230201057 Furkan Emre YILMAZ MATH 144 HW10 / P.1

Question 1. For the graph G pictured below give its adjacency list, adjacency matrix and incidence matrix.

15//

Answer 1.

3// Adjacency list

p → [b, d] ✓

b → [p, d, e] ✓

e → [b, d, a] ✓

d → [p, b, e, r, a, q] ✓

q → [d, a] ✓

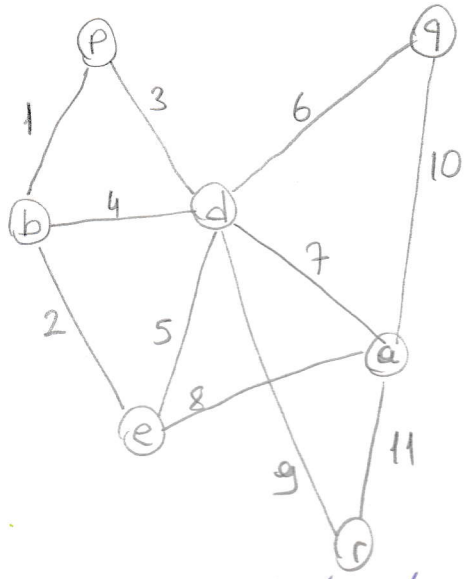
a → [q, d, e, r] ✓

r → [d, a] ✓

Adjacency Matrix:

	p ✓	b ✓	e ✓	d ✓	q ✓	a ✓	r ✓
p	0	1	0	1	0	0	0
b	1	0	1	1	0	0	0
e	0	1	0	1	0	1	0
d	1	1	1	0	1	1	1
q	0	0	0	1	0	1	0
a	0	0	1	1	1	0	1
r	0	0	0	1	0	1	0

←



	1 ✓	2 ✓	3 ✓	4 ✓	5 ✓	6 ✓	7 ✓	8 ✓	9 ✓	10 ✓	11 ✓
p	1	0	1	0	0	0	0	0	0	0	0
b	1	1	0	1	0	0	0	0	0	0	0
e	0	1	0	0	1	0	0	1	0	0	0
d	0	0	1	1	1	1	1	0	1	0	0
q	0	0	0	0	0	1	0	0	0	1	0
a	0	0	0	0	0	0	1	1	0	1	1
r	0	0	0	0	0	0	0	0	1	0	1

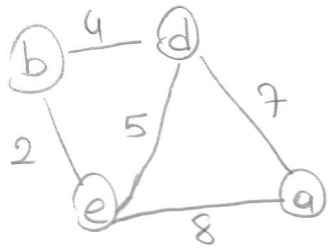
← incident matrix

Question 2. for the graph G defined in Question 1, describe the adjacency list, adjacency matrix and incidence matrix of the graph G[a,b,d,e]

3// Answer 2.

I will use same name for edges as used in Question 1.

G[a,b,d,e]



Adjacency list

b → [e, d] ✓

d → [b, e, a] ✓

e → [b, d, a] ✓

a → [d, e] ✓

Adjacency matrix ✓

	b	d	e	a
b	0	1	1	0
d	1	0	1	1
e	1	1	0	1
a	0	1	1	0

←

Incidence matrix ✓

	4	2	7	5	8
b	1	1	0	0	0
d	1	0	1	1	0
e	0	1	0	1	1
a	0	0	1	0	1

←

Question 3. Is the graph G defined in Question 1, isomorphic to the graph H given with the following adjency matrix

$$H = \begin{array}{c} \\ a \\ b \\ c \\ d \\ e \\ f \\ g \end{array} \begin{array}{c} \begin{array}{ccccccc} a & b & c & d & e & f & g \end{array} \\ \begin{pmatrix} 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 \end{pmatrix} \end{array}$$

Answer 3.

3// Yes they are isomorphic, we can map G to above graph such that preserving structure of the graph G $f: V_G \to V_H$

3 a → [b, c, e] ← f(b)

3 b → [a, c, g] ← f(e)

6 c → [a, b, d, e, f, g] ← f(d)

2 d → [c, g] ← f(g)

2 e → [a, c] ← f(p)

2 f → [c, g] ← f(r)

4 g → [b, c, d, f] ← f(a)

Question 4. For the graph G defined in Question 1. Give

3//

1. a maximal independent set that is not maximum
2. list all maximum independent sets.
3. give an independent set that is not maximal.

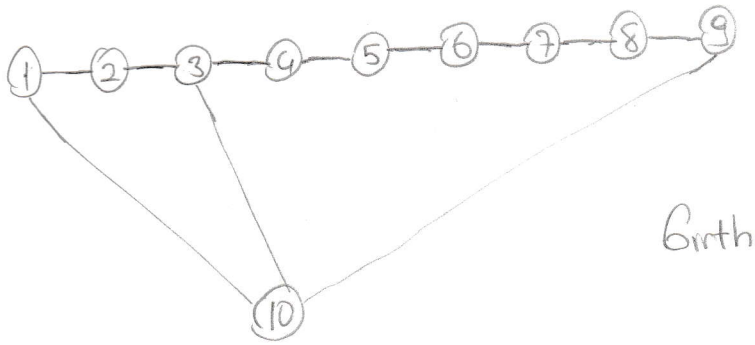
Answer 4.

1. G[b,a] ✓
2. There is only one maximum independent sets and this G[p,e,r,q] ✓
3. G[p,q] ✓

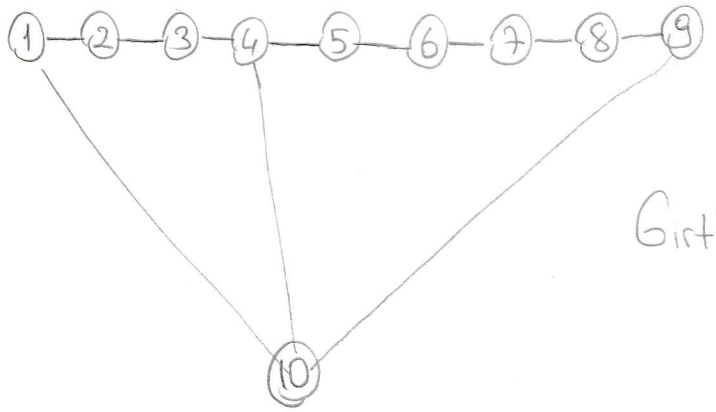
3/

Question 5. Give three pairwise non-isomorphic graphs each with degree sequence 3,3,2,2,2,2,2,2,2,2,2

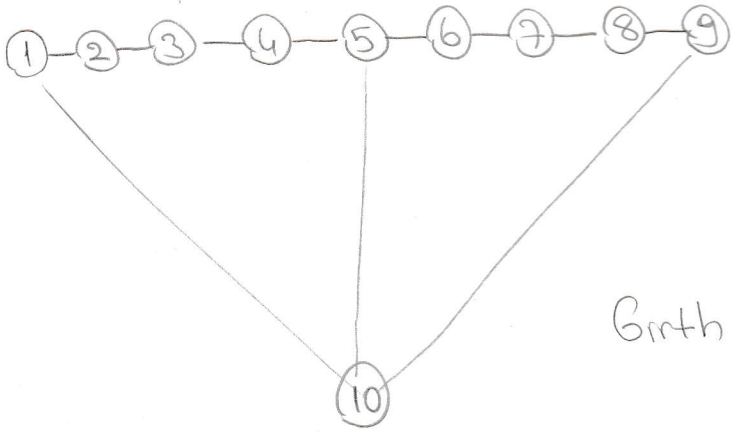
Answer 5.



Girth = 4



Girth = 5



Girth = 6

All the graphs above have same degree sequence but they are not isomorphic because isomorphic graphs has same structural properties. However above graph has different girth so we can conclude that these graphs are not isomorphic.