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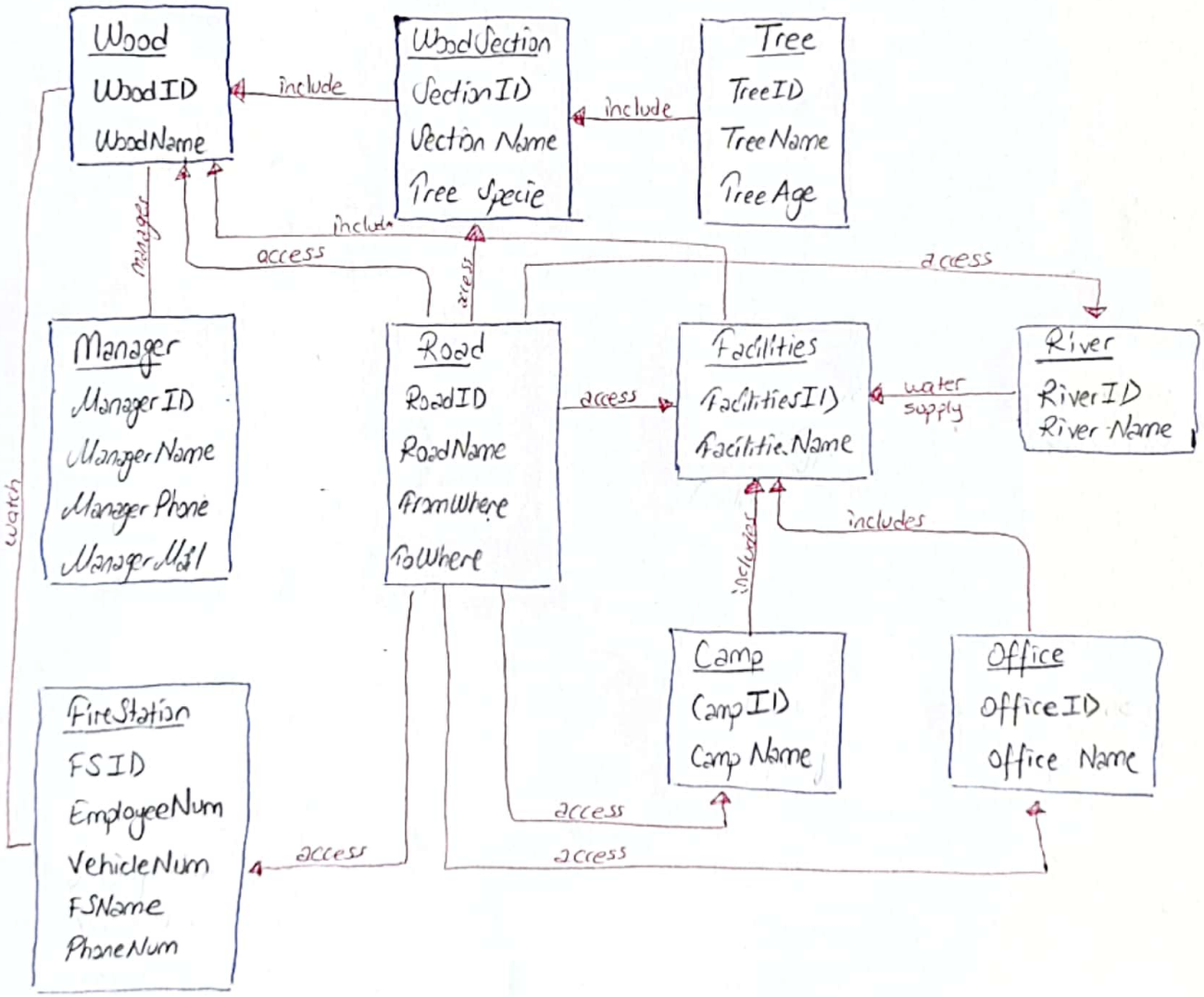
CSE 414 DATABASE HOMEWORK #1

I understood these tables from the text of homework. The park contains :

- Wood
- Wood Sections
- Specific Trees
- Roads
- Fire Stations
- Facilities
- Camp
- Offices
- Rivers
- Manager

1 - Draw E-R diagram of the park.



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2- Give all functional dependencies in the question

WoodID → ManagerID
WoodSectionID → WoodID
TreeID → WoodSectionID
ManagerID → WoodID
RoadID → WoodID
RiverID → River Name
RiverID → FacilitiesID
CampID → CampName
CampID → FacilitiesID
OfficeID → OfficeName
OfficeID → FacilitiesID
FacilitiesID → RiverID
FacilitiesID → RoadID

There are more dependencies than that. However, the other dependencies repeat themselves like (WoodID → WoodID) or unreasonable like (WoodID → WoodName). So I asked my teacher and I didn't write them.

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(4) 3.a) Give 2 relations that holds the criterias of 3NF. Explain why they are in 3NF, give your reasons and proofs in details

(Actually, this question was the 4th question. But to proof the BCNF, I want to write 3NF question first.)

Example 1: WoodID → Manager ID (Manager includes Name, Phone, Mail)

Proof: First we should check each record is a unique for 1NF. So there must not be multivalues. WoodID or Manager ID is a single value. After 1NF, we have to check partial dependency for 2NF. Partial dependency occurs when a non-prime attribute is functionally dependent on a part of candidate key. Our non prime attributes are name, phone and mail but they dependent on our manager id. The last part is 3NF. If a relation is 3NF, that means there must not be transitive functional dependency. For example if $x \to y$ and $y \to z$ then we can say $x \to z$. But in our relation, there is no transitive. Because let's say we reach wood id from manager. But we couldn't find wood's attributes in this manager table. So this relation holds the 3NF criteria.

Example 2: FireStationID → WoodID (FireStation includes EmployeeNum, VehicleNum, FSName, PhoneNum)

Proof: For 1NF, we don't have multivalues. ID's are single value. After 1NF, we have to check partial dependency for 2NF. Our non-prime attributes are phone, employeeNum, name, vehicleNum. They depend on our firestation ID. The last part 3NF. From firestation id, we can't reach wood attributes from this part. So also this relation holds the 3NF criteria.

(4) 3.b) Give 2 relations that doesn't hold the criterias of 3NF. Explain why they are not in 3NF, give your reasons and proofs in details.

There are no relation that doesn't hold the criterias of 3NF. Because every table has single values, no multivalue (1NF). They are not in partial dependency because attributes depend on a primary key (2NF). Also we can't reach all other attributes from a table. They are no transitive (3NF).

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(3) 4.2) Give 2 relations that holds the criterias of Boyce-Codd Normal form, if there is any. Explain why they are in Boyce-Codd Normal form, give your reasons and proofs in details.

A relational schema R is considered to be in BCNF if, for every one of its dependencies $X \rightarrow Y$ and X is a super key. So these tables has 3NF and also they have to have a super key.

Tables	Keys
Wood	Wood ID
WoodSection	Section ID
Tree	Tree ID
Manager	Manager ID
Road	Road ID
Facilities	Facilities ID
River	River ID
FireStation	FSID
Camp	Camp ID
Office	Office ID

Example 1: Wood ID → Manager

Proof: In previous question, we proof these relation has 3NF. Now the other rule is super key. The manager id is a primary key and also is super key for table Manager. So it is single value and we checked 3NF and key rule. This relation holds the criteria of BCNF.

Example 2: FireStation → Wood

Proof: In previous question, we proof the FSID → Wood ID has 3NF. Now the FireStation ID is a primary key and also it is super key for table FireStation So this relation is also example of BCNF.

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(3) 4.b) Give 2 relations that does not hold the criterias of BCNF, if there is any.

In 4.a, I explained and wrote whole super keys for tables. So each table has a super key and we don't have relation that does not hold BCNF.