CSE414 Databases HW1

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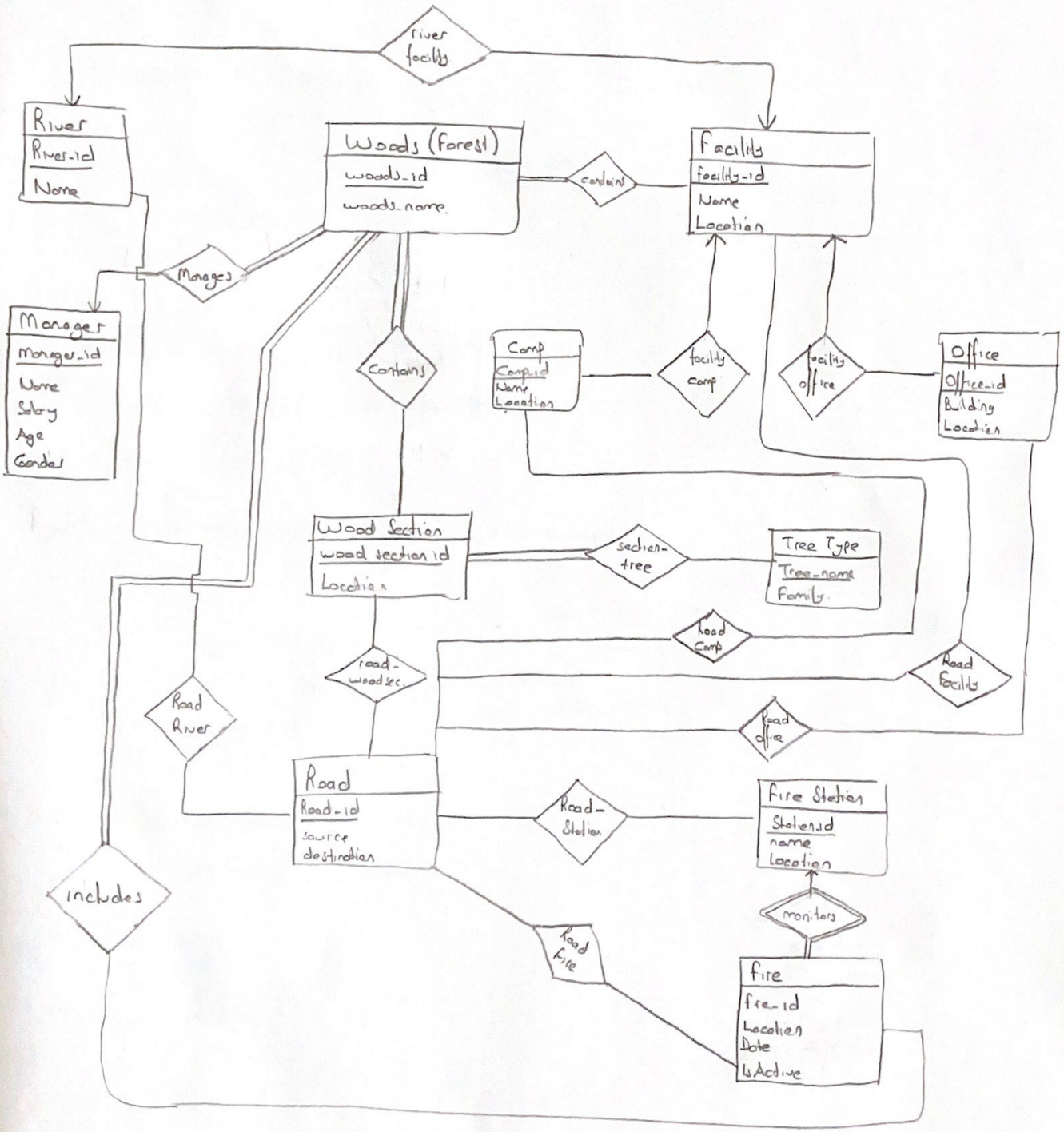
Part 1



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Part 2

Functional Dependencies

→ For Forest table

[woods_id, woods_name] → woods_id
["] → woods_name.
woods_id → woods_id
woods_name → woods_name

} Trivial func. dep.

woods_id → woods_name. → Non-trivial func dep.

There isn't transitiver or multivalued dependency

→ For Facility Table

[facility_id, name, location] → facility_id
["] → name
["] → location
[facility_id, name] → facility_id
["] → name.

[facility_id, location] → facility_id
["] → location
[name, location] → name
["] → location
name → name
facility_id → facility_id
location → location

} Trivid func. dep.

Facilty_id → Name, Location → Non_trivid func. dep.

There isn't transitive or multivalued dep.

→ For River Table

[River_id, None] → River_id
["] → None
River_id → River_id
None → None

} Trivial func. dep.

River_id → None → Non-trivid func dep.

There isn't transitive or multivalued dependency.

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→ For Manager table

[Manager_id, Name, Salary, Age, Gender] → Manager_id
["] → Name
["] → Salary
["] → Age
["] → Gender.

[Manager_id, Salary, Age, Gender] → Manager_id
["] → Salary
["] → Age.
["] → Gender.

[Manager_id, Name, Age, Gender] → Manager_id
["] → Name
["] → Age
["] → Gender

[Manager_id, Name, Salary, Gender] → Manager_id
["] → Name
["] → Salary
["] → Gender

[Manager_id, Name, Salary, Age] → Manager_id
["] → Name
["] → Salary
["] → Gender

Manager_id → Manager_id
Name → Name
Salary → Salary
Age → Age
Gender → Gender

- ~~Non-tri~~ Trivial function dependency
- There isn't transitive and multivalued dependency

Manager_id → Name, Salary, Age, Gender → Non-trivial functi dependency.

→ for Comp table

[Comp_id, Name, location] → Comp_id
["] → Name
["] → location

[Comp_id, location] → comp_id
["] → location

[Comp_id, Name] → comp_id
["] → Name

[Name, location] → Name
["] → location

Name → Name
Comp_id → Comp_id
location → location

Trivial function dependency

Comp_id → Name, location → Non-trivial func. dep.

There isn't transitive and multivalued dep.

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→ For office table

[office_id, building, location] → office_id
["] → building
["] → location
[office_id, building] → office_id
["] → building
[office_id, location] → office_id
["] → location

[building, location] → building
["] → location
building → building
office_id → office_id
location → location

} Trivial func dep.

office_id → building, location → non-trivial func. dep.

There isn't transitive or multivalued dep.

→ For wood section table

[wood_section_id, location] → wood_section_id
["] → location
wood_section_id → wood_section_id
location → location

} Trivial func dep.

wood_section_id → location → Non-trivial func. dep.

There isn't transitive or multivalued dep.

→ For TreeType table

[Tree_name, family] → Tree_name
["] → family
Tree_name → Tree_name
family → family

} Trivial func. dep.

tree_name → family → non-trivial func. dep.

There isn't transitive or multivalued dep.

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→ For Road table

[Road_id, source, destination] → Road_id
["] → source
["] → destination

[Road_id, source] → road_id
["] → source

[Road_id, destination] → road_id
["] → destination

[source, destination] → source
["] → destination

Road_id → road_id
source → source
destination → destination

Trivial function Dependency

Road_id → source, destination → Non-trivial function dependency
There isn't transitive or multivalued dependency

→ For Fire Station table

[station_id, name, location] → station_id
["] → name
["] → location

[station_id, name] → station_id
["] → name

[station_id, location] → station_id
["] → location

[name, location] → name
["] → location

station_id → station_id
name → name
location → location

Trivial func. Dep.

station_id → name, location → non-trivial func. dep.
There isn't transitive or multivalued dep.

→ For fire table

[fire_id, location, date, isActive] → fire_id
["] → location
["] → date
["] → isActive

[fire_id, date, isActive] → fire_id
["] → date
["] → isActive

[fire_id, location, isActive] → fire_id

[fire_id, location, date] → fire_id
["] → location

fire_id → fire_id
location → location
date → date
isActive → isActive

Trivial func. dep.

fire_id → location, date, isActive → non-trivial func. dep.
There isn't transitive or multivalued dep.

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Part 3

a) • Facility table holds the criterios of Boyce-Codd Normal form

→ Facility (facility_id, name, location)

Proof: A reblion schema R is in BCNF with respect to a set F of functional dependencies in F^+ of the form

$$\alpha \rightarrow \beta$$

where $\alpha \subseteq R$ and $\beta \subseteq R$, at least one of the following holds:

→ $\alpha \rightarrow \beta$ is trivial ($\beta \subseteq \alpha$)

→ α is a superkey for R

If we look at the trivial and non-trivial dependencies shown in the Facility table in Part2. The trivial functional dependencies meets the $\alpha \rightarrow \beta$ is trivial or $\beta \subseteq \alpha$ rule Thus, BCNF is provided with this conditions

→ the trivial func dep. examples:

[facility_id, name, location] → facility_id

⋮

[facility_id, name] → facility_id

⋮

name → name

facility_id → facility_id

location → location

→ non-trivial func. dep. examples:

facility_id → name, location ⇒ These are non-trivial but facility_id is superkey so these holds the BCNF

So the facility table holds the BCNF

• Wood Section table holds the criterios of Boyce-codd Normal form.

→ Wood Section (wood_section_id, location)

Proof: A reldion schema R is in BCNF with respect to a set F of functional dependencies in F^+ of the form

$$\alpha \rightarrow \beta$$

where $\alpha \subseteq R$ and $\beta \subseteq R$, at least one of the following holds:

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→ $\alpha \rightarrow \beta$ is trivial ($\beta \subseteq \alpha$)
→ α is superkey for R

If we look at the trivial and non-trivial dependencies shown in the wood section table in part 2. The trivial functional dependencies meets the $\alpha \rightarrow \beta$ is trivial or $\beta \subseteq \alpha$ rule
Thus, BCNF is provided with this conditions.

→ the trivial func dep. examples:

[wood_section_id, location] → wood_section_id
["] → location
wood_section_id → wood_section_id
location → location

→ non-trivial func. dep. examples:

wood_section_id → location. => These are non-trivial but wood_section_id is superkey so these holds the BCNF

So the wood section table holds the BCNF

b) Because of all the functional dependencies specified in part 2, there is no table that does not fit the BCNF form.

Part 4

a) • Road table holds the criterios of 3NF

→ Road (road_id, source, destination)

Proof: A relation schema R is in third normal form if for all:

$\alpha \rightarrow \beta$ in F^+

at least one of the following holds:

→ $\alpha \rightarrow \beta$ is trivial (i.e., $\beta \in \alpha$)
→ α is a superkey for R
→ Each attribute A in $\beta - \alpha$ is contained in a candidate key for R

If a relation is in BCNF it is in 3NF (since in BCNF one of the first two condition above must hold)

Third condition is a minimal relaxation of BCNF to ensure dependency preservation

→ If we look at the trivial and non-trivial dependencies shown in the Road table in part2 The trivial function dependencies meets the $\alpha \rightarrow \beta$ in F^+. Thus these holds criterios of 3NF

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→ the trivial func. dep. examples

[Road_id, source, destination] → road_id
["] → source
["] → destination
[Road_id, source] → Road_id

Road_id → Road_id
Source → Source
Destination → Destination

→ non-trivial func. dep. examples

road_id → source, destination ⇒ These are non-trivial but road_id is superkey so these holds the 3NF

- Fire Station table holds the criterias of 3NF

→ FireStation (station_id, name, location)

Proof: A relation schema R is in third normal form if for all:

$\alpha \rightarrow \beta$ in F^+

at least one of the following holds:

→ $\alpha \rightarrow \beta$ is trivial (i.e., $\beta \in \alpha$)
→ α is a superkey for R
→ Each attribute A in $\beta - \alpha$ is contained in a candidate key for R

If a relation is in BCNF it is in 3NF (since in BCNF one of the first two conditions above must hold)

Third condition is a minimal relaxation of BCNF to ensure dependency preservation

→ If we look at the trivial and non-trivial dependencies shown in the Fire Station table. in part 2 The trivial function dependencies meets the $\alpha \rightarrow \beta$ in F^+. Thus these holds criterias of 3NF

→ the trivial func. dep. examples

[station_id, name, location] → station_id
["] → name
["] → location

station_id → station_id
name → name
location → location

[station_id, name] → station_id
["] → name

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→ non-trivial func. dep. examples

station_id → name, location ⇒ These are non-trivial but station_id is superkey so these holds the 3NF

b) Because of all the functional dependencies specified in part 2, there is no table that does not fit the 3NF form