UNIVERSITI TEKNOLOGI MALAYSIA

ASSIGNMENT 3

– GROUP 3 –

SECTION 03 - 2024/2025

SECI1013 (DISCRETE STRUCTURE)

LECTURER : DR. MUHAMMAD ALIIF BIN AHMAD

DATE OF SUBMISSION : 29th DECEMBER 2024

	NAME:	MATRICS NO.
1.	IDA YATULLAILIYEH BINTI AMRUN	A24CS0084
2.	PARTHIV GUNALAN	A24CS0178
3.	AHMAD WILDAN BIN MAZANI	A24CS0222
4.	AHMED ABDELHADI MOHAMED ZIEN	A22EC4002

Chapter 3 (Question 1)

a i) $P(M)$ = Probability of students taking a math

$P(C)$ = Probability of taking chemistry

$P(B)$ = Probability of taking Biology

$P(Ph)$ = Probability of taking Physics

$P(M) = 3(P(C))$

$P(C) = 2P(B)$

$P(B) = P(Ph)$

$P(M) = 3P(C)$

$= 3 \times 2 \times P(B)$

$= 3 \times 2 \times P(B)$

$= 6 \times P(B)$

$P(M) + P(C) + P(B) + P(Ph) = 1$

$6P(B) + 2P(B) + P(B) + P(B) = 1$

$10P(B) = 1$

$P(B) = \frac{1}{10} = 0.1$

$P(Ph) = P(B)$

$= 0\ 1$

$P(C) = 2P(B)$

$= 2 \times 0\ 1$

$= 0\ 2$

$P(M) = 6P(B)$

$= 6 \times 0.1$

$= 0\ 6$

a ii) $P(B) + P(M)$

$= 0.1 + 0\ 6$

$= 0.7$

2i. $P(A \cup B) = P(A) + P(B)$

$P(A \cup B) = 0.4 + 0.5$

$P(A \cup B) = 0.9$

ii. $P(A') = 1 - P(A)$

$P(A') = 1 - 0.4$

$P(A') = 0.6$

iii. $P(A' \cap B) = P(B)$

$P(A' \cap B) = 0.5$

Chapter 3:

3. P(winning 1^{st} prize) = $\frac{1}{100}$ = 0.01

P(win 2^{nd} prize & lose 1^{st} prize) = $\frac{99}{100} \times \frac{1}{99}$

= 0.01

P(win 3^{rd} prize & lose 1^{st}, 2^{nd} prize) = $\frac{1}{98} \times \frac{98}{99} \times \frac{99}{100}$

= 0.01

P(winning any of the prizes) = P(win 1^{st} prize) + P(win 2^{nd} prize)

+ P(win 3^{rd} prize)

= 0.01 + 0.01 + 0.01

= 0.03

4i. $P(N)$ = probability male chosen has pneumonia

$P(N) = 0.4$

$P(N') = 1 - P(N)$

$= 1 - 0.4 = 0.6$

ii. $P(N) = 0.4$

$P(N') = 0.6$

$P(S)$ = probability of the male chosen is a smoker.

$P(S|N) = 0.8$

$P(S'|N) = 1 - P(S|N)$

$= 1 - 0.8$

$= 0.2$

$P(S|N') = 0.3$

$P(S'|N') = 1 - P(S|N')$

$= 1 - 0.3$

$= 0.7$

Find $P(N|S)$

$$P(N|S) = \frac{P(S|N) \times P(N)}{P(S)}$$

$$P(S) = [P(S|N) \times P(N)] + [P(S|N') \times P(N')]$$

$$P(N|S) = \frac{P(S|N) \times P(N)}{[P(S|N) \times P(N)] + [P(S|N') \times P(N')]}$$

$$P(N|S) = \frac{P(S|N) \times P(N)}{[P(S|N) \times P(N)] + [P(S|N') \times P(N')]}$$

$$P(N|S) = \frac{P(S|N) \times P(N)}{[P(S|N) \times P(N)] + [P(S|N') \times P(N')]}$$

$$= \frac{0.8 \times 0.4}{[0.8 \times 0.4] + [0.3 \times 0.6]}$$

$$= \frac{16}{25} = 0.64$$

Chapter 3 (Question 5)

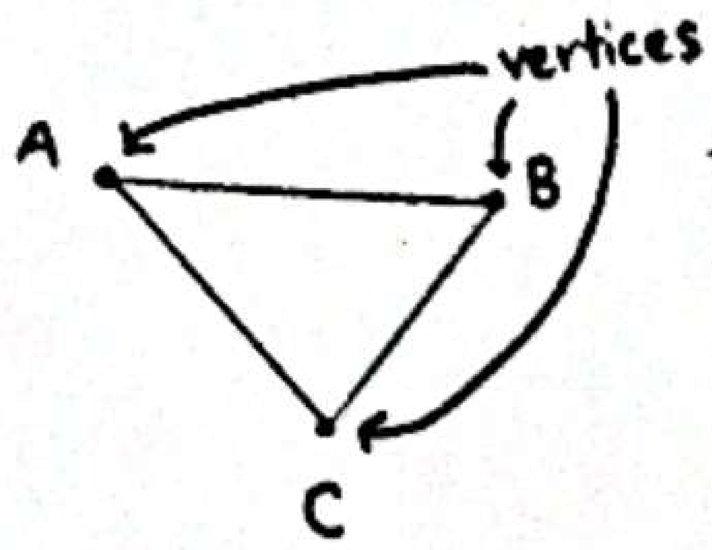
$P(\text{Black1}) = \frac{1}{3}$ ⇒ First Pick

$P(\text{Black2}) = \frac{1}{3}$ ⇒ Second pick remain same since there are 3 color options

$$P(\text{Black1}, \text{Black2}) = P(\text{Black1}) \times P(\text{Black 2})$$
$$= \frac{1}{3} \times \frac{1}{3}$$
$$= \frac{1}{9}$$

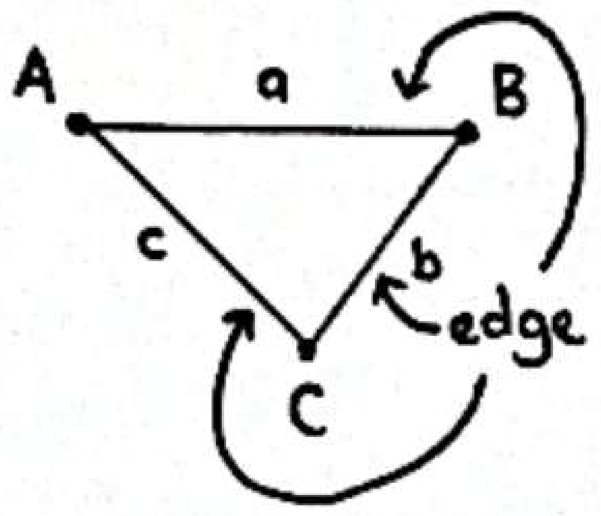
Chapter 4

1a. Vertices



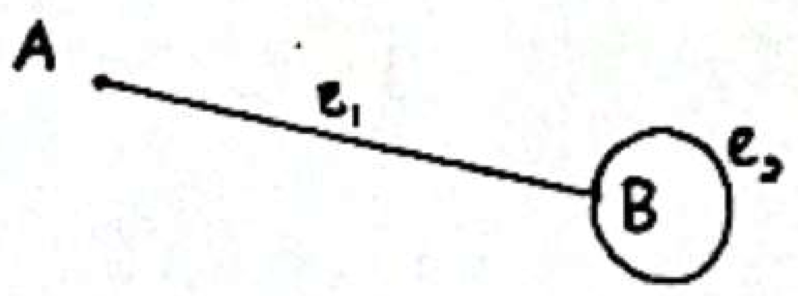
- A, B and C are vertices
- vertices are the dots at the endpoint of the connected lines

1b. Edges



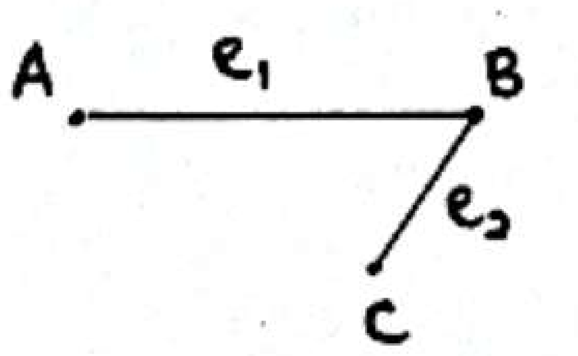
- a, b and c are edges
- edges are the lines that are connected to vertices

1c. Adjacent Vertices



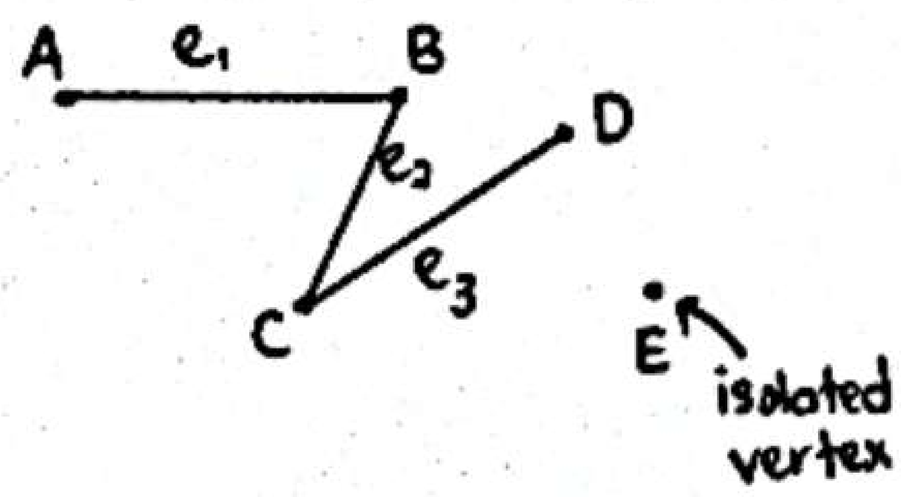
- A and B are adjacent vertices as they are connected to the same edge
- B ~~is also~~ alone is also an adjacent vertice because there is a loop. Hence it is adjacent to itself.

1d. Incident Edge



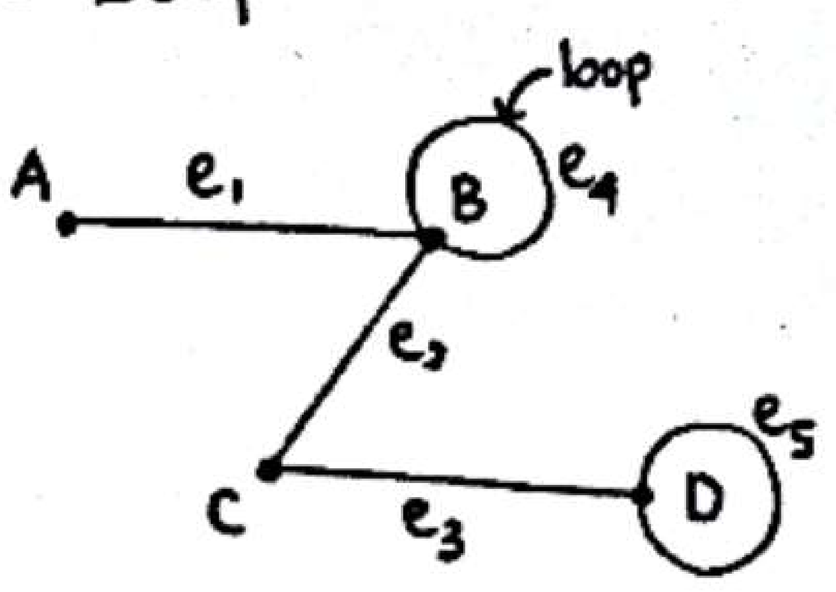
- An edge that is connected to two vertices is said to be incident to both vertices
- e_1 is incident to A and B

1e. Isolated Vertex



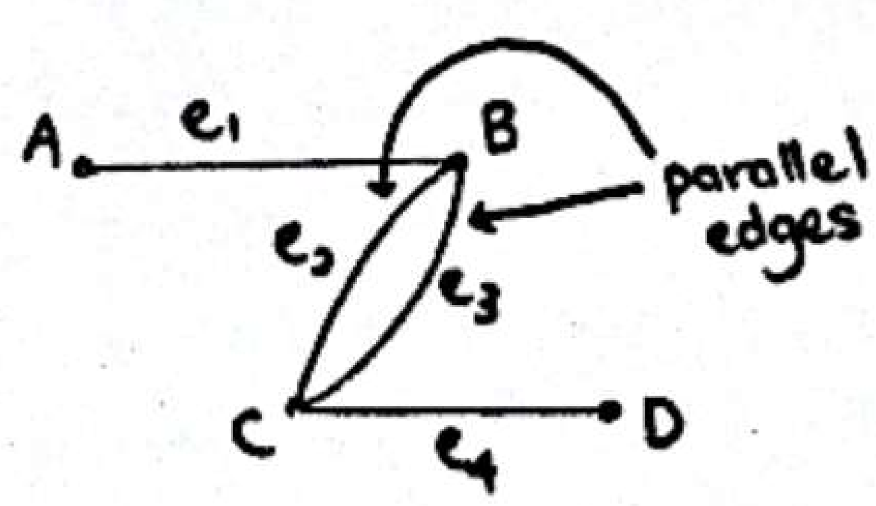
- E is an isolated vertex because there's no edges connected to this vertex

1f. Loop



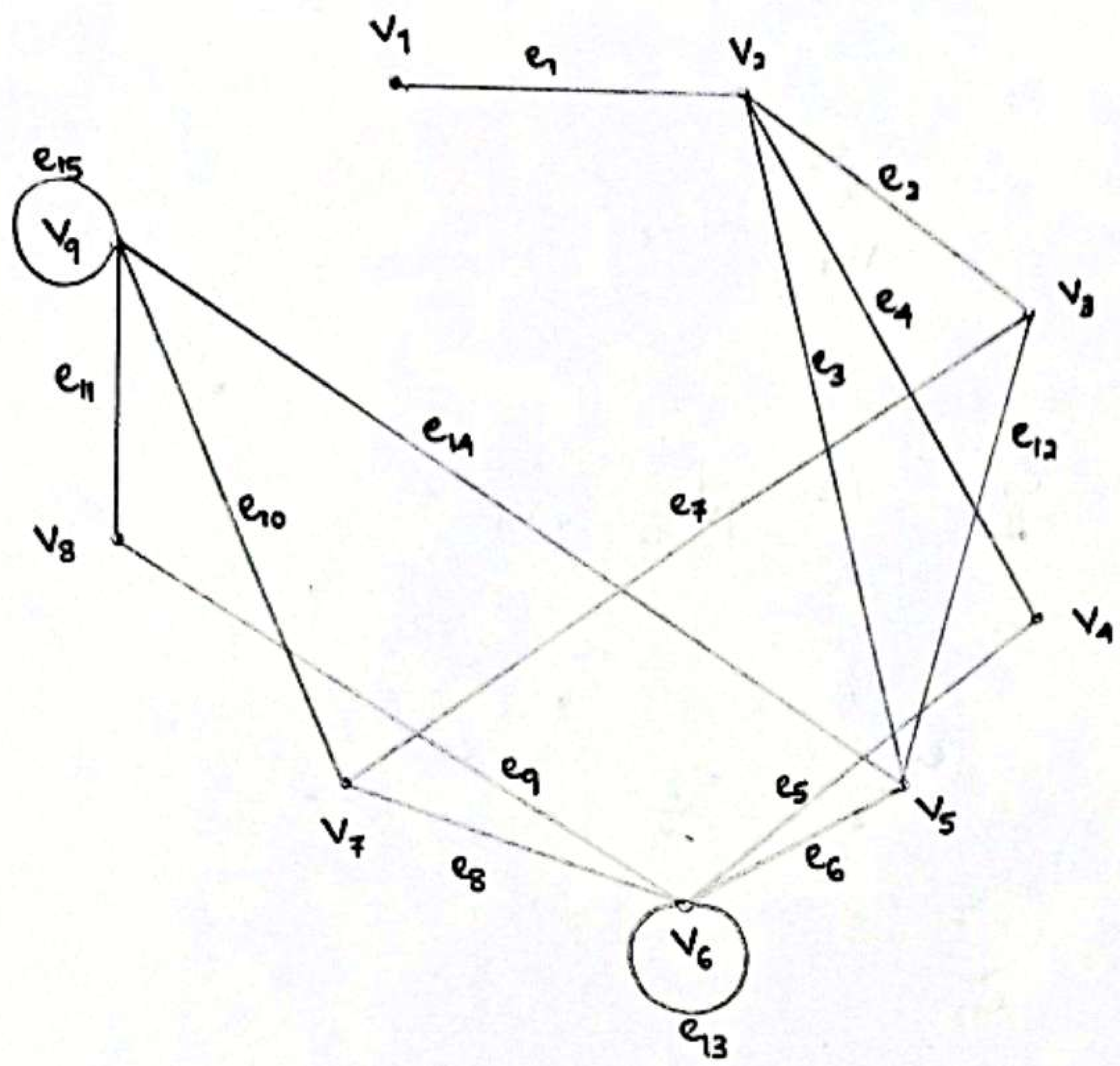
- e_4 and e_5 are loops
- an edge that is connected to a single vertex on both ends is called a loop

1g. Parallel Edges



- e_2 and e_3 are parallel edges
- parallel edges are two edges that are connected to the same two vertices.

2a.



2ai.

Vertex	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9
Degree	1	4	3	2	4	6	3	2	5

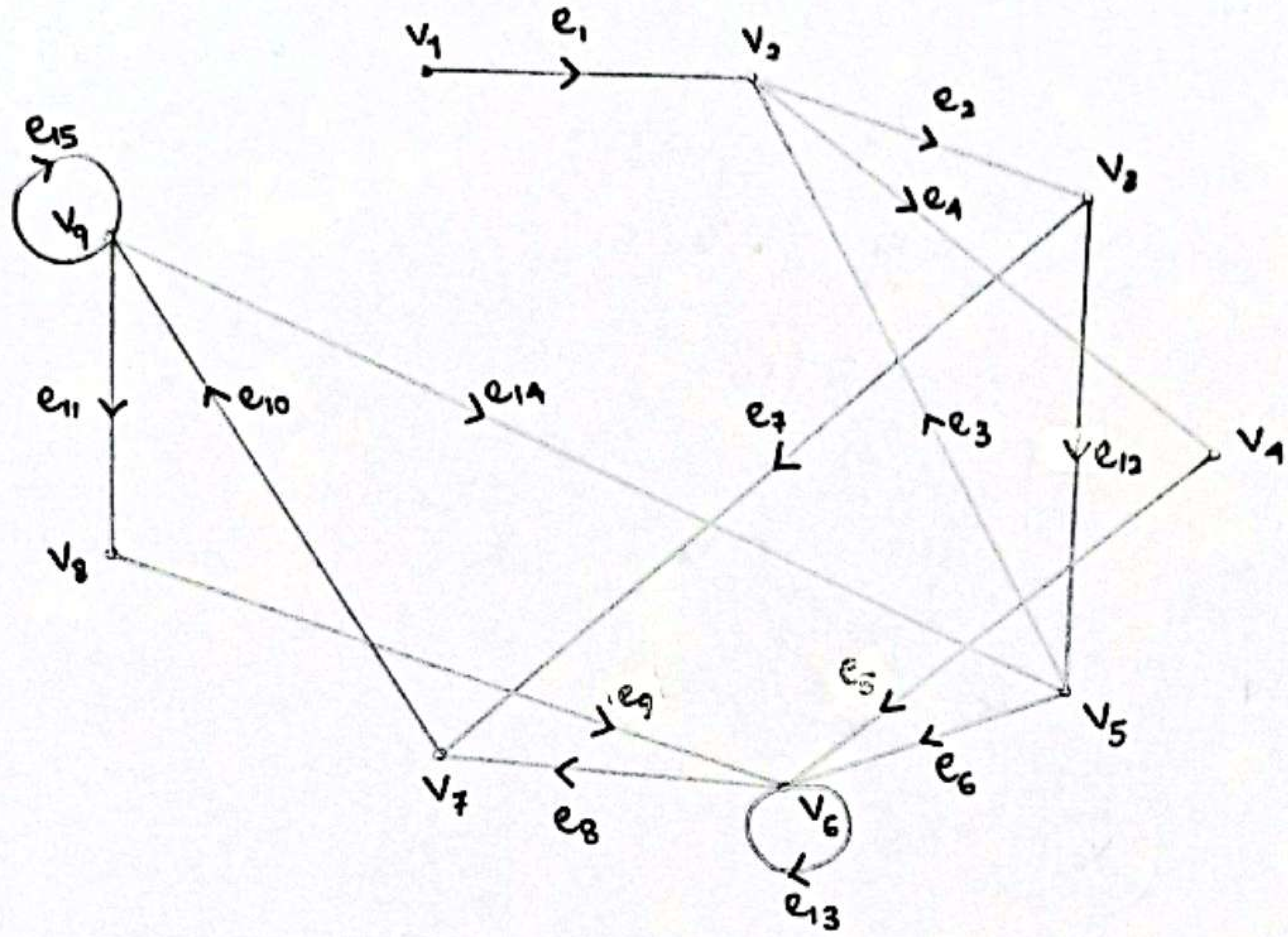
2aii. Adjacent matrix:

$$\begin{array}{c} \\ V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \\ V_6 \\ V_7 \\ V_8 \\ V_9 \end{array}
\begin{array}{c}
\begin{array}{ccccccccc} V_1 & V_2 & V_3 & V_4 & V_5 & V_6 & V_7 & V_8 & V_9 \end{array} \\
\begin{bmatrix}
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1
\end{bmatrix}
\end{array}$$

Incident matrix:

$$\begin{array}{c} \\ V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \\ V_6 \\ V_7 \\ V_8 \\ V_9 \end{array}
\begin{array}{c}
\begin{array}{ccccccccccccccc} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 & e_7 & e_8 & e_9 & e_{10} & e_{11} & e_{12} & e_{13} & e_{14} & e_{15} \end{array} \\
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 & 2 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 & 2
\end{bmatrix}
\end{array}$$

2b.



2bi.

Vertex	v_1	v_2	v_3	v_4	v_5	v_6	v_7	v_8	v_9
Degree	1	4	3	2	4	6	3	2	5

2bii. Adjacent matrix :

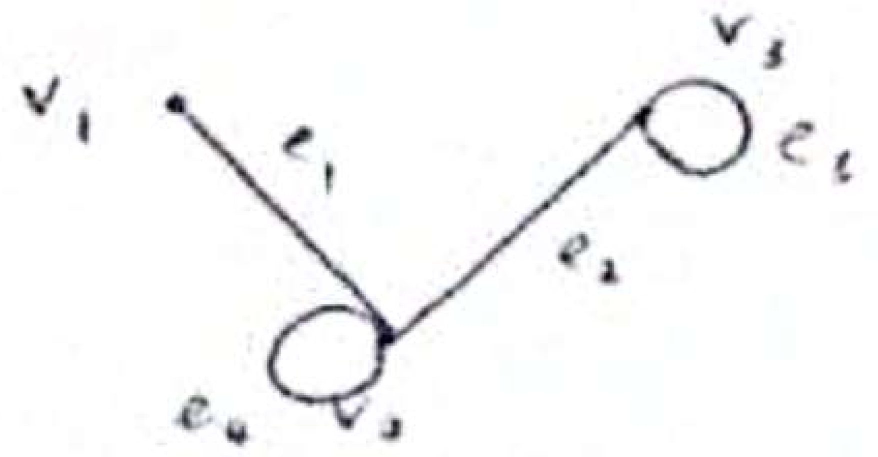
$$
\begin{array}{c}
\\ v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \\ v_6 \\ v_7 \\ v_8 \\ v_9
\end{array}
\begin{array}{c}
\begin{array}{ccccccccc} v_1 & v_2 & v_3 & v_4 & v_5 & v_6 & v_7 & v_8 & v_9 \end{array} \\
\begin{bmatrix}
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1
\end{bmatrix}
\end{array}
$$

Incident matrix :

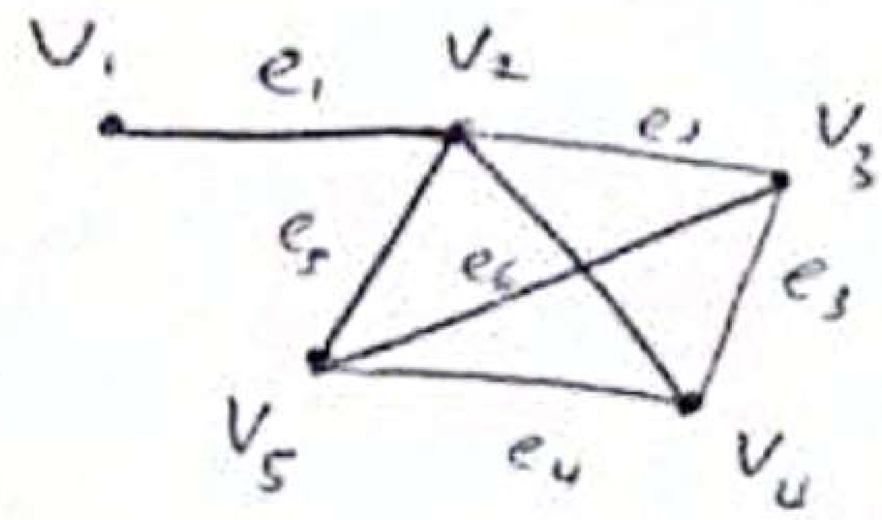
$$
\begin{array}{c}
\\ v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \\ v_6 \\ v_7 \\ v_8 \\ v_9
\end{array}
\begin{array}{c}
\begin{array}{ccccccccccccccc} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 & e_7 & e_8 & e_9 & e_{10} & e_{11} & e_{12} & e_{13} & e_{14} & e_{15} \end{array} \\
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-1 & 1 & -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & -1 & 0 \\
0 & 0 & 0 & 0 & -1 & -1 & 0 & 1 & -1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -1 & -1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & -1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 1 & 0 & 0 & 1 & 1
\end{bmatrix}
\end{array}
$$

Chapter 4:

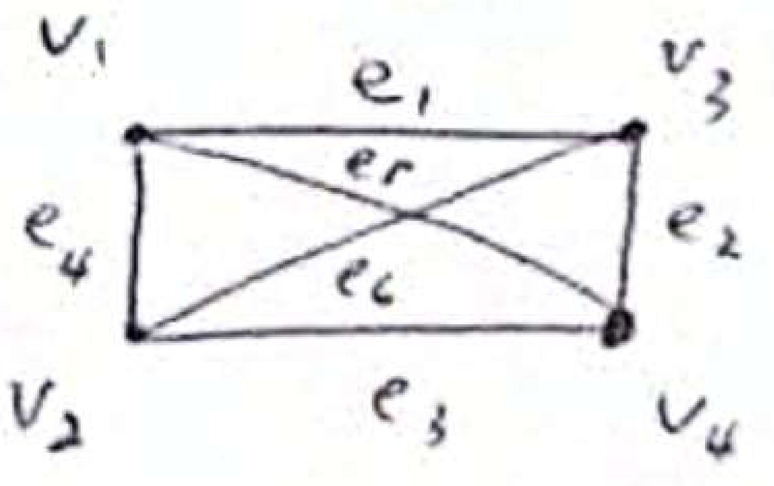
3.a 3 vertices, with degree of vertices 1, 3, and 4

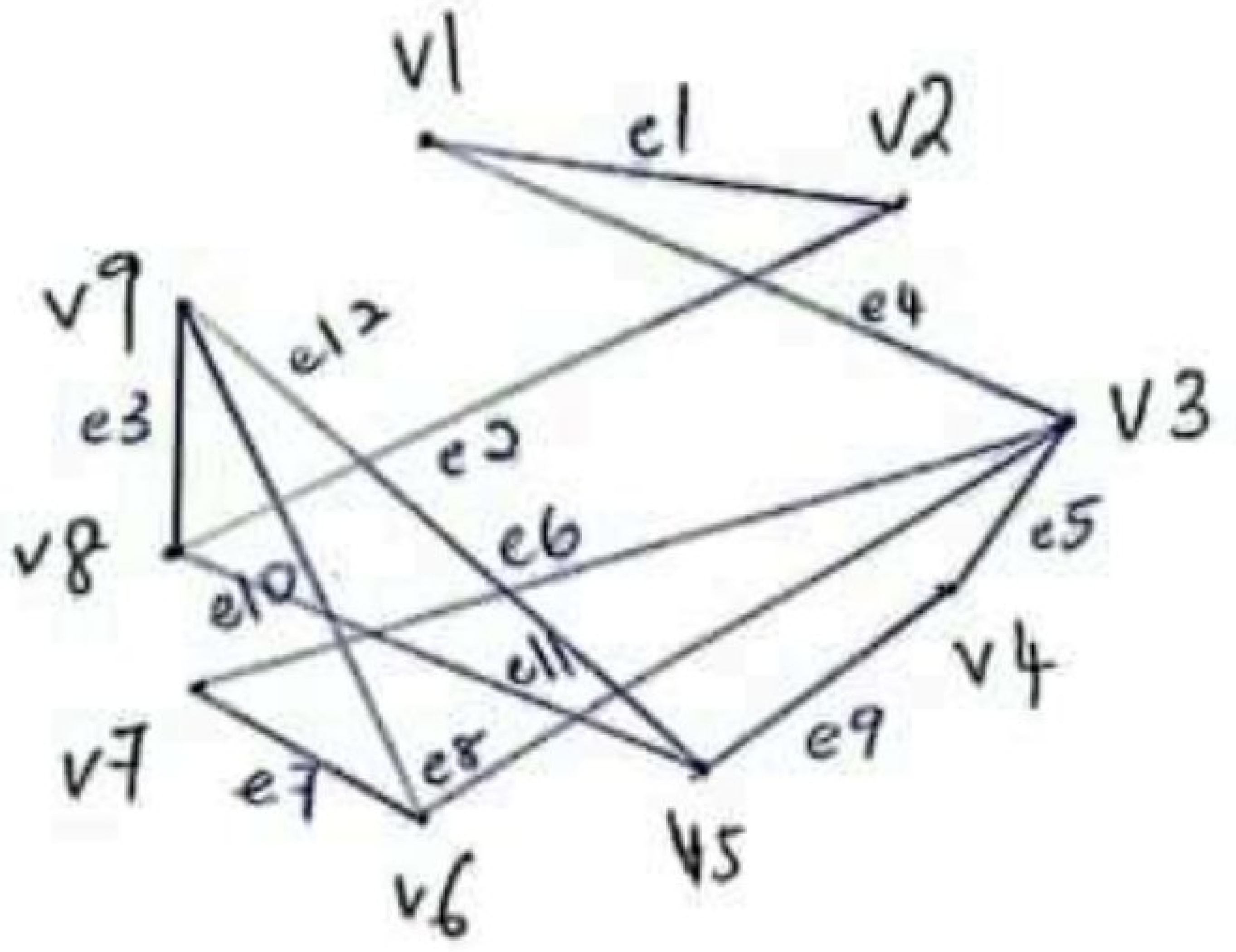


b. A simple graph 5 vertices, with degree of vertices 1, 3, 3, 3, 4



C. A simple graph





i) All possible ~~trails~~ paths from v1 to v9

1. (v1, e1, v2, e2, v8, e3, v9)
2. (v1, e4, v3, e6, v7, e7, v6, e10, v9)
3. (v1, e4, v3, e8, v6, e10, v9)
4. (v1, e4, v3, e5, v4, e9, v5, e12, v9)
5. (v1, e1, v2, e2, v8, e11, v5, e12, v9)
6. (v1, e4, v3, e5, v4, e9, v5, e11, v8, e3, v9
7. (v1, e1, v2, e2, v8, e11, v5, e9, v4, e5, v3, e6, v7, e7, v6, e10, v9)
8. (v1, e1, v2, e2, v8, e11, v5, e9, v4, e5, v3, e8, v6, e10, v9)

ii) All possible trail from v1 to v9

1. (v1, e1, v2, e2, v8, e3, v9)
2. (v1, e4, v3, e6, v7, e7, v6, e10, v9)
3. (v1, e4, v3, e8, v6, e10, v9)
4. (v1, e4, v3, e8, v6, e7, v7, e6, v3, e5, v4, e9, v5, e12, v9)
5. (v1, e4, v3, e8, v6, e7, v7, e6, v3, e5, v4, e9, v5, e11, v8, e3, v9)
6. (v1, e4, v3, e5, v4, e9, v5, e12, v9)
7. (v1, e1, v2, e2, v8, e11, v5, e12, v9)
8. (v1, e4, v3, e5, v4, e9, v5, e11, v8, e3, v9)
9. (v1, e4, v5, e6, v7, e7, v6, e8, v3, e5, v4, e9, v5, e11, v8, e3, v9)
10. (v1, e1, v2, e2, v8, e11, v5, e9, v4, e5, v3, e6, v7, e7, v6, e10, v9)
11. (v1, e1, v2, e2, v8, e11, v5, e9, v4, e5, v3, e8, v6, e10, v9)
12. (v1, e4, v5, e6, v7, e7, v6, e8, v3, e5, v4, e9, v5, e12, v9)

iii) Shortest path: (v1, e1, v2, e2, v8, e3, v9)
Longest path: (v1, e1, v2, e2, v8, e11, v5, e9, v4, e5, v3, e6, v7, e7, v6, e10, v9)

iv) Shortest trail: (v1, e1, v2, e2, v8, e3, v9)
Longest trail: (v1, e1, v2, e2, v8, e11, v5, e9, v4, e5, v3, e6, v7, e7, v6, e10, v9)

5a.

Vertex	A	B	C	D	E	F
Degree	4	2	4	2	2	4

- All the degree of each ~~er~~ vertex are even.
  Thus, there is no euler's path in this graph.

b.

Vertex	A	B	C	D	E	F
Degree	4	2	4	2	2	4

- All the degree are even.
  Thus, there is an euler's circuit in this graph

possible answer = (B, A, E, F, D, C, A, F, C, B)

c. Hamilton circuit = (B, A, E, F, D, C, B)

d. Hamilton circuit only allows visiting a vertex only once but may use the same edges multiple times. Whereas Euler circuit only allow using edges only once but may pass through the same vertex multiple times.