STA 3180 Statistical Modelling: Network Analysis

STA 3180 Statistical Modelling - Network Analysis Lecture Notes

Network analysis is a type of statistical modelling used to analyze the relationships between different entities. It is used to identify patterns, trends, and correlations in a network of connected data points. Network analysis can be used to study social networks, economic networks, biological networks, and more.

Key Concepts

- **Network:** A network is a set of nodes (vertices) and edges (links) that connect them.

- **Node:** A node is an entity in a network. It can represent a person, a place, or an object.

- **Edge:** An edge is a connection between two nodes. It can represent a relationship, a flow of information, or a physical connection.

- **Degree:** The degree of a node is the number of edges connected to it.

- **Path:** A path is a sequence of nodes connected by edges.

- **Centrality:** Centrality measures how important a node is in a network.

Definitions

- **Network Analysis:** Network analysis is a type of statistical modelling used to analyze the relationships between different entities.

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Coding Examples

Example 1: Calculating Degree

```
Start of Code
// Create a graph with 4 nodes and 5 edges
let graph = {
       "A": ["B", "C"],
       "B": ["A", "C", "D"],
```

```
	"C": ["A", "B", "D"],
	"D": ["B", "C"]
};
// Function to calculate the degree of a node
function degree(graph, node) {
	return graph[node].length;
}
// Calculate the degree of node A
let degreeA = degree(graph, "A");
console.log(degreeA); // Output: 2
End of Code
```

Example 2: Calculating Path

```
Start of Code
// Create a graph with 4 nodes and 5 edges
let graph = {
	"A": ["B", "C"],
	"B": ["A", "C", "D"],
	"C": ["A", "B", "D"],
	"D": ["B", "C"]
};
// Function to calculate the path between two nodes
function path(graph, start, end) {
	let queue = [start];
	let visited = { start: true };
	let predecessor = {};
	while (queue.length > 0) {
		let node = queue.shift();
		if (node == end) {
			let path = [end];
			while (node != start) {
				path.unshift(predecessor[node]);
				node = predecessor[node];
			}
			return path;
		}
		for (let neighbour of graph[node]) {
			if (!visited[neighbour]) {
				visited[neighbour] = true;
				predecessor[neighbour] = node;
				queue.push(neighbour);
			}
		}
```

```
        }
        return null;
}
// Calculate the path between nodes A and D
let pathAD = path(graph, "A", "D");
console.log(pathAD); // Output: ["A", "B", "D"]
End of Code
```

Practice Multiple Choice Questions

Q1. What is network analysis?

A. Network analysis is a type of statistical modelling used to analyze the relationships between different entities.

Q2. What is a node in a network?

A. A node is an entity in a network. It can represent a person, a place, or an object.