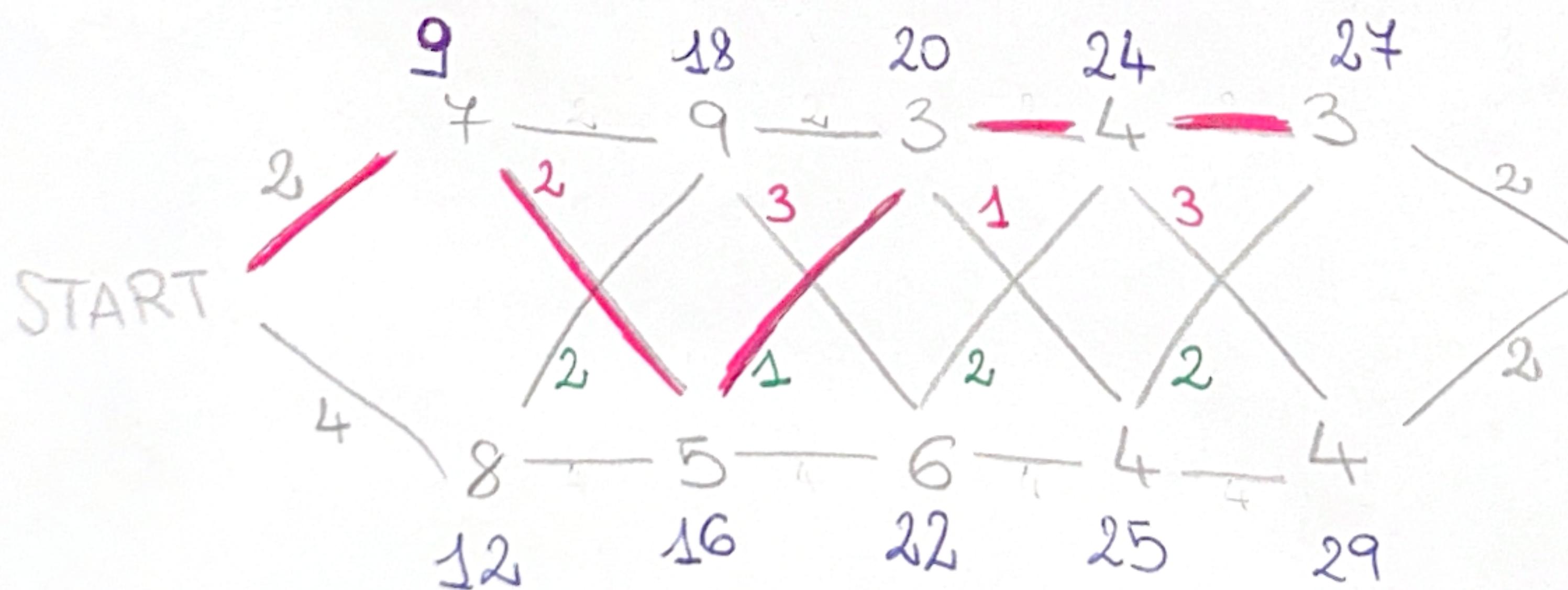
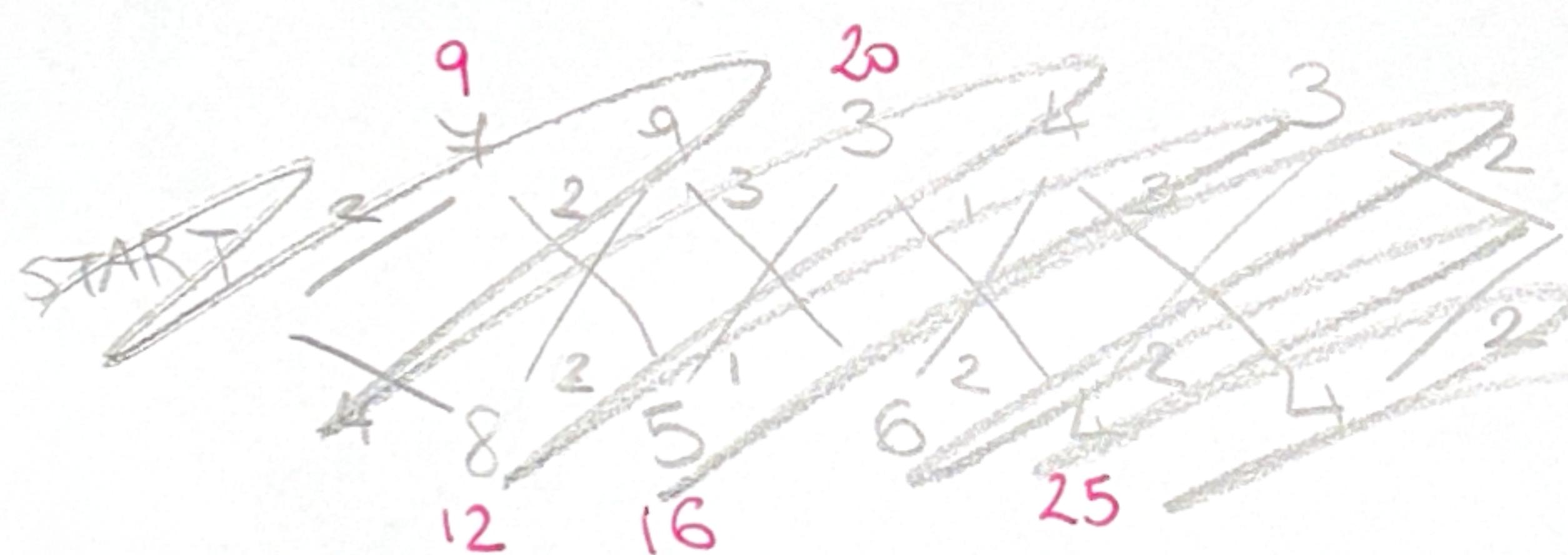
t trasferimento

	0	1	
0	1		
1	2	4	

t entrata

	0	1	
0	1		
1	2	2	

t uscita



Costo minimo : 29 (24+2)

$$S = \{S_{0,0} - S_{1,1} - S_{0,2} - S_{0,3} - S_{0,4}\}$$

3

BAC									
IN-ORDER:	B	E	D	G	F	A	C	H	J
PRE-ORDER:	A	B	D	E	F	G	C	H	I
POST-ORDER:	B	C	A	E	G	F	D	B	J



Figlio sx A: B

Figlio dx A: C

Figlio sx B: NON C'È

" dx B: D

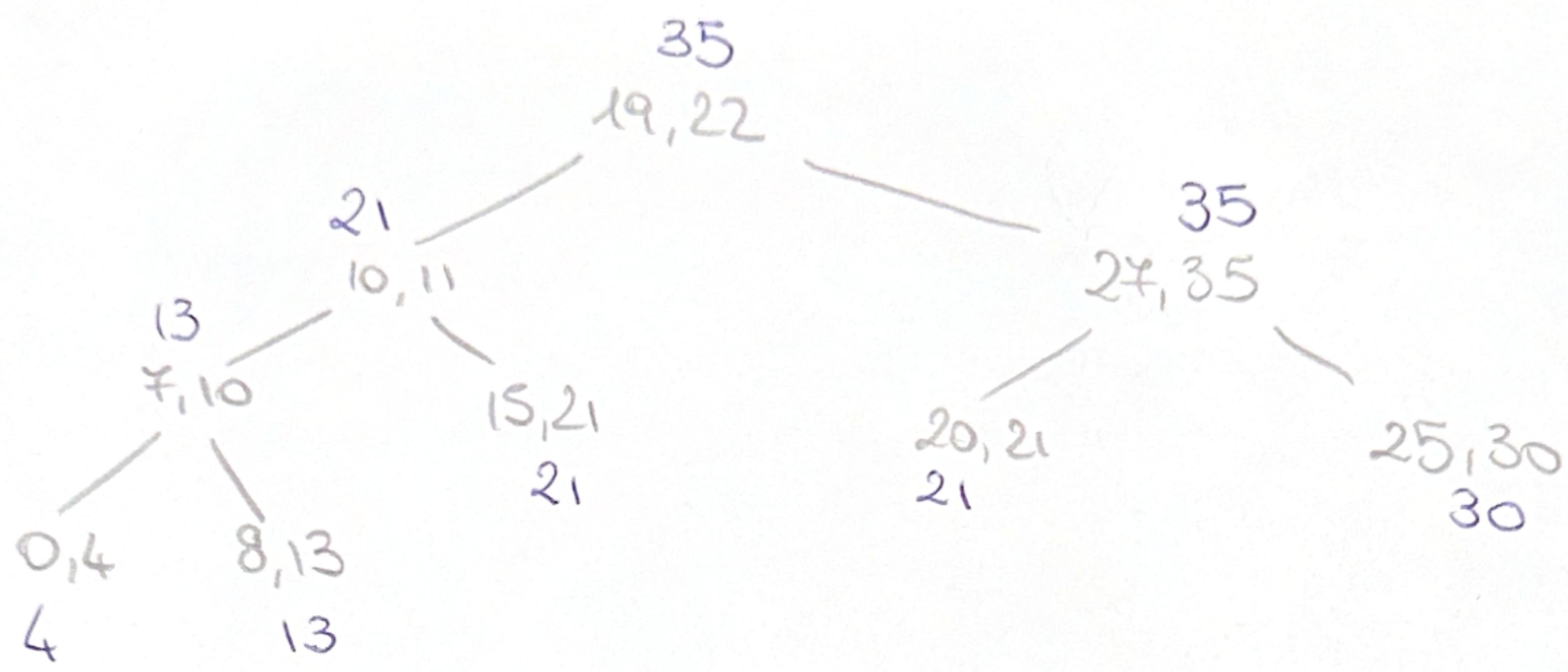
" sx C: NON C'È

" dx C: H

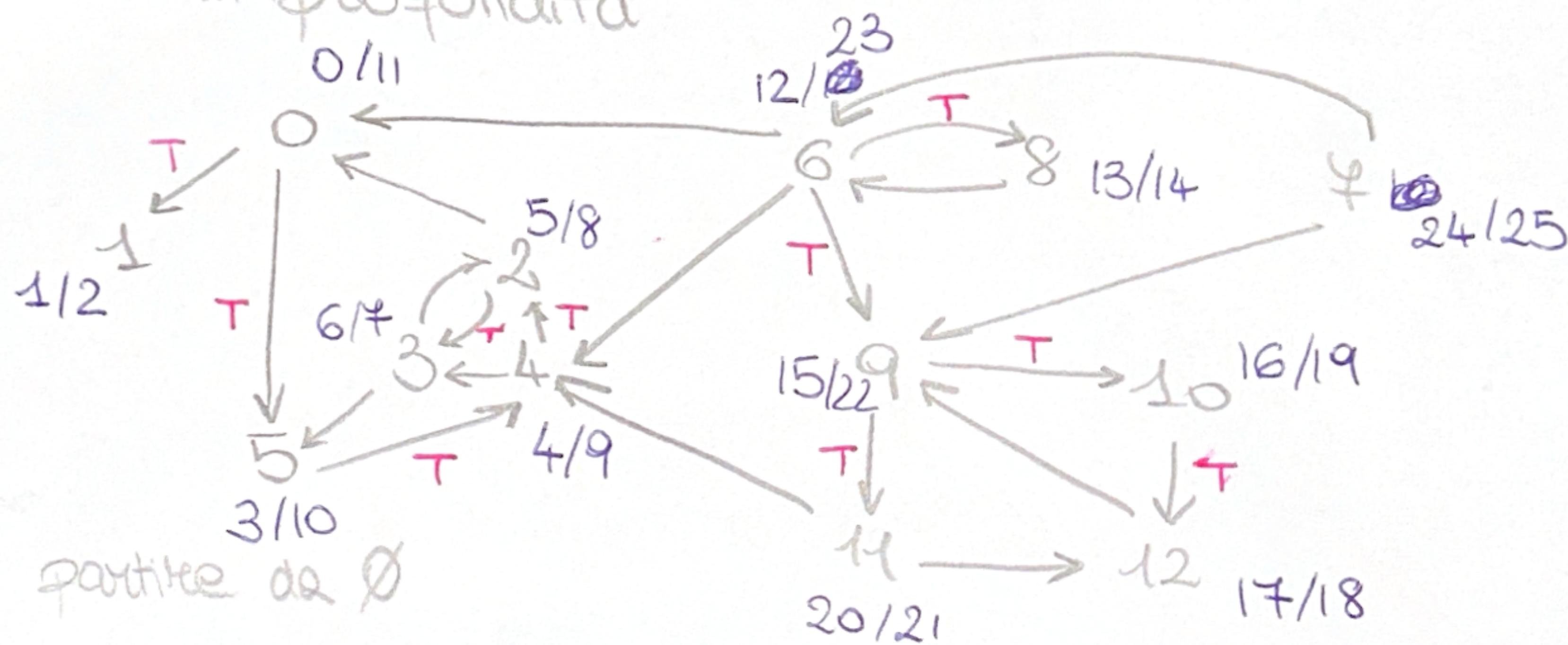
" sx I: J

" dx I: NON C'È

④ Info BST



⑤ Visita in profondità



⑥ Si etichettino gli archi

