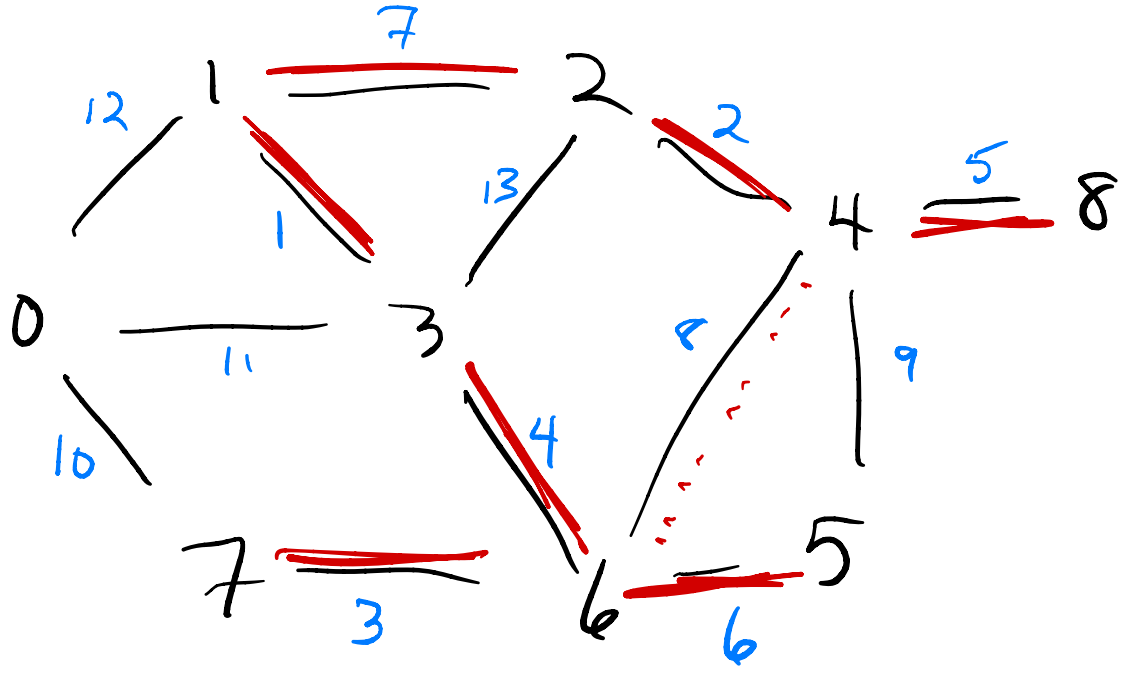
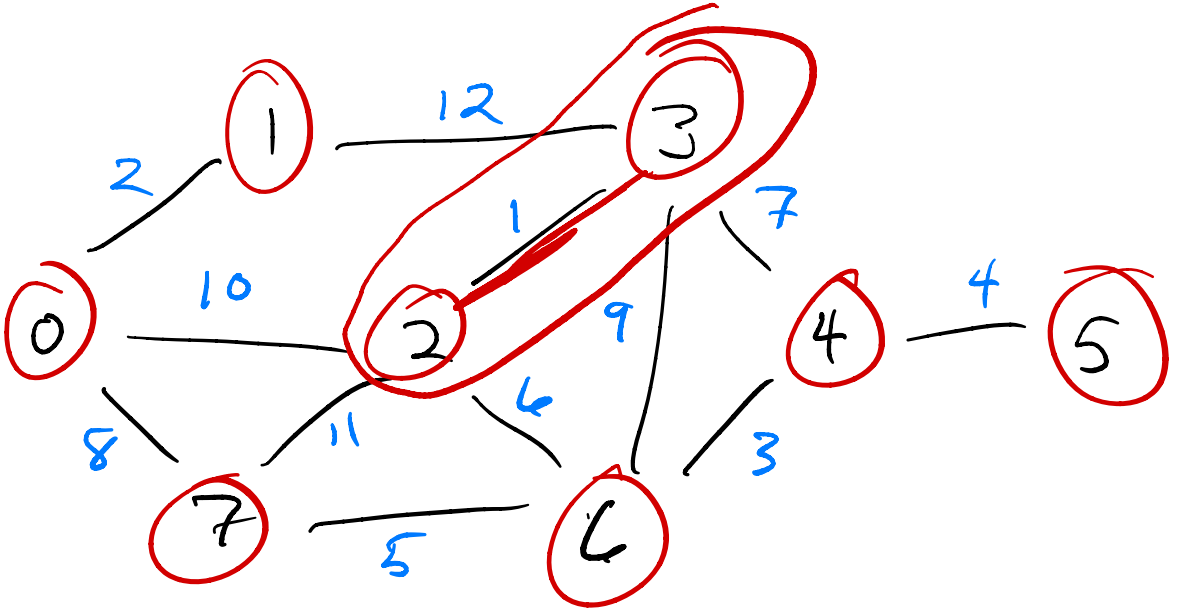
CS 252

W, 1 May 2024



Does the new edge create a cycle?

Are the endpts of the new edge in the same connected component?


0
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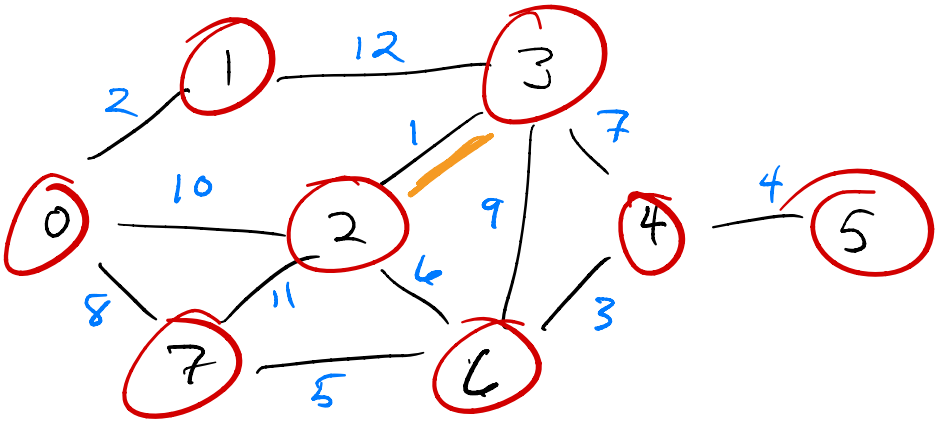
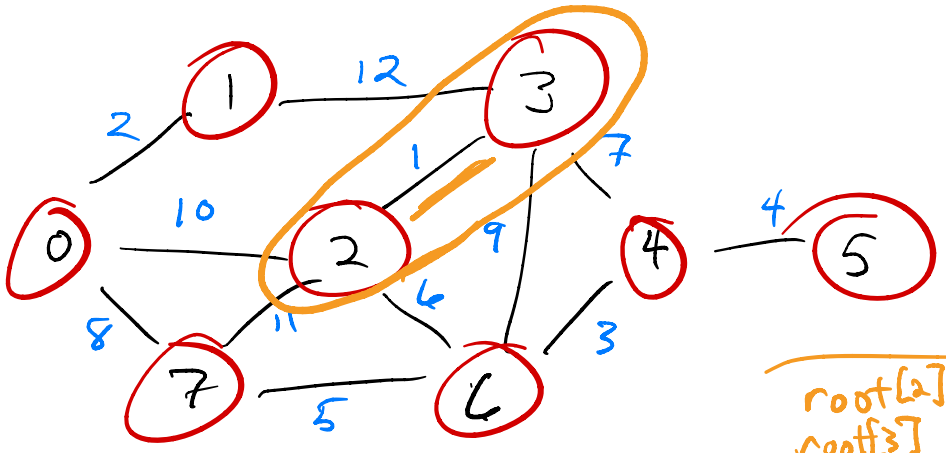


FIND(2) == 2

FIND(3) == 3

	0	1	2	3	4	5	6	7
parent	0	1	2	3	4	5	6	7
size	1	1	1	1	1	1	1	1



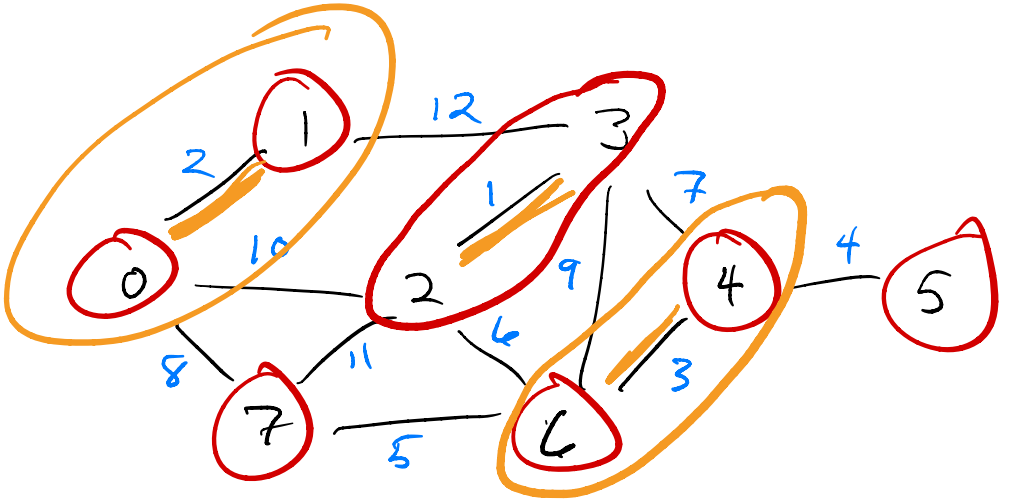
FIND(2) == 2

FIND(3) == 3

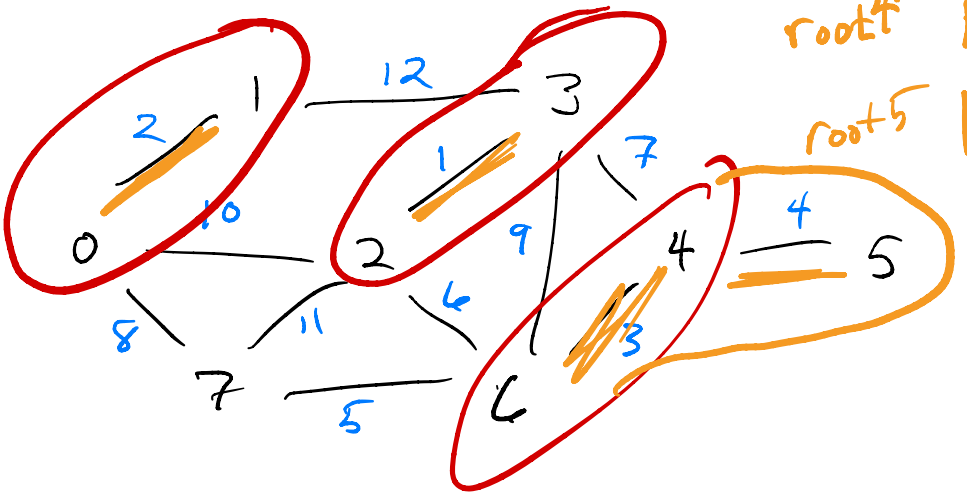
UNION(2,3)

root[2] = 2 sizes
root[3] = 3 both 1

	0	1	2	3	4	5	6	7
parent	0	1	~~2~~ 3	3	4	5	6	7
size	1	1	1	~~1~~ 2	1	1	1	1



	0	1	2	3	4	5	6	7
parent	~~0~~ 1	1	3	3	~~4~~ 6	5	6	7
size	1	~~1~~ 12	1	2	1	1	~~1~~ 12	1

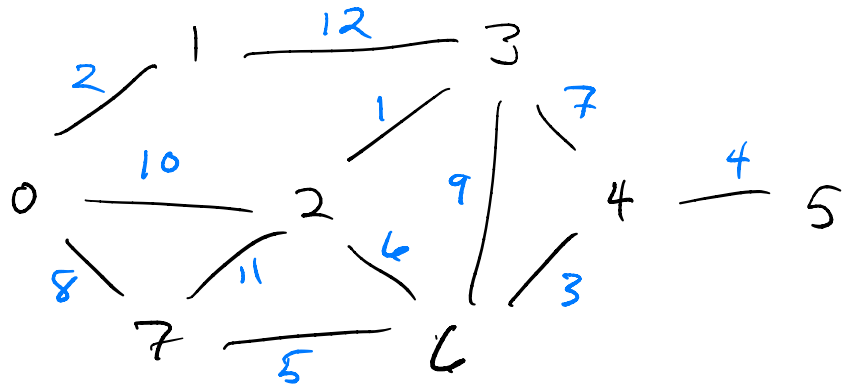


root4 FIND(4) = 6

root5 FIND(5) = 5

ro

	0	1	2	3	4	5	6	7
parent	1	1	3	3	6	~~5~~ 6	6	7
size	1	2	1	2	1	1	~~2~~ 3	1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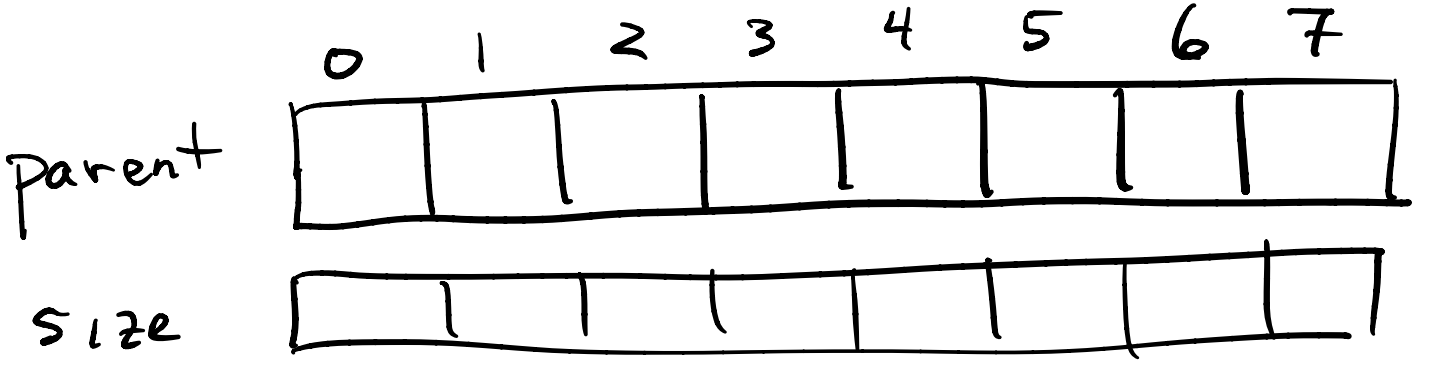
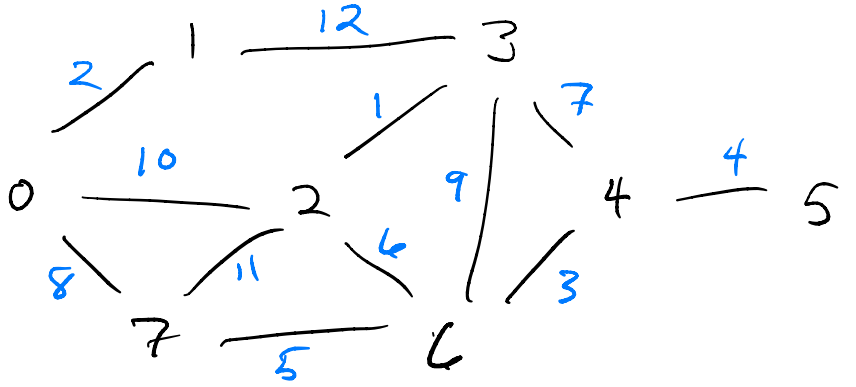

0 1 2 3 4 5 6 7
parent
size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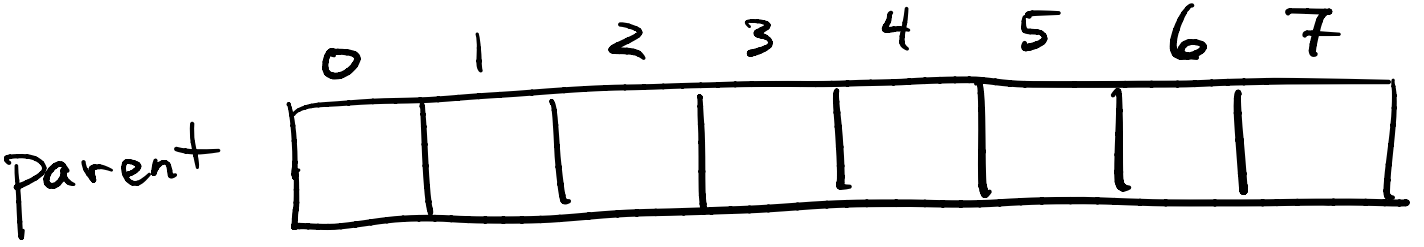
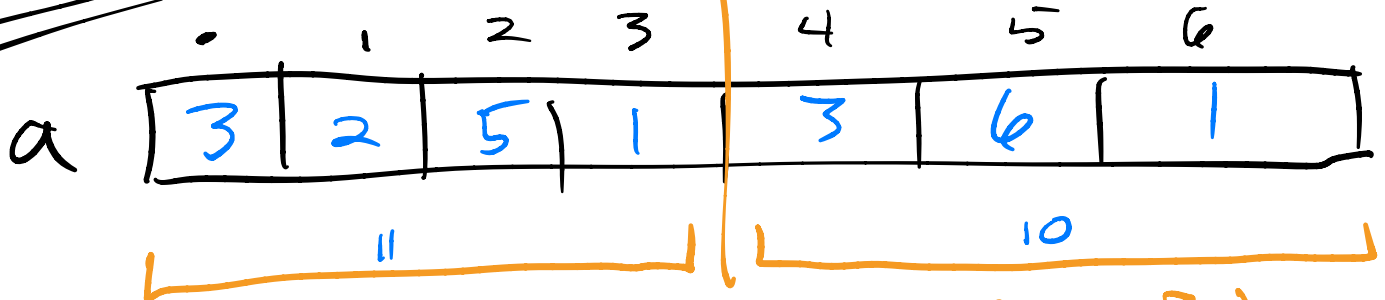

0 1 2 3 4 5 6 7
parent

sum(a) T(n) time



① sum(a[0:4]) T(n/2)

sum(a[4:]) ② T(n/2)

+ ③ O(1)

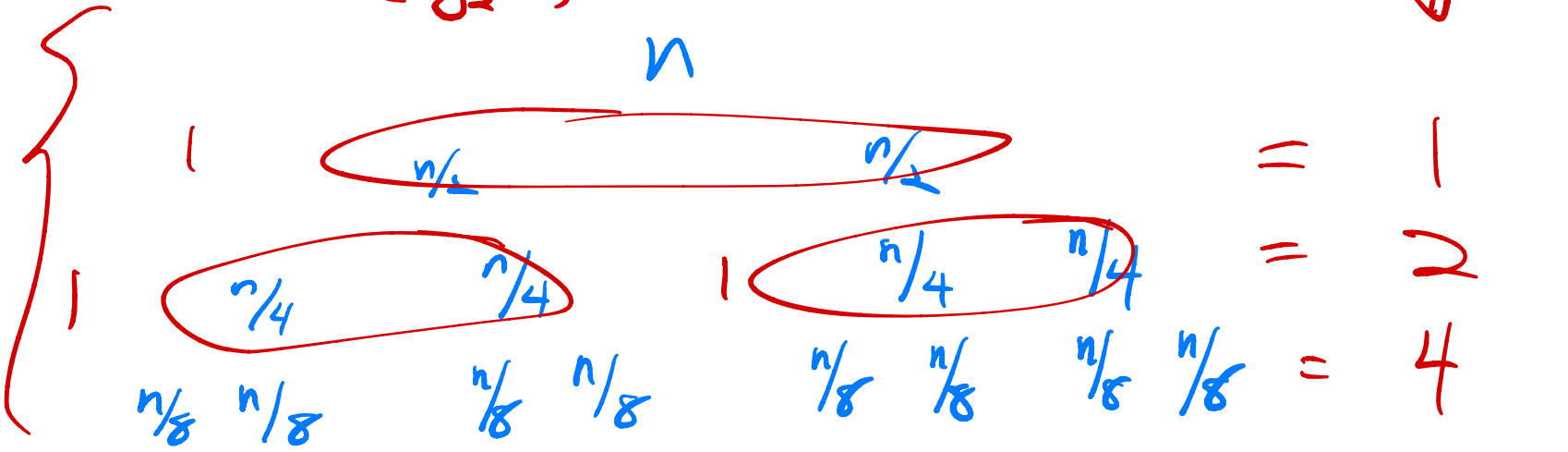
21

Recursive sum

$$T(n) \leq 2T(n/2) + 1$$

Time is all here

levels $\sim (\log_2 n) + 1$



$$1 + 2 + 4 + 8$$

$$3 = 2^2 - 1$$

$$7 = 2^3 - 1$$

$$15 = 2^4 - 1$$

$$1 + 2 + 4 + 8 + \cdots + 2^{\log_2(n)-1}$$

$$2^{\log_2(n)-1} - 1 = \frac{2^{\log_2(n)}}{2} - 1$$

$$\frac{n}{2}$$

Recursive sum(a)

$T(n)$ is $O(n)$