Database Structures

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Topic 04

Introduction

- Database structures are systematic organizations of records and relationships in databases
- Two main types:
  - Trees (hierarchies)
  - Networks

Tree (Hierarchy)

- A tree is a database structure consisted of related records called nodes with the following characteristics:
  - There is a special node called the root
  - The root can be related to any number of other nodes (including zero)
  - Each node related to the root is itself the root of a subtree
  - No node can be in more than one subtree of a given node (subtrees are disjoint sets)
- Note: Definition is recursive

Example of a Tree

What are the subtrees?

Relationships in a Tree

- A tree cannot have any many-to-many relationships
- A tree can only have one-to-many relationships that “go in the same direction”
- A tree can also have one-to-one relationships
Example of a Tree

Tree Terminology

- **Parent**: root of a subtree
- **Descendants of a node**: all nodes "down" the tree from a node
- **Ancestors of a node**: all nodes "up" the tree from a node
- **Child (children)**: immediate descendent(s) of a parent
- **Siblings**: children of the same parent
- **Leaves**: children at the bottom of the tree.

Alternative Definitions of a Tree

- No child has more than one parent
  
  OR

- Each node has one and only one parent except the root which has no parents

Example: Tree with Multiple Types of Subtrees of a Root

Network

- A network is a database structure consisting of related nodes in which any node can be related to any other node
- A node can have any number of parents

Example of a Network
Relationships in a Network

- A network can have any types of relationships
  - Many-to-many
  - One-to-many
  - One-to-one

Example of a Network

A network can have only one-to-many relationships.

Example:

Why is this example not a tree?

Summary

- If a database structure has at least one many-to-many relationship it is a network.
- If a database structure has only one-to-many relationships (or one-to-one) it is:
  - A tree if the one-to-many relationships all “go in the same direction” (no child has more than one parent)
  - A network if the one-to-many relationships do not all “go in the same direction” (a child has more than one parent)

Exercise

Draw an occurrence of the following database structure