

THIS PIECE OF STUDY MATERIAL HAS BEEN
BROUGHT TO YOU BY

MUSTUDENTS UNITED

contributed by - Iram Mohd Ahmed Shaikh
of college - M.H Saboo Siddik College



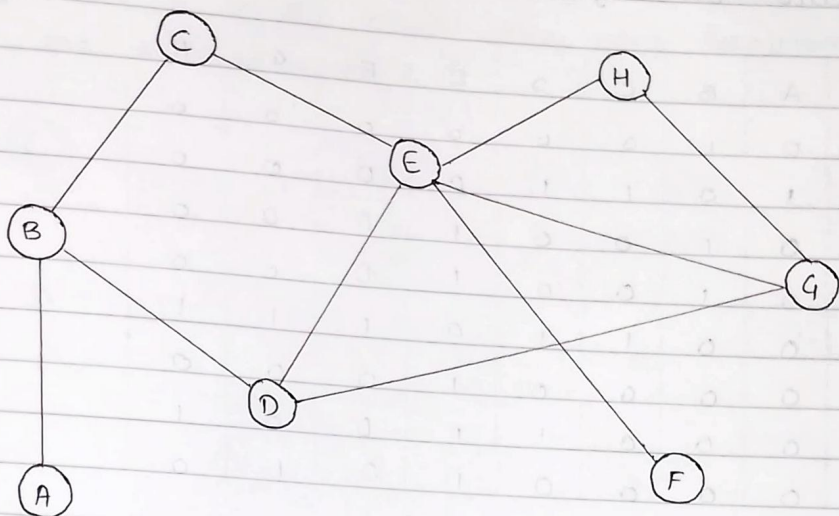
FOR REMOVAL OF CONTENT OR CREDITS CONTACT US AT-
INSTAGRAM ID-MUSTUDENTSUNITED
OR
MAIL US AT -MUSTUDENTSUNITED@GMAIL.COM

27/2/25

SMA

①

Q1



a] How many nodes are in this network?

→ 8

b] How many edges are in the network?

→ 10

c] Is this graph directed or undirected?

→ undirected

d] Create an adjacent list for this graph?

→ (A, B), (B, C), (C, E), (E, D), (E, F), (E, G), (E, H), (D, G), (B, D).

e] Create an adjacent matrix for this graph?

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

f] What is the length of the shortest path from node A to node F?

$A \rightarrow (B \rightarrow D \rightarrow E) \rightarrow F = 3$

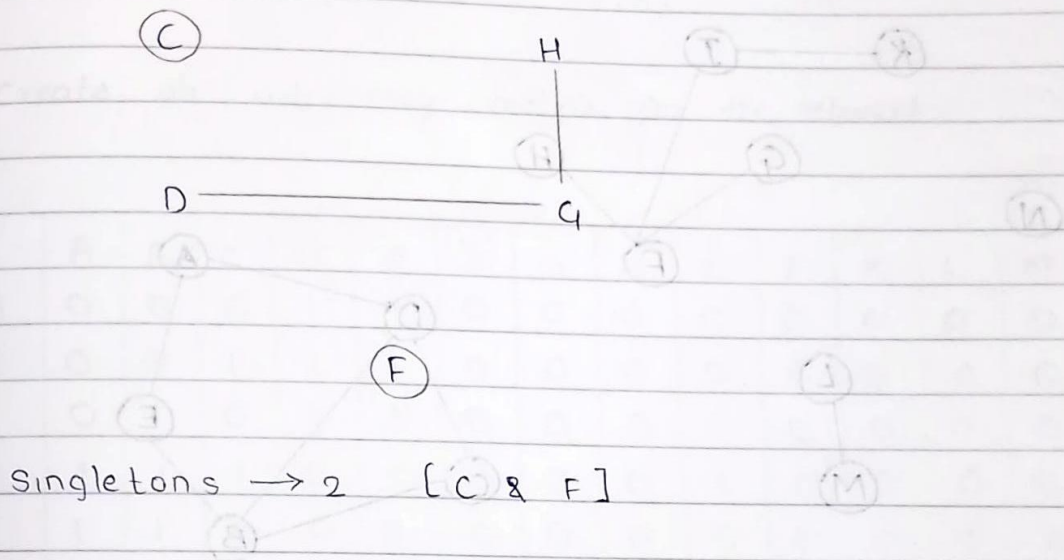
g] What is the largest clique in this network? How many cliques of that size are there?

$E-H-G-D-E$

h] How many connected components are there in this network?

1 connected component as all nodes are connected in the graph.

Draw the 1.5 ego network for node E (without including node E in the graph). How many singletons are in the ego network?



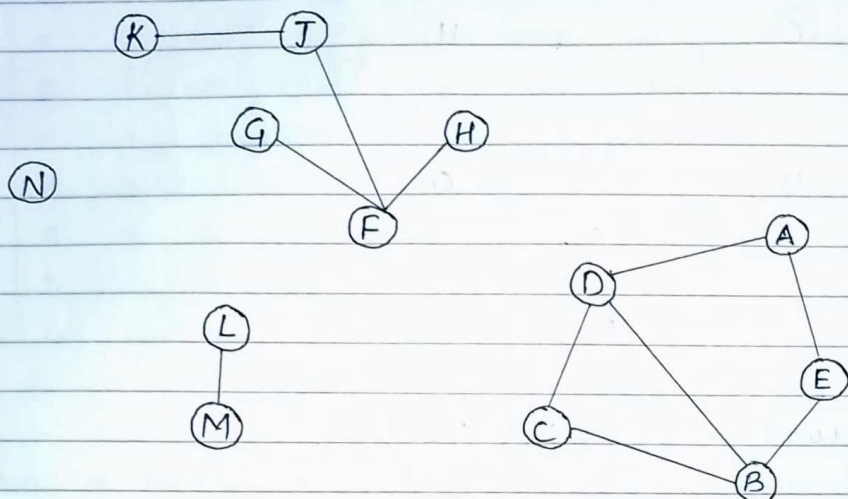
Are there any hubs in this network? If so, which node(s) and why is it a hub?

Node E is the hub in network as it is connected to 5 nodes in network.

Q 2

Consider this graph

(I)



a] How many singletons are there in the network? List them.

2 singletons (I and N) are in network.

b] What is the largest connected component?

There are 2 largest connected component are in network as both have 5 nodes each.

c] Are there any bridges in the network? If so where are they?

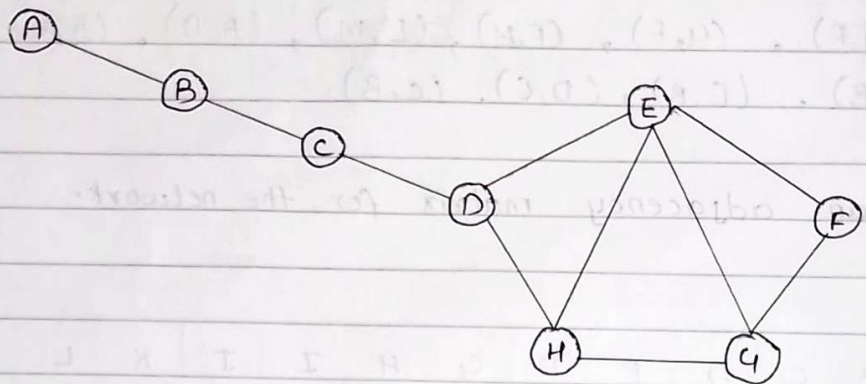
L-M, as the connection depend on the edges before it break. Similarly G-F and F-H, J-K. Hence there are 4 bridges in network.

25

②

②

Q 3



Node	Shortest Path From D
A	3 D C B A
B	2 D C B
C	1 D C
E	1 D E
F	2 D E F
G	2 D H G
H	1 D H

The Average of those shortest path lengths is :

$$\frac{3 + 2 + 1 + 1 + 2 + 2 + 1}{7} = \frac{12}{7} = 1.71$$

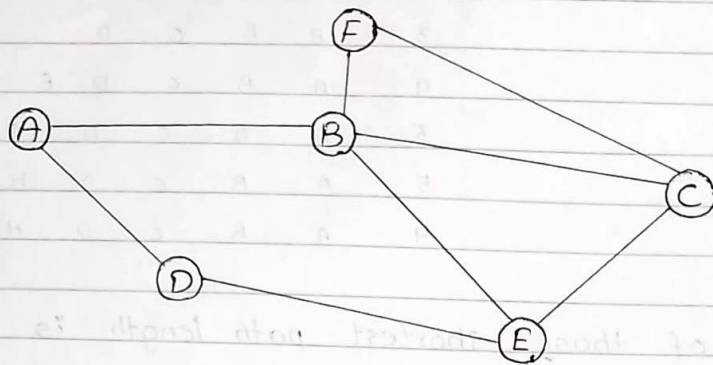
Node	Shortest path from A	
B	1 A B	
C	2 A B C	
D	3 A B C D	
E	4 A B C D E	
F	5 A B C D E F	
G	5 A B C D H G	
H	4 A B C D H	

Average of those shortest path length is :

$$\frac{1 + 2 + 3 + 4 + 5 + 5 + 4}{7} = \frac{24}{7} = 3.43$$

Since node D's centrality is low, therefore node D is central.

- Q 4 Calculate betweenness centrality of all the nodes and find the node with highest betweenness centrality.



→ All edges are bidirectional

$$BC(y) = \sum_{x,z} \frac{S_{xz}(y)}{S_{xz}}$$

For Node A

Paths	$S_{xz}(y)$	S_{xz}	$S_{xz}(y)/S_{xz}$
(B,C)	0	1	$0/1 = 0$
(B,D)	1	2	$1/2$
(B,E)	0	1	0
(B,F)	0	1	0
(C,D)	0	2 ^(CED)	0
(C,E)	0	1	0
(C,F)	0	1	0
(D,E)	0	1	0
(D,F)	1	3 ^{(DABE) (DEBF) (DECF)}	0.333
(E,F)	0	2	0
			<u>0.8333</u>

For Node B

Paths	$\sigma_{xz}(y)$	σ_{xz}	$\sigma_{xz}(y) / \sigma_{xz}$
(A,C)	1	1	1
(A,D)	0	1	0
(A,E)	1	2	0.5
(A,F)	1	1	1
(C,D)	0	1	0
(C,E)	0	1	0
(D,E)	0	1	0
(D,F)	0	3	0.333
(E,F)	1	2	0.5
(C,F)	0	1	0
			3.667

Similarly For

For Node D : 0.5

For Node E : 2.1667

Node F : 0.

List atleast three different network that exist within Facebook, answer for each network?

- what constitutes a node?
- what constitutes a edge?
- Is it directed?
- Is it weighted? what does weight indicate.
- What is smallest component of graph.

Network 1 : Friendship network

- User (Facebook profile)
- Friendship between two users.
- No, since friendship on facebook are mutual.
- Yes, it is weighted which indicate strength
- An isolated user.

Network 2 : Interaction on posts

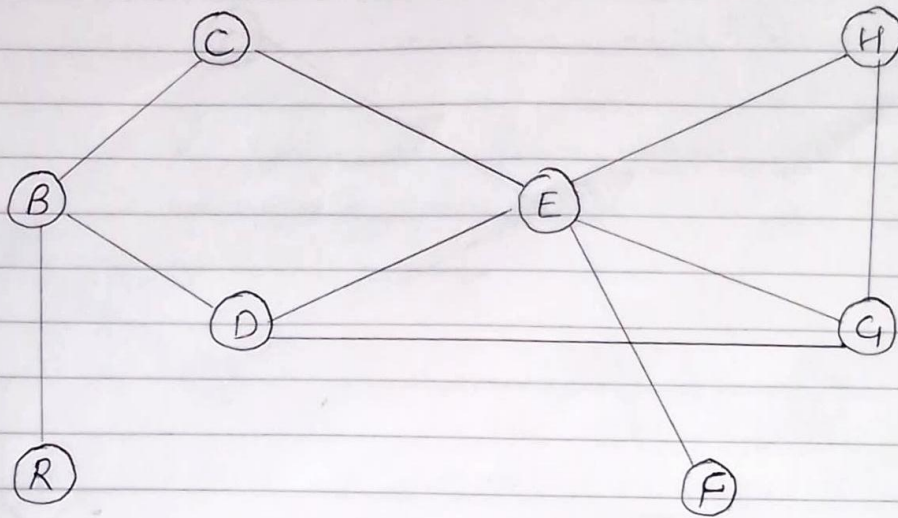
- User
- An interaction between users (like, comment, etc).
- Yes, interaction flows in one directions.
- Yes, number of interactions on posts (No. of likes).
- A single interaction.

Network 3 : "Page - Following (Fan Pages)

- User or Facebook page
- 'Follow' constitutes as edge from user to page
- Yes, as only user can follow page
- Yes, engagement level can be measured
- A single follower of page.

Q 6

answer the following about graph.



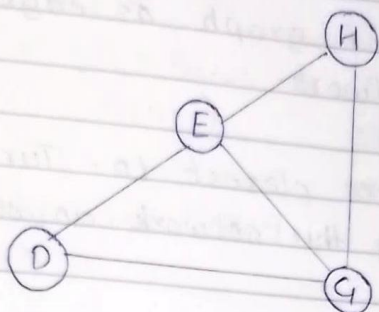
a] What is degree distribution for this graph.

A	1
B	3
C	2
D	3
E	4
F	1
G	3
H	3

b] What is the density of graph.

$$\frac{e}{n*(n-1)/2} = \frac{10}{8*(8-1)/2} = 0.357.$$

Draw 1.5 Ego-centric network of G_1 .



Which node have highest degree? what is the degree.

Node E have highest degree, with degree 4.

Which node have lowest degree? what is the degree?

Node A and F have lowest degree, with degree 1

Which node has the highest closeness centrality.

Node E have highest closeness centrality.

Which node has the highest degree centrality

Node E have highest degree centrality of 0.571.

What is the centralization (based on degree) of the graph.

$$C = \sum_i (\max(n) - (d_i)) = \frac{\sum d_{\max} - d_i}{(n-1)(n-2)}$$

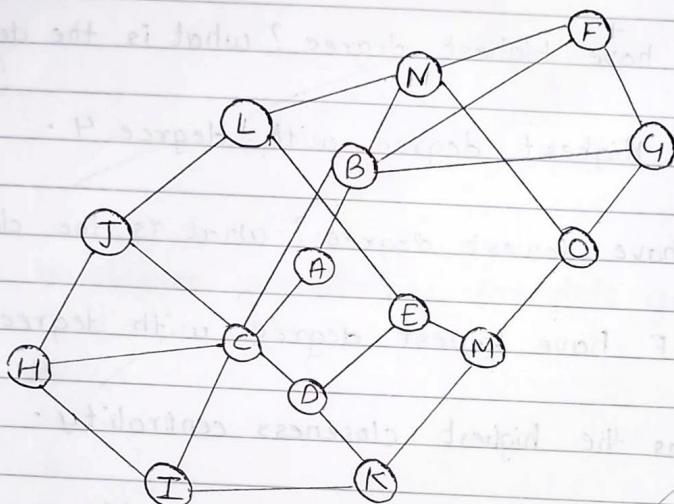
$$\therefore C \approx 0.214$$

Q7] What is cohesion of graph.

1 is the cohesion of graph as edge between R-B breaks the network.

Q 7

List 15 people you are closest to. Turn this into a network, using this network answer the question.



a] What is the degree distribution for graph.

A = 4, B = 4, C = 4, D = 4, E = 4,
F = 3, G = 3, H = 3, I = 3, J = 3,
K = 3, L = 3, M = 3, N = 3, O = 3

b] What is the density of graph?

$$E = 23 \quad N = 15$$

$$\text{Density} = \frac{2 \times E}{n(n-1)} = \frac{2 \times 23}{15(15-1)}$$

$$= \frac{46}{210} \approx 0.219.$$

c] Which node have highest degree? What is the degree?

Node A, B, C, D, E with degree 4 have highest degree.

d] Which node have lowest degree? what is the degree?

Node F, G, H, I, J, K, L, M, N with degree 3 have lowest degree.

e] Which node has the highest closeness centrality?

Node A, B, C, D, E have highest closeness centrality

f] Which node has highest degree centrality?

Node A, B, C, D, E have highest degree centrality of 4.

ii) What is the centralization (degree) of graph.

$$C = \frac{\sum d_{\max} - d_i}{(n-1)(n-2)}$$

Compare Social Media Vs Traditional business Analytics.

	SMA	TBA
Data Type	Semi-structured and unstructured (Eg: Tweet, Comment, etc)	Structured (Eg: Sales report, Financial Statement)
Data Source	Public social media platform (Facebook, Twitter, Youtube) .	Internal business database (ERP, CRM System) .
Data Nature	Real-time, dynamic and high-volume.	Historical, Controlled, Structured.
Storage	Third party Database (cloud-based)	Business-owned databased (cloud -local Server).
Access & Control	Open & widely Shared over internet	Restricted to internal business use.
Data Volume	High volume, diverse format	medium to high volume, uniform format
Decision making	Helps track trends, Sentiment and engagement in real time.	used for long-term forecasting and Strategic planning.

Difference between Traditional Recommendation System Vs Social Media Recommendation System.

Traditional Recommendation System

Uses structured data like user ratings, purchase history and product details.

Relies on collaborative filtering and content based filtering.

Focuses on individual user preference and past interactions.

Past data : Slower Update

Based on explicit user input like rating and reviews

Amazon, Netflix, Spotify

Social Media Recommendation System.

Uses unstructured data like social interaction, Engagement, real-time trends.

Uses deep learning, NLP & graph based models to analyze social connections.

Considers user behavior along with social influence from friends & trends.

Real time : Dynamic Adjustment

Include implicit signals like watch time, Scrolling behavior, & and social network interaction.

Youtube, Instagram, Twitter

Q2

Types of Search engine analytics.

There are two types of Search Engine Analytics:

Search Engine Optimization (SEO)

Search Engine Trend Analysis.

1 Search Engine Optimization :

a SEO is the process of improving a website's ranking on a search engine result page (SERP).

b SERP's have both organic and non-organic results, with organic result being based on relevance to the user's query and non-organic result being paid advertisement.

c It is important for websites, especially commercial ones, to have high ranking on SERP because it can lead to more traffic and potential customer.

d The main factor that determine a website's ranking on a SERP is its PageRank, which is determined by quality and number of incoming links to the website.

e Tools like Open SEO Stats can be used to check a website's PageRank and other relevant information such as traffic, hyperlink status, and page speed.

f Other tools include Google Search Console & Ahrefs for tracking performance.

g Importance of SEO : Enhance website visibility on SERPs.

② Helps businesses attract potential customers.

③ Improves user experience and site credibility.

2 Search Trend Analysis :

a Search engine trend analytics involves analyzing and understanding the keywords used in search engines.

Google Trends is a comprehensive tool for analyzing search engine trend and predicting future trends.

It can be used to understand how people search for a particular brand, when interest in product or services spikes, which keywords drive the most traffic, and how a brand's competitor are performing.

Google Trends data has also been used in various industries to detect early warning sign and track flu epidemics.

From a businesses perspective, Google Trends can help answer questions about search trends & patterns related to brands.

Search Engine Analytics Trend Tools - Google Trend, Google Alerts, Social Mentions, Icerocket & TweetBeep.

Q3

Types of Location Analytics.

Location Analytics, also known as spatial analysis or geo-analytics, involves mapping, visualizing and mining the location of people, data and other resources.

Types of Location Analytics:-

Business data-driven location analytics

Social media data driven location analytics.

1 Business data driven location analytics :

a Business data driven location analytics involves mapping, visualizing and mining location data to reveal patterns and trends in business data.

b By capitalizing on data stored in a business database location analytics can provide location-specific information, products and service based on where customers are.

c Example of how this can be used include recommending the nearest convenience store or taxi, or making decision about the best potential location for a business warehouse.

d Application of Business Driven Location Analytics are

i Powerful Intelligence - Simple maps can be useful, Uses clustering, heat mapping, data aggregation, and color-coded mapping for insights.

ii Geo Enrichment - Enhance maps with customer data like demographics and Spending habits.

iii Collaborations and Sharing - Facilitates better communication & decision-making within businesses.

Social Media Data Driven Location Analytics.

Uses geo tagged social media data to analyze customer behaviour and trends

It is used for Recommendation Purposes.

Applications include :

Recommendation Purpose - Suggest relevant place based on user location.

Customer Segmentation - Tools like Tweepsmat categorize user by locations.

Advertisements - Location-based advertisement allows targeted marketing and promotion campaign mostly delivered through mobile device to reach specific target audience.

Information Request - Based on their current location, customer can request a product, service or resource.

Alerts - Location data can be used to send and receive alerts and notifications, such as sales & promotions alerts, traffic congestions alerts, speed limit warning & storm warning etc.

Search and Rescue - Location data is vital in search and rescue operations e.g. disaster management.

Q4 What is the purpose of search engine optimization.

Purpose of Search Engine Optimization is aimed at improving a website's ranking on a Search Engine Result Page (SERP) to increase visibility, drive organic traffic, and enhance user engagement. According to the

Increase Website Ranking on SERP

SEO helps website appears higher in search engine results, making them more accessible to users.

Drive More Organic Traffic

Higher ranking leads to more visitors without relying on paid advertisements.

Organic traffic is most cost-effective & sustainable compared to paid campaigns.

Improve Website Visibility & Credibility

Website appearing on the first page of search results are seen as more trustworthy by users.

Boost Business Growth and Revenue

SEO is essential for commercial website as higher traffic increases potential sales and customer conversions.

Track and Enhance Website Performance

SEO tools like Open SEO Stats help monitor key performance indicator such as: PageRank, Traffic insights, Page Speed, etc.

Explain common social media risk mitigation strategies.

Common Risks in Social Media

Privacy Breaches

- Unauthorized access to personal or company data.
- Accidental or intentional sharing of sensitive information.
- Risk of data leaks due to weak security settings.

Misinformation

- Spread of false or misleading content that can damage credibility.
- Fake news, deepfakes or manipulated images influencing public perception.
- Lack of fact-checking leading to reputational harm.

Reputation Damage

- Negative comments, reviews or public backlash affecting brand trust.
- Viral post that can misinterpret a person or organization.

Security Threats

- Cyberattacks like phishing, hacking & malware infections.
- Weak password leading to unauthorized account access.

Mitigation Strategies

Social Media Policy

- Establish clear guidelines for employees on what they can and cannot post.
- Define best practices for handling sensitive information.
- Ensure employees understand the risks of sharing company data online.

2 Monitoring & Moderation

- Regularly review posts, comments and mentions to identify potential risks.
- Use AI-based tools to detect harmful content, misinformation or security threats.

3 Responding to Negative Feedback

- Address complaints & criticism professionally & promptly.
- Avoiding deleting or ignoring valid concerns; instead, offer constructive solutions.

4 Data Protection & Security Measures.

- Use encryption and multi-factor authentication (MFA) for social media accounts.
- Restricts access to sensitive data & maintain strict admin control.

5 Legal Compliance

- Adhere to data protection like GDPR (General Data Protection Regulation) and CCPA (California Consumer Privacy Act).
- Ensure user consent for data collection and maintain transparency in privacy policies.

Write Short notes on Source of Location Data.

Location analytics also known as spatial analysis or geo-analytics, involves mapping, visualizing and mining the location of people, data and other resources.

Location data is essential for location analytics.

Source of Location Data:

Postal Address - Traditional method of determining locations using Street names, city and postal codes. often used in business records, government database, and customer addresses.

Latitude & Longitude - Geographic coordinates that pinpoint an exact location on Earth.

Used in navigation, mapping services and geospatial analytics.

GPS-Based Data - Collected from Global Positioning System (GPS) device in Smartphones, vehicles, and Smartwatches.

Provides real-time location tracking for application like Google Maps, Ubers, and food Delivery services.

IP-Based Location Data - Derived from Internet Protocol (IP) addresses assigned to devices connected to the internet.

Helps in identifying the approximate location of users for targeted advertising, fraud detection and website personalization.

Q7 Explain the steps needed to formulate a social media strategy.

Steps to Formulate a Social Media Strategy

Formulating a social media strategy involves a structured approach to effectively engage with the target audience and achieve business goal.

- 1 Define Objectives :
Identify the specific goals the business want to achieve through social media.
Example - include increasing brand awareness, generating leads, improving customer engagement and boosting sales.
- 2 Identify Target Audience :
Determine the demographic, interest, and behaviour of the intended audience.
Consider factor like age, gender, location, social media habit and content preference.
- 3 Research Competition :
Analyze the social media presence and strategies of competitors.
Identify what is working well in the industry & areas where the business can differentiate itself.
- 4 Choose Social Media Platform .
Select the platform that best align with business objectives & target audience.
Example : Instagram, TikTok, LinkedIn, X, Youtube.

Create a Content Calendar :

Plan and schedule the types of content to be posted, including - Text posts (eg - blogs, tweets).

Image & Infographics

Videos & live streams

Links & to external resources.

Maintain consistent posting frequency and align content with key business events.

Engage with Followers :

Actively respond to comment, messages, & inquiries from the audience.

Encourage user-generated content, discussions, and interactions to build community engagement.

Analyze and Adjust

Use social media analytics tools to track the performance of post and campaign.

Key metrics to monitor include - Engagement rates

Traffic

Conversion rate.

Based on insight, refine the Strategy to improve result.

Q8 Write short note on Issues with privacy policies.

Privacy concerns in location analytics primarily stem from the collection, storage, and sharing of users location data.

1 Lack of Transparency :

Many services collect location data without clearly informing users about how, why and for how long their data is stored.

Privacy policies are often vague, making it difficult for users to understand the extent of data collection.

2 User Control & Consent :

Users often have limited control over their location data, with many apps requiring location permission for functionality that may not need it.

Opting out for location tracking is not always straightforward and in some cases, data continuous to be collected even after users disable location services.

3 Anonymity Concerns

Even when location data is anonymized patterns can still be used to identify individuals.

Cross-referencing data with other source (eg. social media post) can lead to the de-anonymization of users.

Data Security & Breaches

Storing large amount of sensitive location data makes it a prime target for hackers.

Breaches can expose users real time movement, home addresses, and travel patterns.

Legal & Regulatory Challenges

There is often a lack of clear legal protection regarding the collection and use of historical location data.

Law enforcement and third parties can access location data through legal loopholes or vague policies.

Q9

Explain the ways to measure the success of a company having social media.

To measure the success of a company using social media several key performance indicators and metrics can be tracked:

- 1 Count (Followers, Likes, Views)
 - The number of followers, friends or subscribers.
 - The number of views, likes and reactions on posts.
- 2 Social Sharing
 - The number of times content is shared, mentioned or retweeted.
- 3 Interaction and Conversations
 - Number of customers engaged.
 - Length and resolutions of conversations.
- 4 Influence and User Importance
 - centrality metrics (number of friends, follower or network influence).
- 5 Reach
 - The number of people who see a company's content.
- 6 Customer Satisfaction
 - Measured through surveys and feedback from social media interactions.

Engagement Rate

Interaction levels (like, share, comment) relative to the number of followers

Referral Rates (Website Traffic)

Click-through rates (CTR) from social media to the website.

Conversion Rate

The percentage of user who take a desired action (purchase, sign-up, etc).

Lead Generation

The number of potential customers acquired via social media campaign.