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DISCRETE STRUCTURE

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1. Partially Ordered Sets (Posets):

A partially ordered set is a set equipped with a partial order relation. In a project management context, consider a set of tasks that need to be completed to finish a project. The set of tasks is partially ordered based on the dependency relationships between them.

**Example**

When given a project with tasks A, B, C, and D. The partial order relation could be defined as:

A precedes B (A → B)

A precedes C (A → C)

B precedes D (B → D)

C precedes D (C → D)

The set {A, B, C, D} will be the partial order relation form of a poset.

1. **Hasse Diagrams**

A Hasse diagram is a graphical representation of a poset, emphasizing the essential structure without unnecessary detail. Each element of the poset is represented by a node, and the partial order relation is depicted by directed edges.

**Example**

For the partial order relation form of a poset, the Hasse diagram would have nodes for tasks A, B, C, and D, with directed edges connecting A to B, A to C, B to D, and C to D.

A

/ \

B C

\ /

D

The Hasse diagram visually represents the partial order relationships between tasks, providing a clear overview of the project's task dependencies.

1. **Lattice**

A lattice is a special type of poset in which every pair of elements has both a least upper bound (LUB) and a greatest lower bound (GLB). In the context of project management, a lattice might represent a set of tasks where each pair of tasks has a common task that can serve as both the starting point and endpoint.

**Example**

Using tasks A, B, C, and D with a different partial order relation

A precedes B (A → B)

A precedes C (A → C)

B and C both precede D (B → D, C → D

The set {A, B, C, D} forms a lattice.

The Hasse diagram for this lattice would show A at the top, with B and C below it, and D at the bottom, indicating the LUB (D) and GLB (A) for each pair of tasks.

A

/ \

B C

\ /

D