SOCIAL NETWORK ANALYTICS

The Strength of Weak Ties

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➤ In mathematical sociology, **interpersonal ties** are defined as

   information-carrying connections between people.

➤ **Tie strengths, generally, come in two varieties**: **Strong & Weak**.

1. **A Strong tie is someone who you know well.**

    • Friends, Family members and Relatives, ……

2. **A Weak tie is a more tenuous relationship**

    • Acquaintance – (ಪರಿಚಯ) a person one knows slightly, but

       who is not a close friend.

The Strength of Weak Ties

What distinguishes a strong tie from a weak tie?

1. **Age of the relationship**. Have you known the person for a long time?

2. **Frequency of contact**. The amount of time you two spend together.

3. **Emotional attachment**. Do you care about the other person?

4. **Reciprocity**. Do you regularly do random acts of kindness for your tie, and do they regularly do random acts of kindness for you?

5. **Kinship**. Even if you do not see your cousin very often, you still likely have a strong tie to him because of your family bond.

The Strength of Weak Ties

The Strength of Weak Ties - Mark S. Granovetter

Granovetter's original 1973 research into the subject looked at how people find jobs. He discovered that information about jobs that led to employment was more likely to come from the weak ties with acquaintances than from closer friends.

The Strength of Weak Ties

Bridges

The person labelled A has four friends, but one of her friendships is qualitatively different from the others:

- A's links to C, D, and E connect her to a tightly-knit group of friends who all know each other,
- While the A's link to B seems to reach into a different part of the network.

Figure 1:

The structural peculiarity of the A's link to B will translate into differences in the role it plays in A's everyday life:

- while the tightly-knit group A, C, D, and E will all tend to be exposed to similar opinions and similar sources of information,
- A's link to B offers her access to things she otherwise wouldn't necessarily hear about.
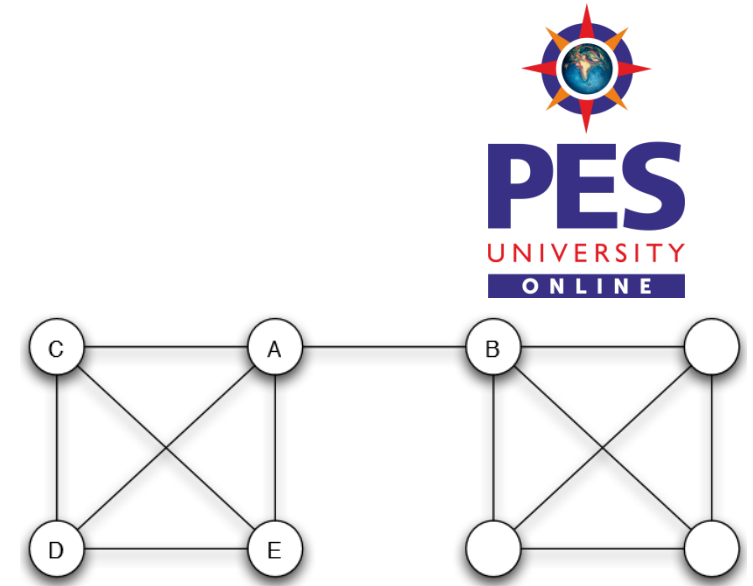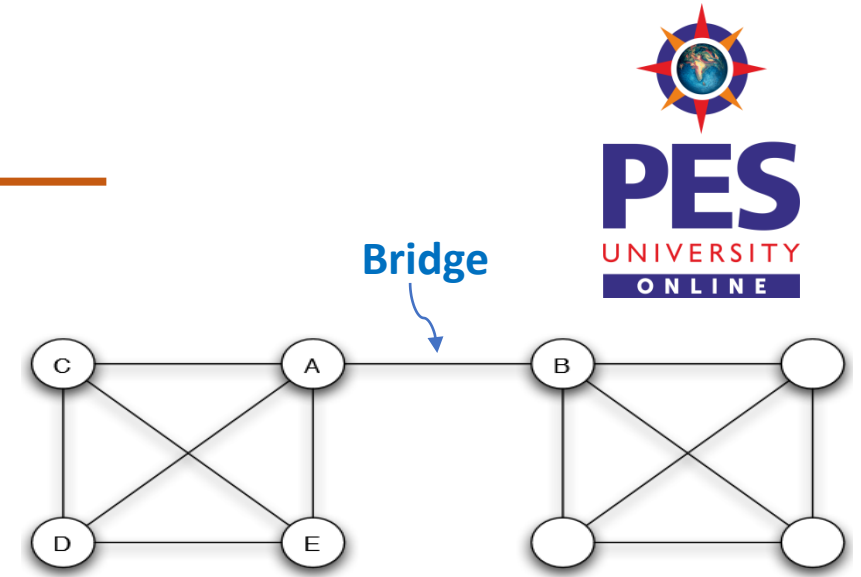
Bridges

To make precise, the sense in which the A-B link is unusual, we introduce the following definition.

- We say that an edge joining two nodes A and B in a graph is a bridge **if deleting the edge would cause A and B to lie in two different components**.

- In other words, **this edge is literally the only route between its endpoints, the nodes A and B**.

Figure 1: The A-B edge is a bridge, meaning that its removal would place A and B in distinct connected components.
Bridges provide nodes with access to parts of the network that are unreachable by other means.

The Strength of Weak Ties

Local bridges:

An edge is a local bridge
➤ **if its endpoints A and B have no friends in common**
   — in other words,
➤ **if deleting the edge would increase the distance between A and B to a value strictly more than two.**

An edge is a local bridge precisely **when it does not form a side of any triangle in the graph.**
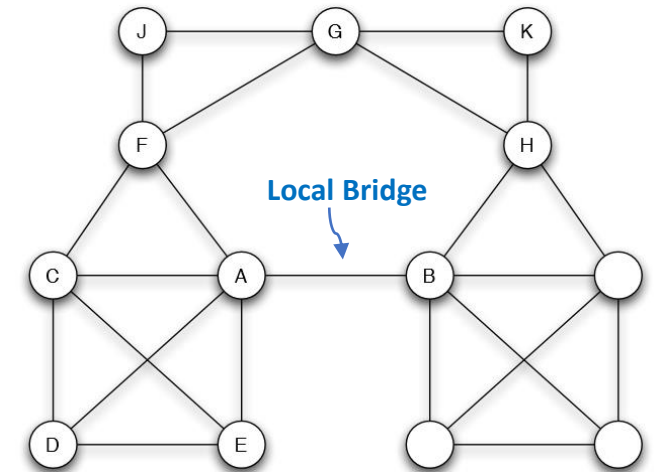

Local Bridge

Figure 2: The A-B edge is a local bridge of span 4, since the removal of this edge would increase the distance between A and B to 4.

The Strength of Weak Ties

The Strong Triadic Closure Property:

"If the node has strong ties to two neighbors, then these neighbors must have at least a weak tie between them"

In general, **links can have a wide range of possible strengths**,
we'll categorize all links in the social network as belonging to one of two types:

1. **Strong ties (the stronger links, corresponding to friends), and**

2. **Weak ties (the weaker links, corresponding to acquaintances).**
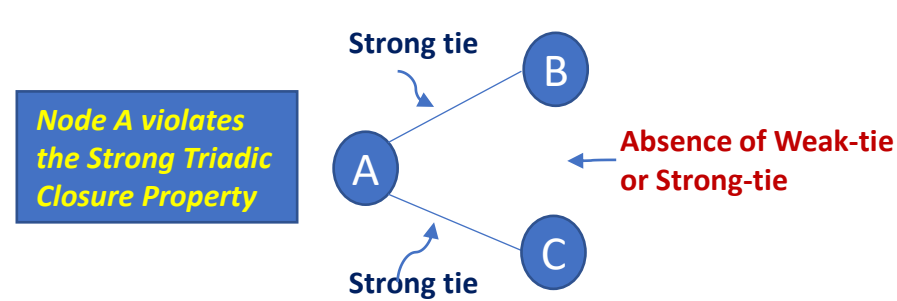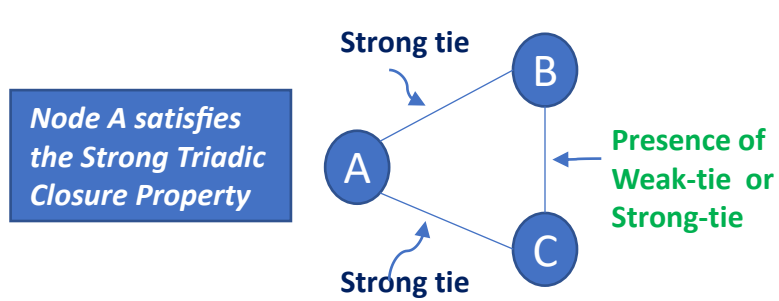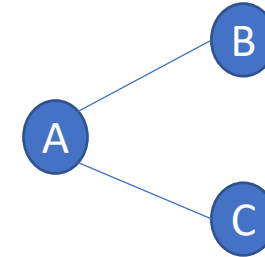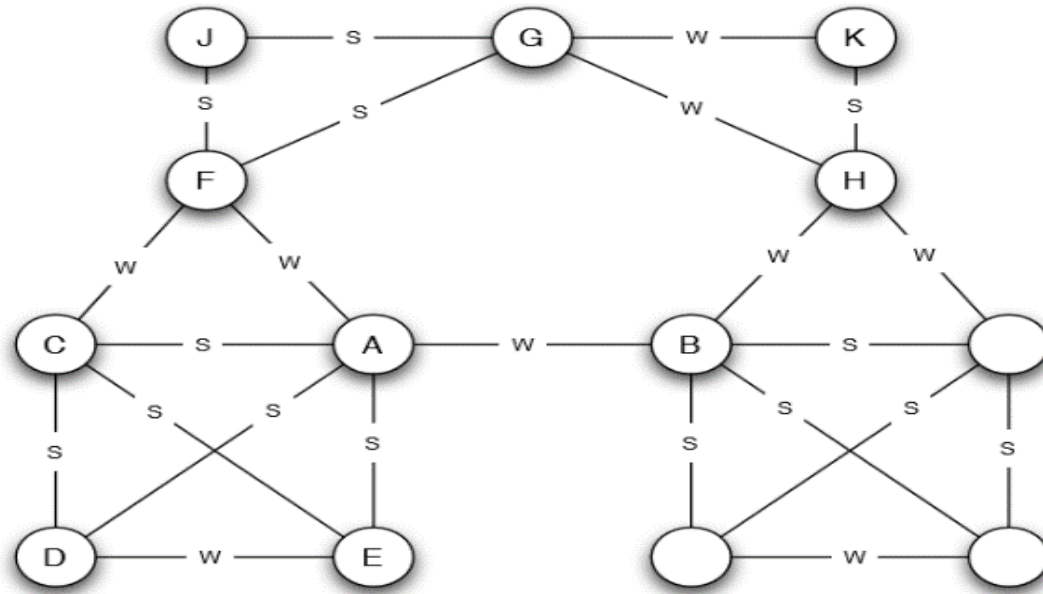
The Strength of Weak Ties
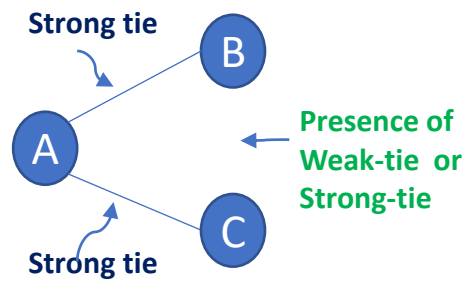
The Strong Triadic Closure Property:

"If a node A has edges to nodes B and C, then the B-C edge is especially likely to form if A's edges to B and C are both strong ties"

**Granovetter suggested a more formal of this, as follows.**

➤ *We say that a **node A violates the Strong Triadic Closure Property** if it has strong ties to two other nodes B and C, and there is no edge at all (either a strong or weak tie) between B and C.*

➤ *We say that a **node A satisfies the Strong Triadic Closure Property** if it does not violate it.*

Strong tie

B

A

C

Node A satisfies the Strong Triadic Closure Property

Strong tie

B

A

C

Strong tie

Presence of Weak-tie or Strong-tie

Node A violates the Strong Triadic Closure Property

Strong tie

B

A

C

Strong tie

Absence of Weak-tie or Strong-tie

The Strength of Weak Ties

Figure 3: Each edge of the social network is labelled here as either a **strong tie (S)** or a **weak tie (W),** to indicate the strength of the relationship.

The labelling in the figure satisfies the Strong Triadic Closure Property at each node: **if the node has strong ties to two neighbours, then these neighbours must have at least a weak tie between them.**

The Strength of Weak Ties
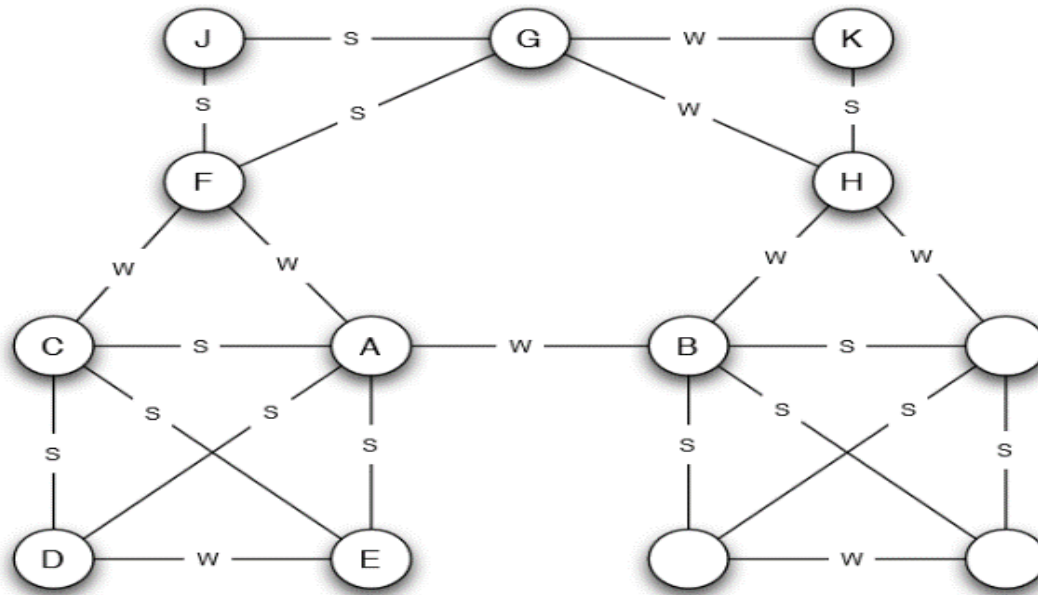
No node in above figure violates the Strong Triadic Closure Property, and hence all nodes satisfy the Property.

The Strength of Weak Ties
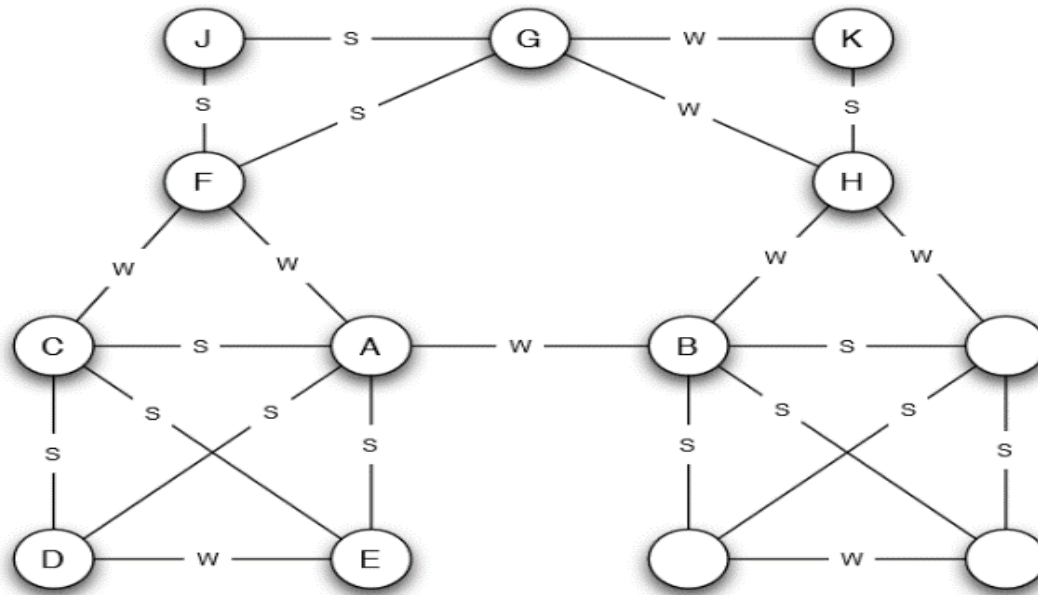
On the other hand, if the A-F edge were to be a strong tie rather than a weak tie, then nodes A and F would both violate the Strong Triadic Closure Property: Node A would now have strong ties to nodes E and F without there being an E-F edge, and node F would have strong ties to both A and G without there being an A-G edge.

Local Bridges and Weak Ties:

Using triadic closure we can establish a connection, in the following claim.

Claim: **If a node A in a network satisfies the Strong Triadic Closure Property and is involved in at least two strong ties, then any local bridge it is involved in must be a weak tie.**

In other words, assuming the Strong Triadic Closure Property and a sufficient number of strong ties, **the local bridges in a network are necessarily weak ties.**

According to Granovetter - "All bridges are weak ties".

The Strength of Weak Ties

Exercise:

➢ Consider the graph in Figure 3.21, in which each edge - except the edge connecting b and c - is labeled as a strong tie (S) or a weak tie (W). According to the theory of strong and weak ties, with the strong triadic closure assumption, how would you expect the edge connecting b and c to be labeled? Give a brief (1-3 sentence) explanation for your answer.
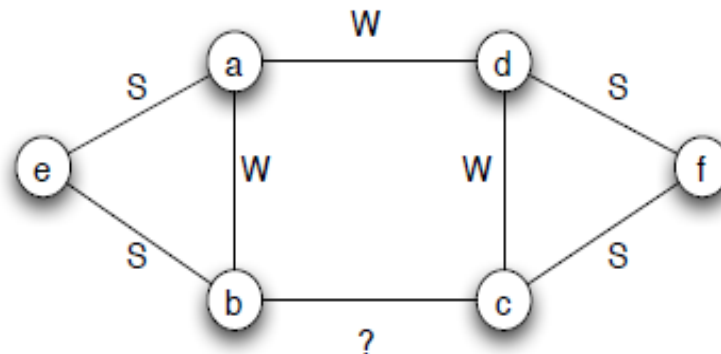

Figure 3.21:

The Strength of Weak Ties

➢ We have both **friends**(**Strong tie**) and **acquaintances**(**weak tie**).

- Our friends are often a part of a close-knit group who largely know one another.

- Our acquaintances are far less likely to know one another.

➢ **The more weak-ties we have,**

- **the more connected to the world we are** and

- **are more likely to receive important information about ideas, threats and opportunities in time to respond to them.**

The Strength of Weak Ties

➤ Societies and Social systems that have more weak ties are more likely to be dynamic and innovative.

➤ Weak ties, are responsible for

➤ the majority of the embeddedness and structure of social networks in society as well as

➤ the transmission of information through these networks. Specifically, more novel information flows to individuals through weak ties rather than strong ties.
Because our close friends tend to move in the same circles that we do, the information they receive overlaps considerably with what we already know.

➤ Acquaintances, by contrast, know people that we do not, and thus receive more novel information.

The Strength of Weak Ties

Summary:

➢ **Weak ties**(as bridges) **produce the branching structure that reaches many nodes in a few steps in networks**, hence networks have short average path lengths.

Assignment – Paper reading

- **The strength of weak ties – Mark S Granovetter**

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THANK YOU

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