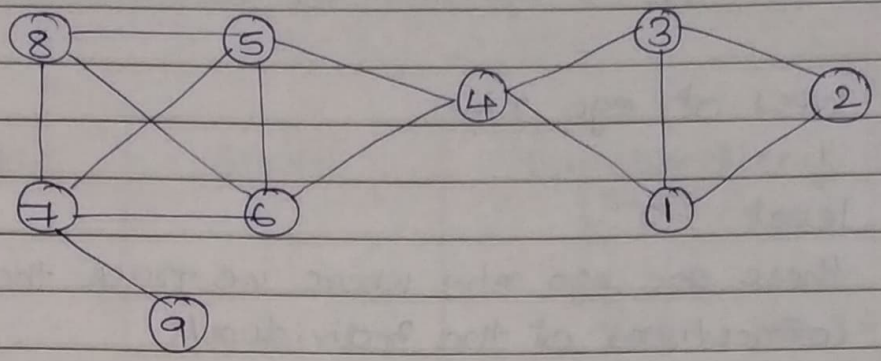
Atharva Prashant Pawar (9427) Comps - A

SMA Assignment 1 (UT1 QB)

Q1.



a) create an adjacency list for this graph:

Root	List
1	2 → 3 → 4 → null
2	3 → 1 → null
3	1 → 2 → 4 → null
4	1 → 3 → 5 → 6 → null
5	4 → 6 → 7 → 8 → null
6	4 → 5 → 7 → 8 → null
7	5 → 6 → 8 → 9 → null
8	5 → 6 → 7 → null
9	7 → null

b) creat an adjacency matrix for this graph:

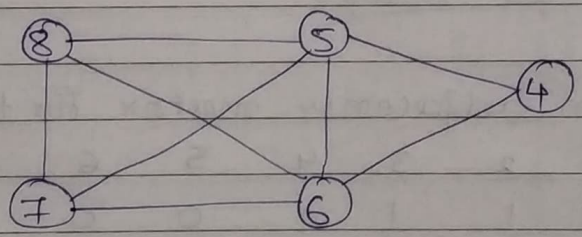
	1	2	3	4	5	6	7	8	9
1	0	1	1	1	0	0	0	0	0
2	1	0	1	0	0	0	0	0	0
3	1	1	0	1	0	0	0	0	0
4	1	0	1	0	1	1	0	0	0
5	0	0	0	1	0	1	1	1	0
6	0	0	0	1	1	0	1	1	0
7	0	0	0	0	1	1	0	1	1
8	0	0	0	0	1	1	1	0	0
9	0	0	0	0	0	0	1	0	0

c) Draw the 1.5 ego n/w for node 6.

* types of ego n/w:

1. Level 1.0:
   these are ego n/w where we track the immediate connections of the individual.
2. Level 1.5:
   - these are ego n/ws where we track the immediate connections & connections b/w those immediate connections.
3. Level 2.0:
   - these are ego n/w where track immediate connections, connections b/w them & 2nd degree connections.

∴ 1.5 ego n/w for node 6.



d) Find the degree centrality of each node of fig 1. which node is the central node in the n/w.

* Degree Centrality:

Table:

Node	Score	Standardized Score (score/n-1)
1	3	3/8 = 0.375
2	2	2/8 = 0.25
3	3	3/8 = 0.375
4	4	4/8 = 0.5
5	4	4/8 = 0.5
6	4	4/8 = 0.5
7	4	4/8 = 0.5
8	3	3/8 = 0.375
9	1	1/8 = 0.125

* Most central node for degree centrality is node: 4, 5, 6, 7

e) Calculate centralization of the fig 1 n/w by applying centralization formula.

⇒

Formula: $$\frac{\sum_{i=1}^{n} c(n^*) - c(ni)}{\max \sum_{i=1}^{N} c(n^*) - c(ni)}$$

n^* is the most central node. $\therefore n^*$ is node 4,5,6,7 $\boxed{c(n^*) = 0.5}$

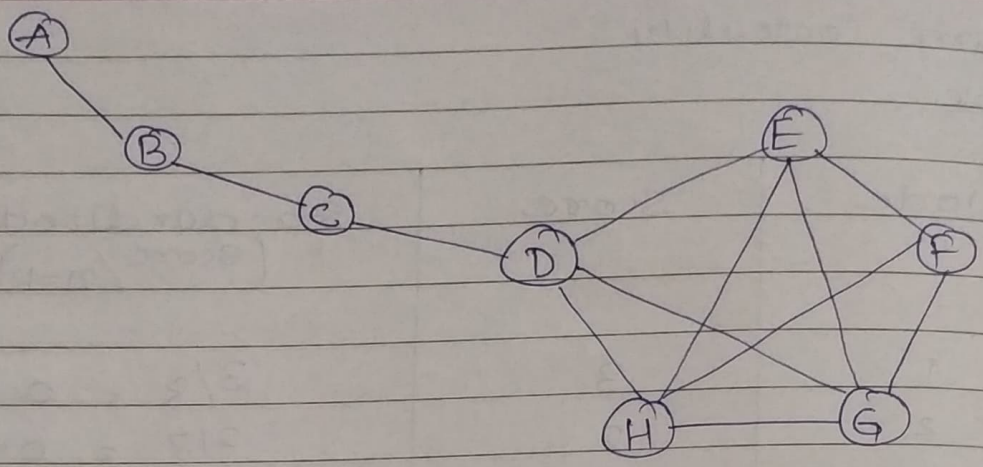
$$\text{Centralization} = \frac{(0.5 - 0.375) + (0.5 - 0.375) + (0.5 - 0.375) + (0.5 - 0.125)}{0.5 - 0.25}$$

$$= \frac{0.125 + 0.25 + 0.125 + 0.125 + 0.375}{0.25}$$

$$= \frac{1}{0.25} = 4$$

$\boxed{\therefore \text{Centralization} = 4}$

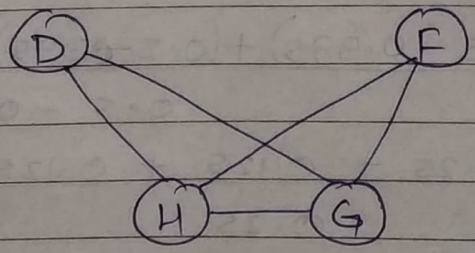
Q 2)



a) Create an adjacency matrix for fig 2 n/w.

	A	B	C	D	E	F	G	H
A	0	1	0	0	0	0	0	0
B	1	0	1	0	0	0	0	0
C	0	1	0	1	0	0	0	0
D	0	0	1	0	1	0	0	1
E	0	0	0	1	0	1	1	1
F	0	0	0	0	1	0	1	1
G	0	0	0	1	1	1	0	1
H	0	0	0	1	1	1	1	0

b) Draw the 1.5 ego n/w for node E (w (without including node E in the graph)



c) Find the degree centrality of each node. Which node is the central node in the n/w.

Node	Score.	Standardized Score = $\frac{\text{Score}}{n-1}$
A	1	1/7 = 0.143
B	2	2/7 = 0.286
C	2	2/7 = 0.286
D	4	4/7 = 0.571
E	4	4/7 = 0.571
F	3	3/7 = 0.429
G	4	4/7 = 0.571
H	4	4/7 = 0.571

∴ the most central node for degree centrality is D, E, G, H.

d) Find the closeness centrality of each node. Which node is the central node in the n/w.

Node A:

Node	Shortest Path from A
B	1
C	2
D	3
E	4
F	5
G	4
H	4

Closeness centrality of node A = $\frac{1+2+3+4+5+4+4}{7}$

= 3.286

Node B: Node : A C D E F G H
Shorter Path : 1 1 2 3 4 3 3

closeness centrality of Node B = $\frac{1+1+2+3+4+3+3}{7}$

$= 2.429$

Node C: Node : A B D E F G H
Shor Path : 2 1 1 2 3 2 2

closeness centrality of Node C : $\frac{2+1+1+2+3+2+2}{7}$

$= 1.857$

Node D: Node : A B C E F G H
S.Path : 3 2 1 1 2 1 1

closeness centrality of Node D = $\frac{3+2+1+1+2+1+1}{7}$

$= 1.571$

Node E: Node : A B C D F G H
S. Path : 4 3 2 1 1 1 1

node E = $\frac{4+3+2+1+1+1+1}{7} = 1.857$

Node F: Node : A B C D E G H
S. Path : 5 4 3 2 1 1 1

node F = $\frac{5+4+3+2+1+1+1}{7} = 2.429$

Node G: Node : A B C D E F H

S. Path : 4 3 2 1 1 1 1

$$\text{node } G = \frac{4+3+2+1+1+1+1}{7} = 1.857$$

Node H: Node : A B C D E F G

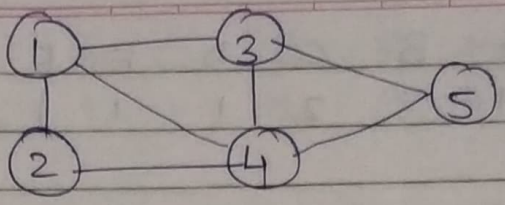
S. Path : 4 3 2 1 1 1 1

$$\text{node } H = \frac{4+3+2+1+1+1+1}{7} = 1.857$$

~~1.571~~

∴ Node D is more central as it has a score of 1.571.

Q 3)



a) Calculate betweenness centrality for node 3.

The vertex betweenness centrality $BC(v)$ of a vertex v is defined as follow

$$BC(v) = \sum_{u \neq v} \in v \left(\frac{\sigma vw(v)}{\sigma vw} \right)$$

σvw = total no. of shortest path b/w v & w

$\sigma vw(v)$ = total no. of shortest path b/w v & w that pass through y.

* table : (for Node 3) $y = 3$

	σvw	$\sigma vw(v)$	$\sigma vw(v) / \sigma vw$
(1,2)	1	0	$0/1 = 0$
(1,4)	1	0	$0/1 = 0$
(1,5)	2	1	$1/2 = 0.5$
(2,4)	1	0	$0/1 = 0$
(2,5)	1	0	$0/1 = 0$
(4,5)	1	0	$0/1 = 0$

Betweenness centrality for Node 3 is "0.5".

b) Calculate the eigen vector centrality for given n/w.

$$\begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array}\begin{array}{c} \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

let $X_0 = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$

* Iteration 1:

$$\begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 3 \\ 2 \\ 3 \\ 4 \\ 2 \end{bmatrix} = \begin{bmatrix} 3/8.062 \\ 2/8.062 \\ 3/8.062 \\ 4/8.062 \\ 2/8.062 \end{bmatrix} = \begin{bmatrix} 0.372 \\ 0.248 \\ 0.372 \\ 0.496 \\ 0.248 \end{bmatrix}$$

Normalized value $= \sqrt{3^2 + 2^2 + 3^2 + 4^2 + 2^2}$

$= 8.062$

* Iteration 2:

$$\begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix} \begin{bmatrix} 0.372 \\ 0.248 \\ 0.372 \\ 0.496 \\ 0.248 \end{bmatrix} = \begin{bmatrix} 1.116 \\ 0.865 \\ 1.116 \\ 1.24 \\ 0.868 \end{bmatrix} = \begin{bmatrix} 0.474 \\ 0.342 \\ 0.474 \\ 0.527 \\ 0.342 \end{bmatrix}$$

Normalized values

$= \sqrt{(1.116)^2 + (0.248)^2 + (0.372)^2 + (0.496)^2 + (0.248)^2}$

$= 2.353$

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* Iteration 3:

$$\begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix} \begin{bmatrix} 0.474 \\ 0.342 \\ 0.474 \\ 0.527 \\ 0.342 \end{bmatrix} = \begin{bmatrix} 1.343 \\ 1.001 \\ 1.343 \\ 1.632 \\ 1.001 \end{bmatrix} = \begin{bmatrix} 0.467 \\ 0.348 \\ 0.467 \\ 0.567 \\ 0.347 \end{bmatrix}$$

Normalized value.

$$= \sqrt{(1.343)^2 + (1.001)^2 + (1.343)^2 + (1.632)^2 + (1.001)^2}$$

$$= 2.877.$$

$$=$$

* Iteration 4:

$$\begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix} \begin{bmatrix} 0.467 \\ 0.348 \\ 0.467 \\ 0.567 \\ 0.347 \end{bmatrix} = \begin{bmatrix} 1.382 \\ 1.034 \\ 1.382 \\ 1.629 \\ 1.034 \end{bmatrix} = \begin{bmatrix} 0.471 \\ 0.352 \\ 0.471 \\ 0.555 \\ 0.352 \end{bmatrix}$$

normalized value

$$= \sqrt{(1.382)^2 + (1.034)^2 + (1.382)^2 + (1.629)^2 + (1.034)^2}$$

$$= 2.935$$

* Iteration 5:

$$\begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix} \begin{bmatrix} 0.471 \\ 0.352 \\ 0.471 \\ 0.555 \\ 0.352 \end{bmatrix} = \begin{bmatrix} 1.378 \\ 1.026 \\ 1.378 \\ 1.646 \\ 1.026 \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \end{bmatrix}$$

normalized value

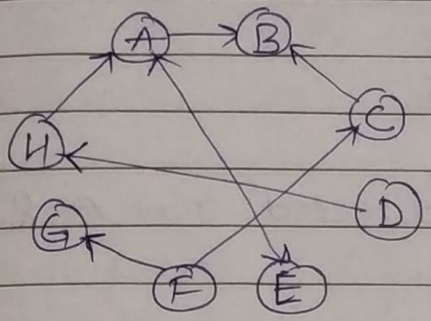
$$= \sqrt{(1.378)^2 + (1.026)^2 + (1.378)^2 + (1.646)^2 + (1.026)^2}$$

$$= 2.935$$

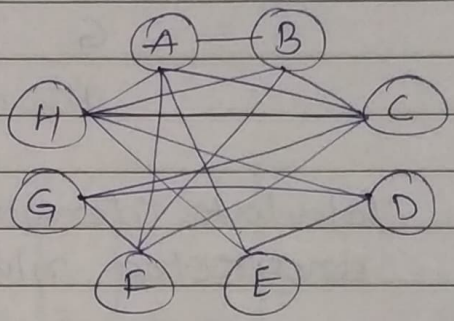
∴ eigen vector centrality:

1	0.471
2	0.352
3	0.471
4	0.555
5	0.352

Q4)



n/w : A



n/w : B

a) Calculate the degree distribution for n/w A & B.

* n/w A

In-degree distribution

Node	Degree
A	2
B	2
C	1
D	0
E	1
F	0
G	1
H	1

Out-degree distribution

Node	Degree
A	1
B	0
C	1
D	1
E	0
F	2
G	0
H	1

* n/w B:

Node	Degree.
A	5
B	4
C	5
D	3
E	3
F	4
G	3
H	5

b) Calculate density for directed n/w A & undirected n/w B.

NW: A in a directed graph with n nodes & e edges the formula for density is:

$$\text{Desity} = \frac{e}{n^*(n-1)}$$

where: $e = 8$, $n = 8$, $n-1 = 7$

$$\therefore \frac{8}{8(7)} = \frac{1}{7} = 0.1429$$

$\therefore$ Desity = 0.1429

N/W: B: in an undirected n/w with n nodes & e edges the formula is

$$\text{desity} = \frac{e}{n(n-1)/2}$$

where $e = 16$, $n = 8$, $n-1 = 7$

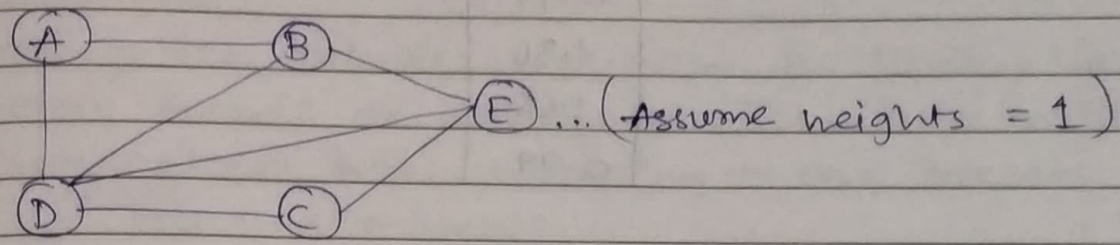
$$d = \frac{16}{8(7)/2} = \frac{4}{7} = 0.571$$

$\therefore$ Density for n/w B is higher, it is more Dense.

Theory:

Q1. Reflect on your professional n/w. Identify both strong & weak ties within your n/w. How have these ties contributed to your career development & access to opportunities? Assume the n/w & compute eigenvector centrality for each node of the n/w.

=>



... (Assume weights = 1)

Adjecency matrix unit matrix

Itr 1:

$$\begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix} \times \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 3 \\ 2 \\ 3 \\ 4 \\ 2 \end{bmatrix} = \begin{bmatrix} 0.46 \\ 0.30 \\ 0.46 \\ 0.61 \\ 0.30 \end{bmatrix}$$

normalised value $= \sqrt{3^2 + 2^2 + 3^2 + 4^2 + 2^2} = 6.48$

Itr 2:

$$\begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix} \times \begin{bmatrix} 0.46 \\ 0.30 \\ 0.46 \\ 0.61 \\ 0.30 \end{bmatrix} = \begin{bmatrix} 1.37 \\ 1.07 \\ 1.37 \\ 1.52 \\ 1.07 \end{bmatrix} = \begin{bmatrix} 0.47 \\ 0.37 \\ 0.47 \\ 0.52 \\ 0.37 \end{bmatrix}$$

normalised value = 2.89

Itr 3:

$$\begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix} \times \begin{bmatrix} 0.47 \\ 0.37 \\ 0.47 \\ 0.52 \\ 0.37 \end{bmatrix} = \begin{bmatrix} 1.36 \\ 0.99 \\ 1.36 \\ 1.68 \\ 1.99 \end{bmatrix}$$

Normalized value = 2.91

Since normalised value converge, the eigen vector centrality for each node is

$$\begin{bmatrix} 1.36 \\ 0.99 \\ 1.36 \\ 1.68 \\ 0.99 \end{bmatrix}$$

* Strong ties:
- Stronge ties are those connections whom we are close, ie freq. of interactions is high. This includes relatives, friends, mentors, collegues, etc.
- Strong ties help in mental help, coaching & introduce to new opportunities & perspectives

* Weak ties:
- Weak ties are those connections whom we are not close, ie freq. of interactions is lower.
- They are generally aquantainces, alumi, etc.
- weak ties may not provid necesary support & opportunities, but usually open doors to opportunities which are not within normal reach.

2) Consider your social media connections. How do strong & weak ties on platforms like Facebook, Twitter or Linkedin influence the info. you encounter? Are there instances where weak ties have played a significant role in sharing valuable info. Assume the n/w & compute the betweeness centrality for any one node.

⇒ On social media platform like facebook & twitter, strong ties, & weak ties play a significant impact on type of info we encounter:

* Strong ties:
- strong ties include connections like family members, close friends or colleagues. These help in providing personalised info. according to our interests & help us to give valuable views.

* Weak ties.
- Weak ties include connections like acquaintance & distant relatives.
- These help in providing varied response. & provide different perspectives which help us grow intellectually.

Consider a following n/w for between-ness centrality

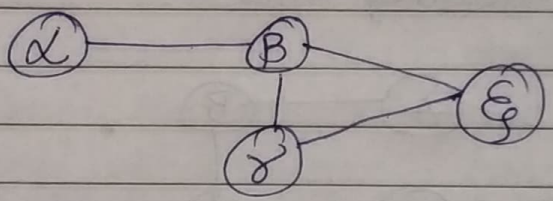


Fig: B

	σ_{vw}	$\sigma_{vw}(v)$
(α, γ)	1	1
(α, ε)	1	1
(γ, ε)	1	0

$$BC(\beta) = \Sigma_{uv \in V} \left[\frac{\sigma_{v\omega}(v)}{\sigma_{vw}} \right] = 1 + 1 + 0 = 2$$

Q3) Within your family, assess the strength of ties b/w different members. How do strong ties contribute to emotional support & in what ways might weak ties bring in diverse perspectives or opportunities? Assume the n/w & compute the degree distribution & desity of the n/w.

⇒ 1. Assessing the strength of ties within a family is a complex task as it is dependent on various factors

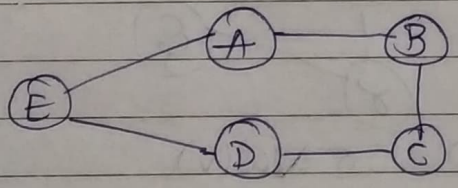
2. Strong ties contribute to emotional support by providing sense of belonging & trust. They differ impact & encouragement which promotes resilience.

3. Weak ties, such as extended relatives bring diverse perspectives & opportunities by introducing new ides, experiences & resource.

4. The degree distribution of family n/w. & density over pattern of relationships

5. High value of these parameters might mean close relations & more strong ties & vice versa.

6. Assume following n/w.



- no. of nodes $n_v = 5$
- no. of edges. $n_e = 5$
- max no. of edges $= \frac{5(5-1)}{2} = \frac{5(4)}{2} = 10$

$$\text{density} = \frac{5}{10} = 0.5$$

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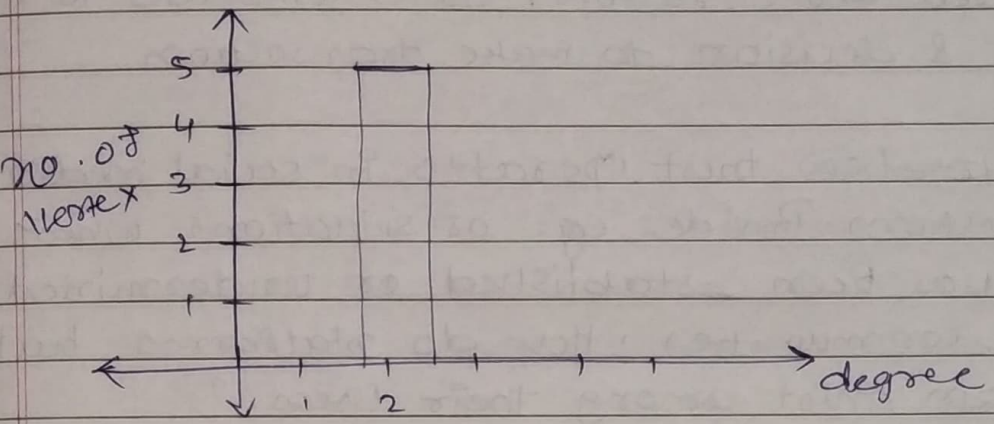
* Degree distribution:

Vertex	degree.
A	2
B	2
C	2
D	2
E	2

All nodes have degree = 2



Q4) Consider your experience with online shopping. How does trust play a role in your decision to make a purchase from a particular online platform? What factors contributes to building trust in e-commerce transactions.

=> 1. In my experence of online shopping, trust plays a crusial role in my decision to make a purchase from a online platform.

2. Trust is built through various factors that contribute to sense of coliability security & confidence in my online shopping experence.

3. Trust is a single reason why shopping giants like flipkart thrives.

4. Some key factors which contributes too building trust one as follows :.
- Reputation & Reviews
- secure Payment Methods
- Clean & transparent polices.
- User friendly website & customer services.
- secure & private info. handling
- Government approvals & certification.
- Past experiences

with all above factors. there contribute to my trust & decision to make transaction

Q5) Analyze how trust operates in social media interactions. Provide eg. of situations where trust was been established or undermined in online communities. How do platforms build & maintain trust among their users.?

⇒ 1. Trust plays a crucial role in social media interaction shaping how users engage with content, share info. & interact with others.

2. Trust in social media is build & maintained through various mechanism but it can be easily undermined by factors such as privacy concerns, misinfo. & unethical behaviour.

3. Here are some aspects where trust can be built or marred are as follows :
- Authenticity & transparency
- Engagement & Interaction
- Privacy & Data Protection
- Community guideline & Moderation

4. Eg: of situations which enhance & undermine the trust:

a. Established Trust:

- Health related online comm. for info & support.
- Platform which introduces features to combat misinfo., demostrating commitment to accuracy & credibility.

b. Undermined Trust &

- Breach of privacy polices by a platform
- Unsecure internet platforms with no necessary mechanisms like site without http

5. To build & maintain trust, social media platform can:-

- implement & enforce clear policies regarding content moderation, & easily accessible privacy & data protection
- provide transparent & easily accessible info. regarding their algo. data practices & advertising policies.
- Engage with users through feedback mechanisms & as responsible customer support
- Continuously evolve & improve their features & policies based on user feedback & industry best practices.
- Continuously evolve & improve their user feedback taking ways to get good & valueable feedback for platform upgradation.