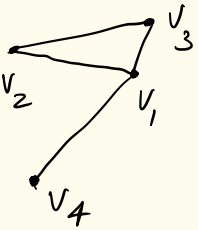
HOMEWORK 1

SUBMIT YOUR SOLUTION BY ~~TUESDAY 6th MARCH (BEGINNING OF THE CLASS)~~.
BY MONDAY 9th MARCH 2020, BY E-MAIL

EXERCISE 1

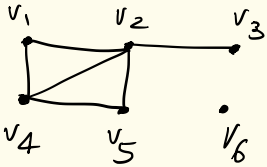
FIGURE 1

(a)



UNDIRECTED GRAPH

(b)



UNDIRECTED GRAPH

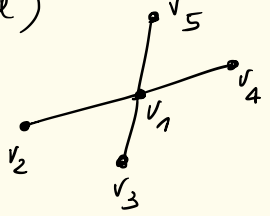
FIND FOR EACH GRAPH IN FIG. 1

1) THE DEGREE OF EACH VERTEX
2) THE EVEN VERTICES
3) THE AVERAGE DEGREE

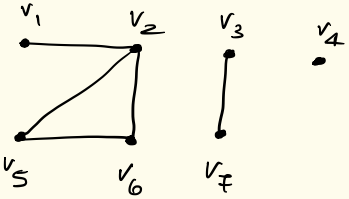
EXERCISE 2

FIGURE 2 (UNDIRECTED GRAPHS)

a)



b)



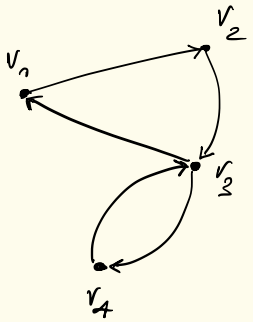
FOR EACH GRAPH OF FIG. 2 :

1) FIND THE ISOLATED VERTICES
2) SAY IF THEY ARE COMPLETE
3) FIND A PATH FROM v_1 TO v_5
4) SAY IF THEY ARE CONNECTED
5) FIND THE CONNECTED COMPONENTS OF v_1 AND OF v_3 IN EACH GRAPH
6) THE ADJACENCY MATRIX A ASSOCIATED TO EACH GRAPH

EXERCISE 3

FIGURE 3 (DIRECTED GRAPH)

$G = (V, E)$



FIND:

1) THE VERTEX SET V
2) THE EDGE SET E
3) THE ADJACENCY MATRIX A
4) THE IN, OUT, AND TOTAL DEGREE FOR EACH NODE
5) FIND A PATH

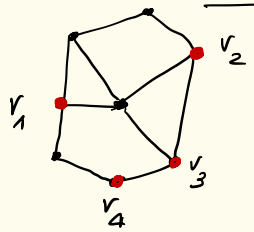
EXERCISE 4

ARE THE FOLLOWING TWO GRAPHS ISOMORPHIC ?

FIGURE 4

EXERCISE 5

FIGURE 5



FIND FOR THE GRAPH IN FIG. 5 :

1) THE DISTANCES : $d(v_1, v_2)$, $d(v_1, v_3)$, $d(v_1, v_4)$

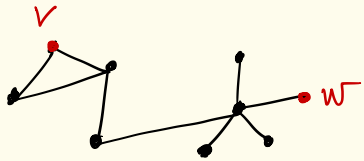
2) THE DIAMETER

3) THE CENTERS

4) THE RADIUS

EXERCISE 6

FIGURE 6



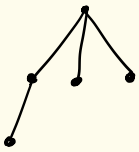
1) FIND THE CUT POINT OF THE GRAPH IN FIG 6

2) REMOVE THE CUT POINT AND THE EDGES INCIDENT TO THE CUT POINT, AND FIND THE CONNECTED COMPONENTS FOR v AND w

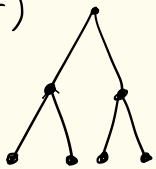
EXERCISE 7

FIGURE 7

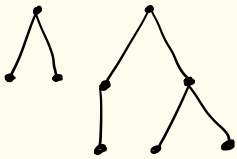
a)



b)



c)



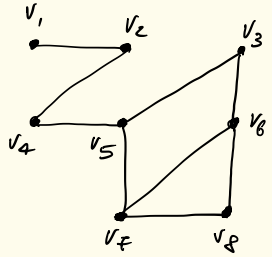
FIND WHICH GRAPHS IN FIG. 7

1) ARE TREES
2) ARE FORESTS
3) ARE BINARY TREE

EXERCISE 8

LET $G=(V,E)$ BE AN UNDIRECTED GRAPH WITH AN ORDERED VERTEX SET $V=\{v_1, v_2, \ldots, v_8\}$ AND DIAGRAM IN FIG. 8.

FIGURE 8



FOR THE GRAPH IN FIG. 8 :

1) FIND THE ADJACENCY MATRIX

2) FIND THE NUMBER OF CHAINS OF LENGTH 2 AND 4

3) ASSUME THE FOLLOWING BIJECTION φ :

i	$\varphi(i)$
1	2
2	1
3	3
4	4
5	6
6	5
7	7
8	8

FIND THE PERMUTATION MATRIX P_φ

4) FIND THE NUMBER OF CHAINS OF LENGTH 2 AND 4 IN THE RELABELLED GRAPH $\tilde{G}=(\tilde{V}, \tilde{E})$ WHERE $\tilde{V}=\{\tilde{v}_1, \tilde{v}_2, \ldots, \tilde{v}_8\}$ WITH $\tilde{v}_i = v_{\varphi(i)}$

EXERCISE 9

LET $G=(V,E)$ BE A NULL GRAPH WITH n VERTICES, I.E. $|V|=n$, $E=\emptyset$

1) FIND THE NUMBER OF EDGES
2) FIND THE NUMBER OF FACES
3) IS G A PLANAR GRAPH?
4) FIND THE VALUE OF $|V|-|E|+|F|$
5) WHY THE EULER'S FORMULA DOES NOT APPLY TO G?

EXERCISE 10

FIND THE LEAVES OF THE GRAPH IN FIG. 9 ASSUMING THE VERTEX a IS THE ROOT.

FIGURE 9