

Teorie

1.

Care este numărul de arce dintr-un graf conex, aciclic cu 13 noduri?

Answer: 12 ✓

$\frac{1}{2}m \cdot m-1$

12

contine o singură
componentă conexă

nu trebuie să avem
loop

rez → împărtim să fie cât mai
egale

A

6 moduri

B

7 moduri

$$\Rightarrow 6 \cdot 7 = 42$$

2.

Câte arce are un graf neorientat, complet cu 4 noduri?

Answer: 6 ✓

$\frac{1}{2}n(n-1)$

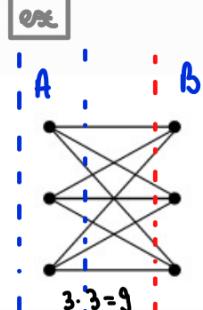
rez

3.

Care este numărul maxim posibil de arce într-un graf neorientat, bipartit cu 13 noduri?

Answer: 42 ✓

42



4.

Care este numărul maxim de arce într-un graf neorientat, aciclic cu 5 noduri?

Answer: 4

↳ arca poate avea și 0 arce

$m-1 \Rightarrow 5-1=4$

5.

Care este numărul maxim de arce într-un graf neorientat, aciclic cu 12 noduri?

Answer: 11

$12-1=11$

6.

Care este numărul minim de arce care pot fi adăugate pentru a transforma un graf cu 11 componente conexe în graf conex?

Answer: 10

10

avem 11 moduri singulare (fără niciun arc)
 $\Rightarrow 11$ componente conexe
 \Rightarrow min arce pt a deveni un graf conex
 $= 11-1 = 10$

7.

Question 5
Not yet answered
Marked out of 2.00
Flag question

Care este numărul de arce dintr-un graf conex, aciclic cu 12 noduri?

Answer: 11

$12-1=11$

11

8.

Câte arce are un graf neorientat, complet cu 12 noduri?

Answer: 66

$\frac{12 \cdot 11}{2} = 6 \cdot 11 = 66$

9.

Care este numărul de arce dintr-un graf conex aciclic cu N moduri?

Select one:

a. $N/2$

b. $N-1$

c. N

d. $N+1$

10.

Care din urmatoarele structuri este folosita eficient pentru traversarea prin cuprindere a unui graf?

Select one:

- a. Arboare
- b. Stiva
- c. Coada cu prioritati
- d. Coada

11.

Traversarea unui graf poate fi efectuata fara a retine nodurile vizitate.

Select one: *nu ș-ăr mai opri parcursul*

- True
- False

12.

Arboarele de acoperire minim este intotdeauna unic pentru un graf dat.

Select one:

- True
- False

dacă avem muchii cu aceleași pondere → aceeași sumă

Burs:

Ar putea fi selectat și arcul (5-6) de cost 5. Arboarele de acoperire minim **nu este unic**.

13.

Analiza algoritmilor

Q2 Care este numarul de arce dintr-un graf neorientat cu N noduri?

Select one:

- a. N
- b. N/2
- c. N+1
- d. N(N-1)/2

*n- arce graf
N noduri
neorientat aciclic : $(N-1)$
complet: $\frac{N(N-1)}{2}$*

Burs:

14.

Un graf biconex

Alegeți una sau mai multe opțiuni:

- a. nu contine puncte de articulație
- b. are exact două componente conexe
- c. cel putin un ciclu
- d. N-1 arce, unde N reprezinta numarul de noduri

Un graf care **nu** conține puncte de articulație se numește **graf biconex**.

- Într-un **graf biconex**, fiecare pereche de noduri este conectată prin cel puțin **două** drumuri distincte.

15.

Care este numarul maxim de arce intr-un graf neorientat aciclic de N noduri?

Select one:

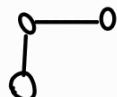
- a. N
- b. 2N-1
- c. N-1
- d. N+1

16.

Un graf conex aciclic este un arbore.

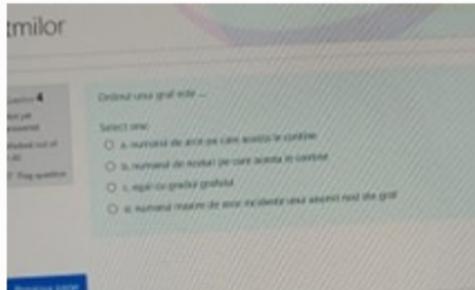
Select one:

- True
- False



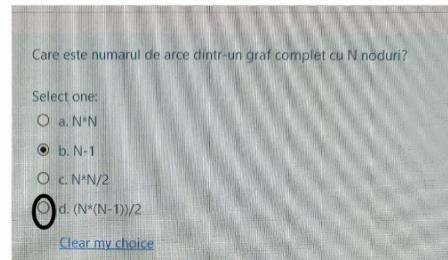
*arbore
scu
graf conex aciclic*

17

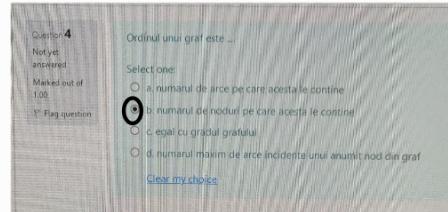


mai jos
ordinul unui
graf

18.

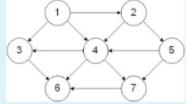


19.



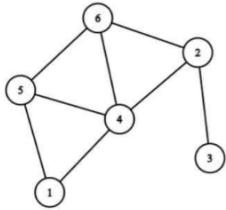
bFS

Consider the graph in the figure below. Write the order that Depth-First-Search would explore the nodes **starting from node 1**. Always explore nodes with smaller labels when given the choice. (explore 2 before 3 when you have the choice). Write down: the order in which nodes get visited, and the set of edges which form the DFS-spanning tree.



$1 \rightarrow 2 \rightarrow 4 \rightarrow 3 \rightarrow 6 \rightarrow 7 \rightarrow 5$

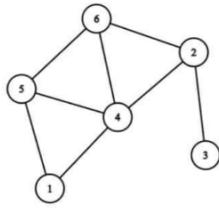
Scrieți nodurile, separate prin virgulă, rezultate după aplicarea unei parcurgeri în adâncime a grafului din imagine, pornind de la nodul 2 (nodurile adiacente vor fi parcuse în ordine crescătoare).



2,3,4,1,5,6

$2 \rightarrow 3 \rightarrow 4 \rightarrow 1 \rightarrow 5 \rightarrow 6$

Scrieți nodurile, separate prin virgulă, rezultate după aplicarea unei parcurgeri în adâncime a grafului din imagine, pornind de la nodul 6 (nodurile adiacente vor fi parcuse în ordine crescătoare).

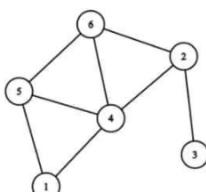


6,2,3,4,1,5

$6 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 1 \rightarrow 5$

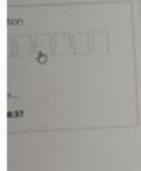
Question 4
Answer saved
Marked out of 2.00
Flag question

Scrieți nodurile, separate prin virgulă, rezultate după aplicarea unei parcurgeri în adâncime a grafului din imagine, pornind de la nodul 2 (nodurile adiacente vor fi parcuse în ordine crescătoare).



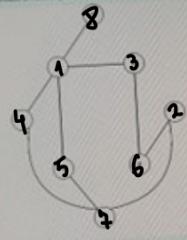
Answer: 2,3,4,1,5,6

$2 \rightarrow 3 \rightarrow 4 \rightarrow 1 \rightarrow 5 \rightarrow 6$



Se va elabora un altfel de graf care să cuprindă în adăugare, lista de numere de la numărul 2.

2



~~2 6 3 1 1 5 7 8~~
2 6 3 1 4 7 5 8

Se vor elibera celelalte patru numere care nu sunt în graful.

Exemplu:

1,2,3

4,5,6,7

8,9,10

11,12,13

14,15,16

17,18,19

20,21,22

23,24,25

26,27,28

29,30,31

32,33,34

35,36,37

38,39,40

41,42,43

44,45,46

47,48,49

50,51,52

53,54,55

56,57,58

59,60,61

62,63,64

65,66,67

68,69,70

71,72,73

74,75,76

77,78,79

80,81,82

83,84,85

86,87,88

89,90,91

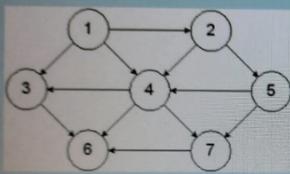
92,93,94

95,96,97

98,99,100

BFS

Consider the graph in the figure below. Write the order that **Breadth-First-Search** would explore the nodes **starting from node 1**.
 1. Always explore nodes with smaller labels when given the choice. (explore 2 before 4 when you have the choice). Write down:
 the order in which nodes get visited, and the set of edges which form the BFS-spanning tree.

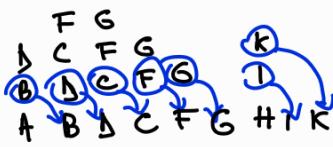


$\begin{matrix} 4 & 5 & 6 & 4 \\ 3 & 4 & 5 & 6 \\ 2 & 3 & 4 & 5 \\ 1 & \rightarrow 2 & \rightarrow 3 & \rightarrow 4 & \rightarrow 5 & \rightarrow 6 & \rightarrow 7 \end{matrix}$

În 1 et ered ed out of ag question

Să se afiseze urmatorul graf prin parcugerea prin cuprindere (a tuturor nodurilor), plecând de la indexul cel mai mic din fiecare componentă:

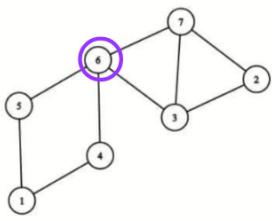
Se vor afisa cheile separate prin virgula fara spatiu.
 Exemplu:
 1,2,3



$\begin{matrix} 8 & C & F & G \\ 6 & b & c & f \\ A & B & B & C & F & G & H & I & K \end{matrix}$

Puncte articulație

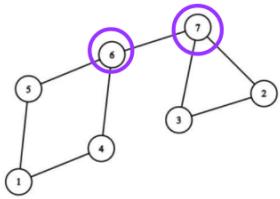
Scrieți nodurile care reprezintă puncte de articulație (ordonate crescător și separate prin virgulă) pentru graful din imagine.



Answer: 6 ✓

→ mod pe care dacă îl ștergi , graful se împarte în 2 sau mai multe componente conexe

Scrieți nodurile care reprezintă puncte de articulație (ordonate crescător și separate prin virgulă) pentru graful din imagine.



6,7

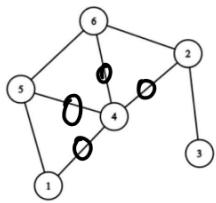


Answer: 6,7 ✓

Grad graf

Care este gradul grafului din imagine?

! = cel mai mare grad al unui nod
= nr. maxim de arce care pleacă dintr-un nod



4

4

Answer:

Question 5
If you
wered
kicked out of
the class
room
would you
be angry?
No

Care este gradul grafului din imagine?

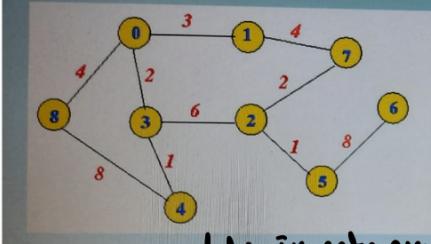
```
graph TD; 1 --- 5; 1 --- 4; 2 --- 3; 3 --- 2; 3 --- 7; 4 --- 1; 4 --- 5; 4 --- 6; 5 --- 1; 5 --- 4; 6 --- 4; 6 --- 5; 7 --- 3;
```

4

4

Prim's alg

Given the graph in the figure below, write, in order, the edges added to the MST by applying Prim's algorithm.



$v \rightarrow$ noduri in care am ajuns $N - v \rightarrow$ restul (nevizitate)

arc \rightarrow lungimea cel mai mic cost

$\{0\}$	$\{1, 2, 3, 4, 5, 6, 7, 8\}$	0-3
$\{0, 3\}$	$\{1, 2, 4, 5, 6, 7, 8\}$	3-4
$\{0, 3, 4\}$	$\{1, 2, 5, 6, 7, 8\}$	0-1
$\{0, 1, 3, 4\}$	$\{2, 5, 6, 7, 8\}$	0-8 (drescător aleas 0)
$\{0, 1, 3, 4, 8\}$	$\{2, 5, 6, 7\}$	1-7
$\{0, 1, 3, 4, 7, 8\}$	$\{2, 5, 6\}$	7-2
$\{0, 1, 2, 3, 4, 7, 8\}$	$\{5, 6\}$	2-5
$\{0, 1, 2, 3, 4, 5, 7, 8\}$	$\{6\}$	5-6
$\{0, 1, 2, 3, 4, 5, 6, 7, 8\}$		

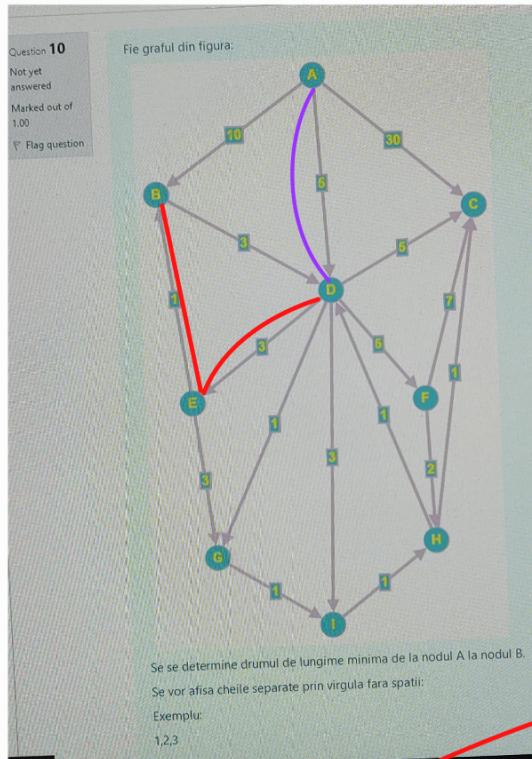
Kruskal's algorithm

moduli	arc	
$\{0\} \cup \{3\} \cup \{2\} \cup \{3\} \cup \{4\} \cup \{5\} \cup \{6\} \cup \{7\} \cup \{8\}$	2-5 (lungimea ponderata cea mai mica)	
$\{0\} \cup \{3\} \cup \{2, 5\} \cup \{3\} \cup \{4\} \cup \{6\} \cup \{7\} \cup \{8\}$	3-4	
$\{0\} \cup \{1\} \cup \{2, 5\} \cup \{3, 4\} \cup \{6\} \cup \{7\} \cup \{8\}$	0-3	
$\{0, 3, 4\} \cup \{1\} \cup \{2, 5\} \cup \{6\} \cup \{7\} \cup \{8\}$	2-7	
$\{0, 3, 4\} \cup \{1\} \cup \{2, 5, 7\} \cup \{6\} \cup \{8\}$	0-1	
$\{0, 1, 3, 4\} \cup \{2, 5, 4\} \cup \{6\} \cup \{8\}$	0-8	
$\{0, 1, 3, 4, 8\} \cup \{2, 5, 7\} \cup \{6\}$	1-7	
$\{0, 1, 2, 3, 4, 5, 7, 8\} \cup \{6\}$	5-6 (este ultimul neglijat \rightarrow modul 6)	
$\{0, 1, 2, 3, 4, 5, 6, 7, 8\}$		

Order

Order

Lungime drum minim



!graf orientat

$A \rightarrow B$

A, B, E, B

A, b, E

A, b, G, i, H

	A	B	C	b	E	F	G	H	I
b	0	10^{8+1}	$30^{5+5} 8+1$	5	$5+3$	$5+5$	$5+1$	$7+1$	$5+3^{6+1}$
T	A	E	A, B, H	A	b	b	b	i	b G

$\Rightarrow A \rightarrow B \rightarrow E \rightarrow B$ cost: $5 + 3 + 1 = 9$

	A	B	C	f	E	F	G	H	i
b	0	10^{8+1}	$30^{5+5} 8+1$	5	$5+3$	$5+5$	$5+1$	$7+1$	$5+3^{6+1}$
T	A	E	A, B	A	b	b	b	i	b G

$b - c \rightarrow 5 + 5 = 10 < 10$ actualizăm

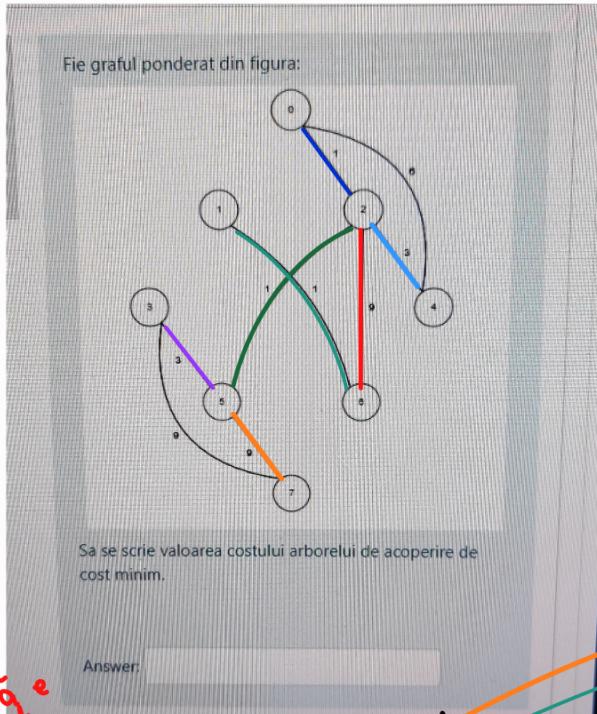
$E - b \rightarrow 8 + 1 = 9 < 10$ actualizăm

$H - c \rightarrow 8 + 1 = 9 < 10$ actualizăm

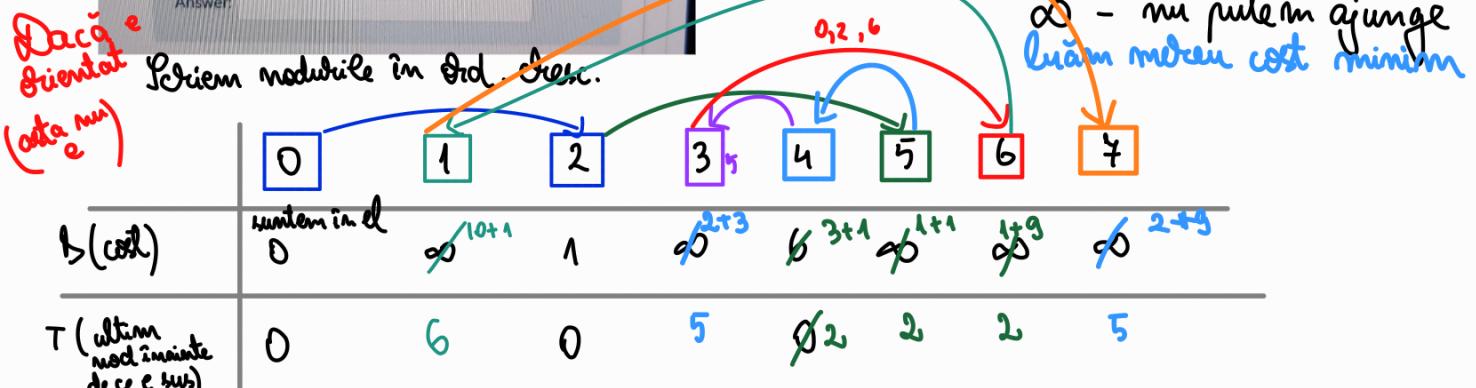
lungime drum $A \rightarrow B$

$A \xrightarrow{B} E \xrightarrow{B} B$ cost: $5 + 3 + 1 = 9$

Cet



Answer:



dacă costul e mai mare, nu actualizăm

∞ - nu putem ajunge
luăm mereu cost minimum

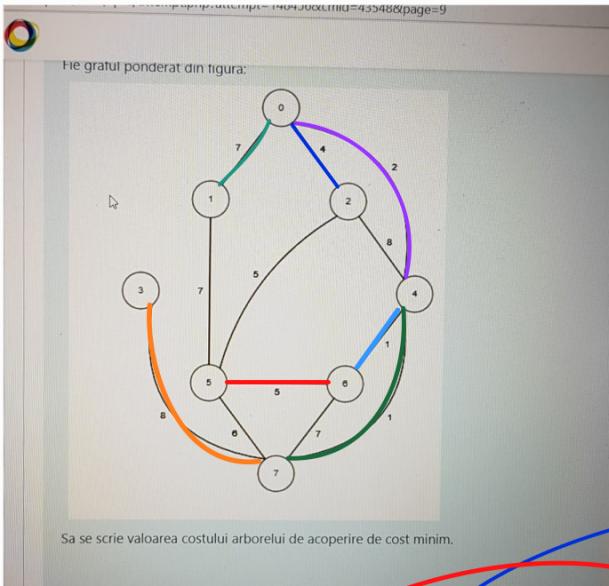
$$7 - 3 \Rightarrow 11 + 9 = 20 > 5$$

0-4 e parcursul mai deosebit

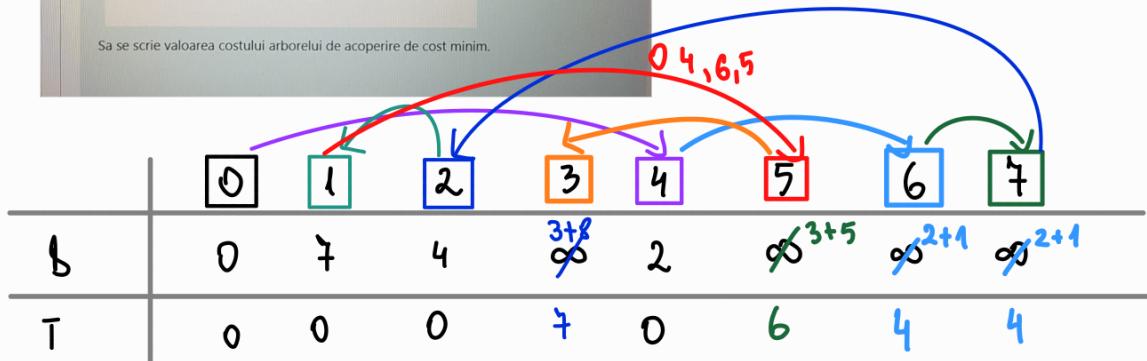
$$\text{cost: } 1 + 3 + 9 + 1 + 1 + 9 + 3 = 4 + 20 + 3 = 27$$

Dacă e nefuriat → Prim sau Kruskal

U	$N - U$	arcă	cost
$\{0\}$	$\{1, 2, 3, 4, 5, 6, 7\}$	$0-2$	1
$\{0, 2\}$	$\{1, 3, 4, 5, 6, 7\}$	$2-5$	1
$\{0, 2, 5\}$	$\{1, 3, 4, 6, 7\}$	$3-5$	3
$\{0, 2, 3, 5\}$	$\{1, 4, 6, 7\}$	$2-4$	3
$\{0, 2, 3, 4, 5\}$	$\{1, 6, 7\}$	$2-6$	9
$\{0, 2, 3, 4, 5, 6\}$	$\{1, 7\}$	$6-1$	1
$\{0, 1, 2, 3, 4, 5, 6\}$	$\{7\}$	$3-7$	9
$\{0, 1, 2, 3, 4, 5, 6, 7\}$			27



luăm în ord. cresc.



$$2-4 \rightarrow 2+8=10>4 \text{ nu actualizăm}$$

$$6-7 \rightarrow 3+7=10>3 \text{ nu actualizăm}$$

$$4-5 \rightarrow 3+6=9>8 \text{ nu actualizăm}$$

$$2-5 \rightarrow 4+5=9>8 \text{ nu actualizăm}$$

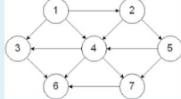
$$1-5 \rightarrow 7+7=14>8$$

$$\text{cost: } 7+4+2+1+1+5+8 = 11+4+13 = 28$$

U	N-U	arc	cost
{0}	{1,2,3,4,5,6,7}	0-4	2
{0,4}	{1,2,3,5,6,7}	4-6	1
{0,4,6}	{1,2,3,5,7}	4-7	1
{0,4,6,7}	{1,2,3,5}	0-2	4
{0,2,4,6,7}	{1,3,5}	2-5	5
{0,2,4,5,6,7}	{1,3}	0-1	7
{0,1,2,4,5,6,7}	{3}	7-3	8
			28

Recapitulare

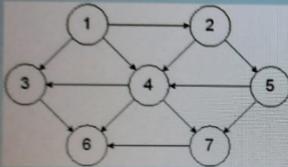
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1 → 2 → 4 → 3 → 6 → 7 → 5

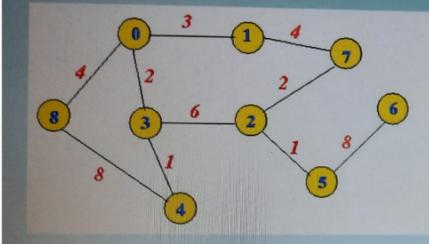
BFS

Consider the graph in the figure below. Write the order that Breadth-First-Search would explore the nodes starting from node 1. Always explore nodes with smaller labels when given the choice. (explore 2 before 4 when you have the choice). Write down the order in which nodes get visited, and the set of edges which form the BFS-spanning tree.



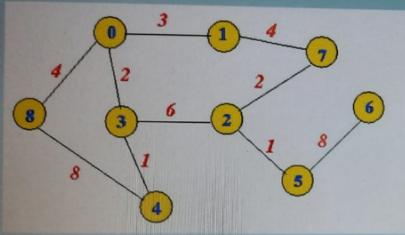
4
5
6
6
7
3
4
5
6
6
7
1
2
3
4
5
6
7

Given the graph in the figure below, write, in order, the edges added to the MST by applying Prim's algorithm.



Prim's algorithm	modifică vizitate	modifică vizitate
$\{0\}$	$\{1, 2, 3, 4, 5, 6, 7, 8\}$	$0 - 3$
$\{0, 3\}$	$\{1, 2, 4, 5, 6, 7, 8\}$	$3 - 4$
$\{0, 3, 4\}$	$\{1, 2, 5, 6, 7, 8\}$	$0 - 1$
$\{0, 1, 3, 4\}$	$\{2, 5, 6, 7, 8\}$	$0 - 8$
$\{0, 1, 3, 4, 8\}$	$\{2, 5, 6, 7\}$	$1 - 7$
$\{0, 1, 3, 4, 7, 8\}$	$\{2, 5, 6\}$	$7 - 2$
$\{0, 1, 2, 3, 4, 7, 8\}$	$\{5, 6\}$	$2 - 5$
$\{0, 1, 2, 3, 4, 5, 7, 8\}$	$\{6\}$	$5 - 6$
$\{0, 1, 2, 3, 4, 5, 6, 7, 8\}$	$\{\}$	

Given the graph in the figure below, write, in order, the edges added to the MST by applying Prim's algorithm.



Kruskal's alg.

$\{0\} \{1\} \{2\} \{3\} \{4\} \{5\} \{6\} \{7\} \{8\}$

arc -

2-5

$\{0\} \{1\} \{2,5\} \{3\} \{4\} \{5\} \{6\} \{7\} \{8\}$

3-4

$\{0\} \{1\} \{2,5\} \{3,4\} \{5\} \{6\} \{7\} \{8\}$

0-3

$\{0,3,4\} \{1\} \{2,5\} \{6\} \{7\} \{8\}$

2-7

$\{0,1,3,4\} \{2,5\} \{6\} \{7\} \{8\}$

0-8

$\{0,1,3,4,8\} \{2,5\} \{6\} \{7\}$

1-7

$\{0,1,3,4,7,8\} \{2,5\} \{6\}$

3-2

$\{0,1,2,3,4,5,7,8\} \{6\}$

5-6

$\{0,1,2,3,4,5,6,7,8\}$