COMP 3311
DATABASE MANAGEMENT SYSTEMS

LECTURE 3 EXERCISES
ENTITY-RELATIONSHIP (E-R) MODEL AND DATA BASE DESIGN

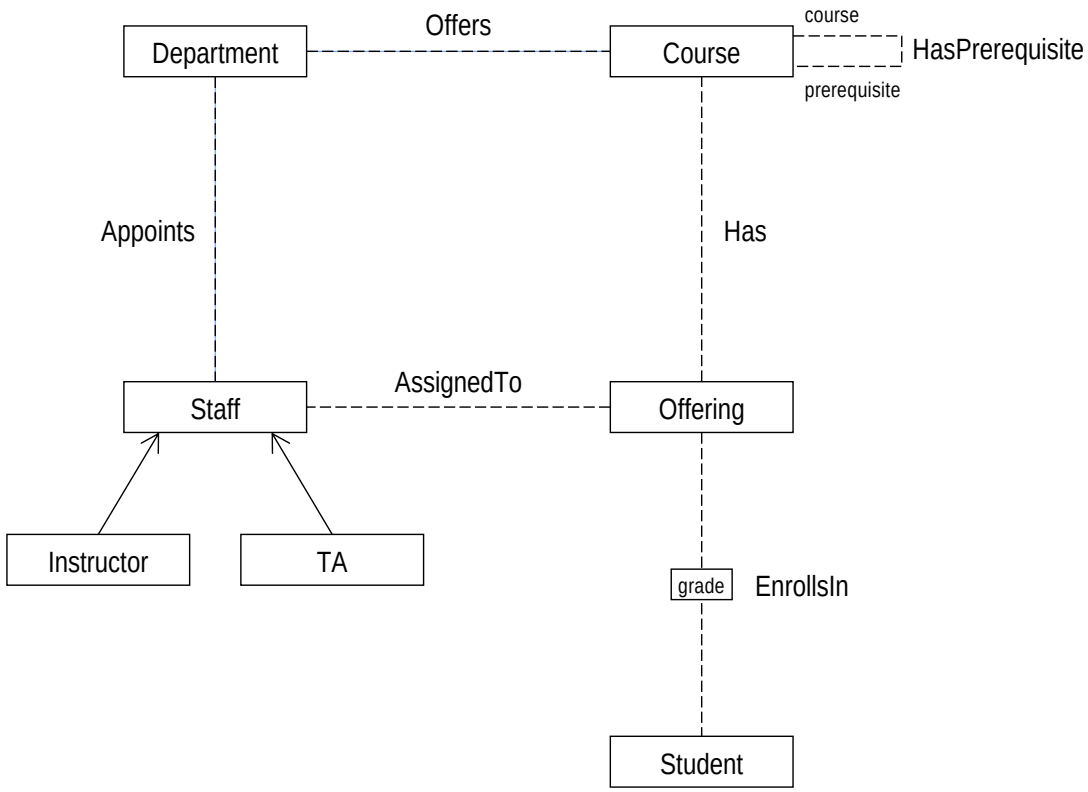
EXERCISE 1: UNIVERSITY APPLICATION

We want to record information about students, departments, courses and course teaching teams.

- For each student we store the student id, name and majors.
- For each department we store a unique code and name.
- For each course we store a unique course id, name, department and prerequisites.
- For each offering of a course we store the section, semester and year.
- Each student must enroll in one to five course offerings.
- Each course offering can enroll zero to sixty students.
- For each course offering that a student takes we store the grade.
- Each course offering's teaching team has one or more staff, who is either an instructor or a TA.
- For each staff assigned to a course offering's teaching team we store the hkid, name, department and office number.
- For each instructor we store their academic title (e.g., professor).

For the university application E-R diagram, identify keys and discriminators of entities, weak entities and their identifying relationship(s) and show relationship cardinality and participation constraints.

EXERCISE 1: UNIVERSITY APPLICATION— E-R DIAGRAM



Student	Department	Course	Offering	Staff	Instructor	TA
studentId name {major}	code name	courseId name	section semester year	hkid name officeNumber	title	

EXERCISE 1: UNIVERSITY APPLICATION— KEYS OF ENTITY TYPES

- For each student we store the student id, name and majors.
- For each department we store a unique code and name.
- For each course we store a unique course id, name, department and prerequisites.
- For each offering of a course we store the section, semester and year.
- Each student must enroll in one to five course offerings.
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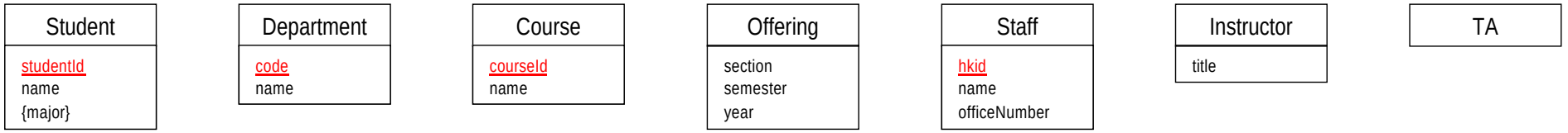
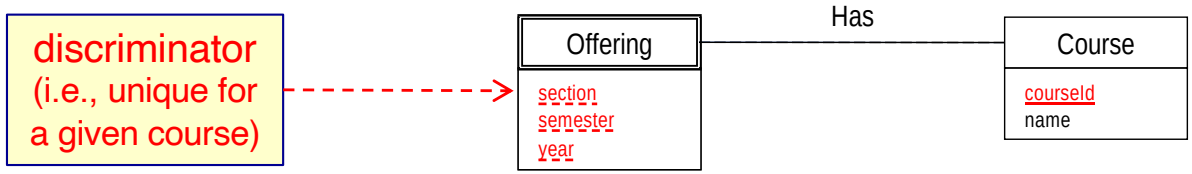


EXERCISE 1: UNIVERSITY APPLICATION— KEYS OF ENTITY TYPES

- For each offering of a course we store the section, semester and year.



What kind of entity is Offering?

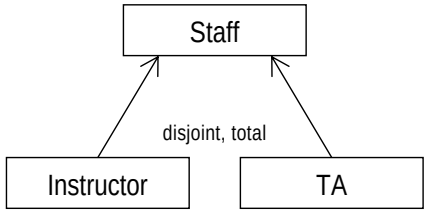
⟹ Weak entity dependent on Course.

Is there a discriminator for Offering?

⟹ Yes — section, semester, year.

EXERCISE 1: UNIVERSITY APPLICATION—ENTITY GENERALIZATION COVERAGE

- Each course offering's teaching team has one or more staff, who is either an instructor or a TA.



What should be the completeness constraint?

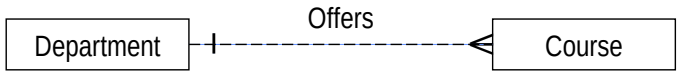
⟹ total

What should be the disjointness constraint?

⟹ disjoint

EXERCISE 1: UNIVERSITY APPLICATION—RELATIONSHIP CARDINALITY & PARTICIPATION

- For each course we store a unique course id, name, department and prerequisites.



What should be the cardinality constraint (max-card) for Department?

⟹ many (A department can offer many courses—domain knowledge.)

What should be the participation constraint (min-card) for Department?

⟹ unknown (Could be partial or total; need to verify with client. Leave unspecified.)

What should be the cardinality constraint (max-card) for Course?

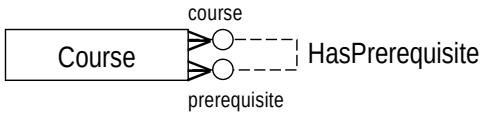
⟹ unknown (Could be 1 or N; need to verify with client. Leave unspecified.)

What should be the participation constraint (min-card) for Course?

⟹ total (Every course must be offered by some department—domain knowledge.)

EXERCISE 1: UNIVERSITY APPLICATION— RELATIONSHIP CARDINALITY & PARTICIPATION

- For each course we store a unique course id, name, department and prerequisites.



What should be the cardinality constraints?

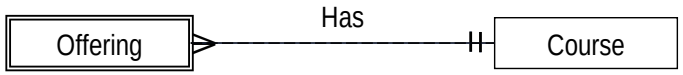
⟹ Course (prerequisite) many (A course can be a prerequisite for several courses.)
Course (course) many (A course can have several prerequisites.)

What should be the participation constraints?

⟹ Course (prerequisite) partial (A course does not have to be a prerequisite.)
Course (course) partial (A course can have no prerequisites.)

EXERCISE 1: UNIVERSITY APPLICATION—RELATIONSHIP CARDINALITY & PARTICIPATION

- For each offering of a course we store the section, semester and year.



What should be the cardinality constraint (max-card) for Offering?

⟹ 1 (Every offering is for at most one course—domain knowledge.)

What should be the participation constraint (min-card) for Offering?

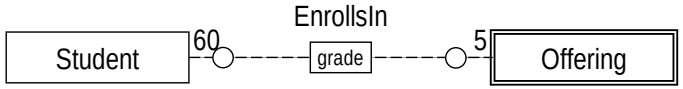
⟹ total (Every offering must be for some course—domain knowledge.)

What about for Course?

⟹ (?,many) min-card most likely 0, but need to verify with client. Leave unspecified.

EXERCISE 1: UNIVERSITY APPLICATION— RELATIONSHIP CARDINALITY & PARTICIPATION

- Each student must enroll in one to five course offerings.
- Each course offering can enroll zero to sixty students.



Is a student required to enroll in an offering as soon as the student's record is created?

Is Offering dependent on Student?

No!
(domain knowledge)

⟹ No.

What should be the cardinality constraint (max-card) for Student?

⟹ 5 (A student can enroll in at most 5 course offerings.)

What should be the participation constraint (min-card) for Student?

⟹ total (A student must enroll in at least 1 course offering.)

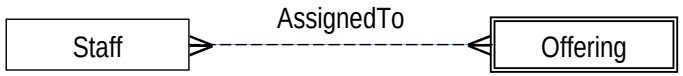
What about for Offering?

⟹ (0, 60)

☞ **Does the participation constraint for Student make sense?**

EXERCISE 1: UNIVERSITY APPLICATION—RELATIONSHIP CARDINALITY & PARTICIPATION

- Each course offering's teaching team has one or more staff, who is either an instructor or a TA



Is an offering required to have a staff assigned to it?

Is Offering dependent on Staff?

⟹ No.

Need to verify with client!

What should be the cardinality constraint (max-card) for Offering?

⟹ many (An offering can have several staff assigned to it.)

What should be the participation constraint (min-card) for Offering?

⟹ total (An offering has at least one staff assigned to it.)

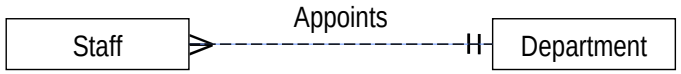
What about for Staff?

⟹ (?,many) min-card most likely 0, but need to verify with client. Leave unspecified.

☞ **Does the participation constraint for Offering make sense?**

EXERCISE 1: UNIVERSITY APPLICATION—RELATIONSHIP CARDINALITY & PARTICIPATION

- For each staff assigned to a course offering's teaching team we store the hkid, name, department and office number.



What should be the cardinality constraint (max-card) for Staff?

⟹ 1 (For each staff … we store the … department ….)

What should be the participation constraint (min-card) for Staff?

⟹ total (Every staff must be appointed in some department—domain knowledge.)

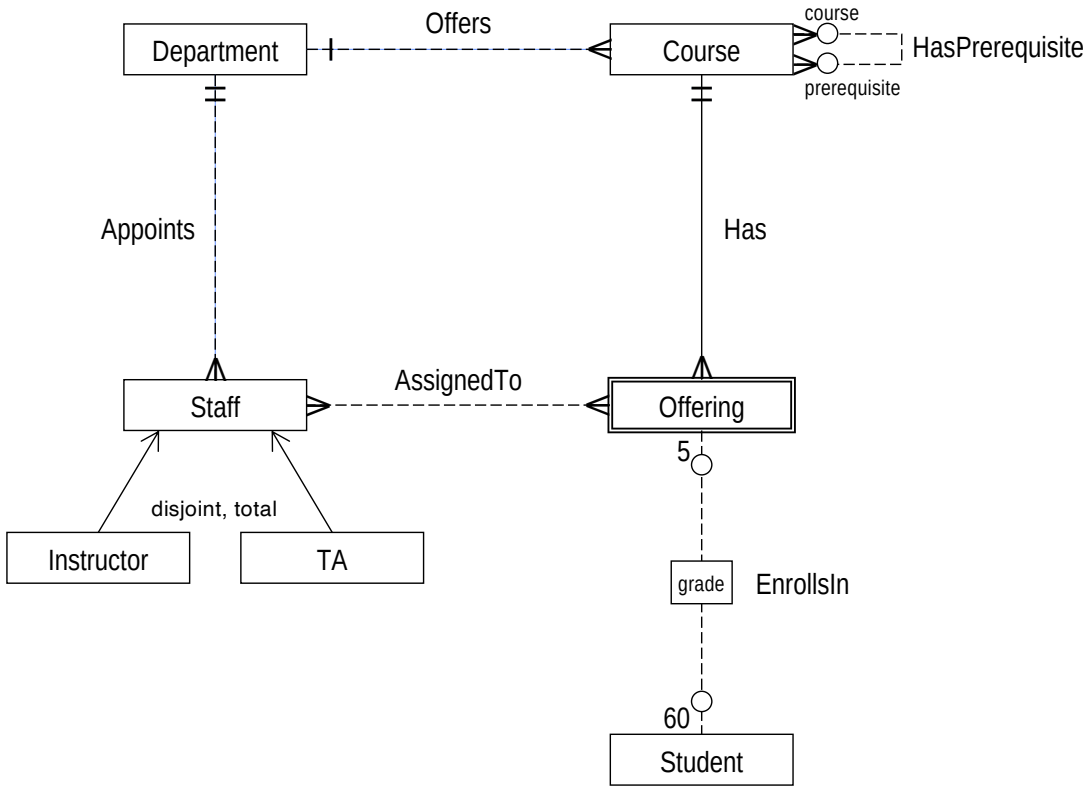
What should be the cardinality constraint (max-card) for Department?

⟹ many (A department can appoint several staff—domain knowledge.)

What should be the participation constraint (min-card) for Department?

⟹ unknown (Could be partial or total; need to verify with client. Leave unspecified.)

EXERCISE 1: UNIVERSITY APPLICATION— E-R DIAGRAM



Student
studentId name {major}

Department
code name

Course
courseId name

Offering
section semester year

Staff
hkid name officeNumber

Instructor
title

TA

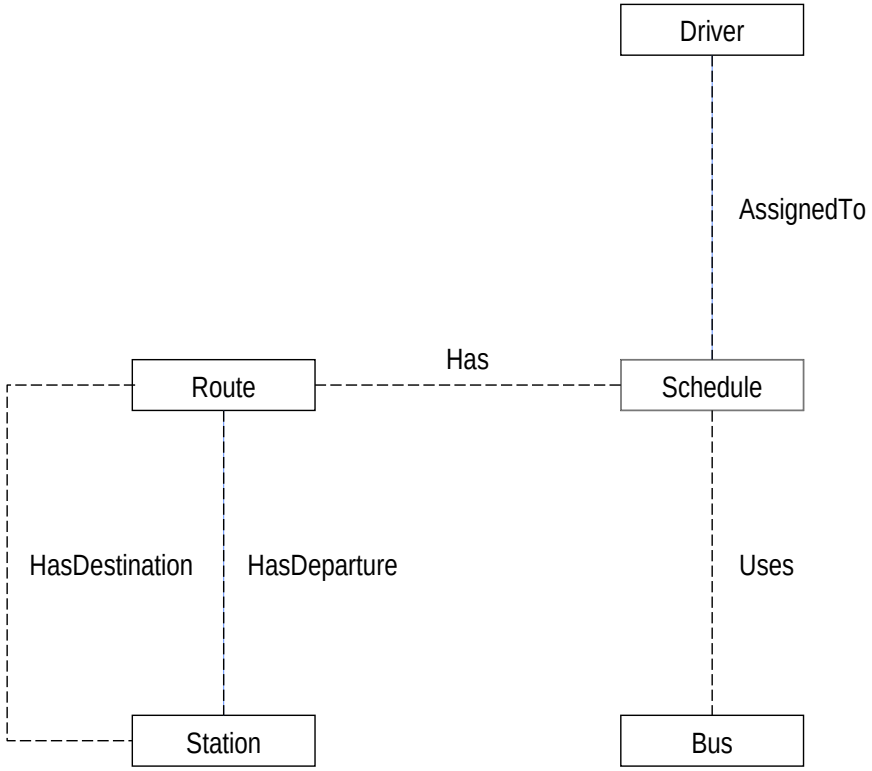
EXERCISE 2: BUS COMPANY

We want to keep track of bus routes and schedules for a bus company.

- Each bus route has a unique route number, a departure station and a destination station.
- For each bus route, there is a schedule, which records the departure times of buses.
- For each departure time of each route, a driver and a bus can be assigned; however, information about the driver or the bus may sometimes be missing.
- A driver has a unique employee id, a name and a phone number.
- A bus is identified by its license number and has a maximum seating capacity.

For the bus company application E-R diagram, identify keys and discriminators of entities, weak entities and their identifying relationship(s) and show relationship cardinality and participation constraints.

EXERCISE 2: BUS COMPANY—E-R DIAGRAM



Route	Schedule	Driver	Bus	Station
routeNo	departureTime	empId name phoneNo	licenseNo maxSeating	name

EXERCISE 2: BUS COMPANY—KEYS OF ENTITIES

- Each bus route has a unique route number, a departure station and a destination station.
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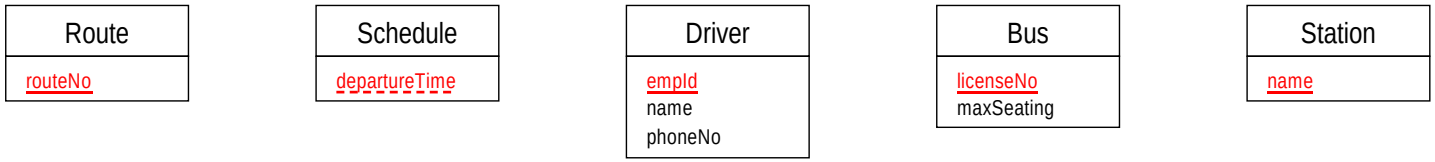

EXERCISE 2: BUS COMPANY— RELATIONSHIP CARDINALITY & PARTICIPATION

- Each bus route has a unique route number, a departure station and a destination station.
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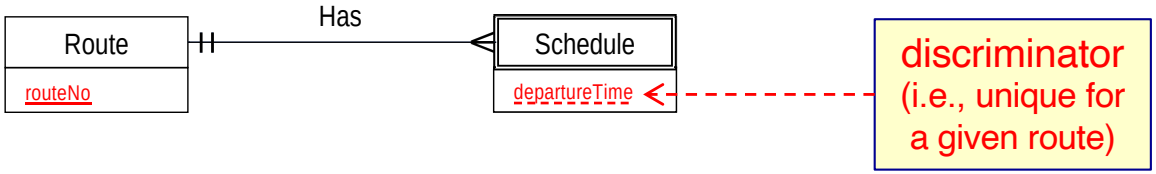


What type of entity is Schedule**?** ⟹ Weak entity dependent on Route.

Is there a discriminator for Schedule**?** ⟹ Yes — departureTime.

What should be the cardinality constraint (max-card) for Schedule**?** ⟹ 1

What should be the participation constraint (min-card) for Schedule**?** ⟹ total

What about for Route**?** ⟹ cardinality many; participation unknown.

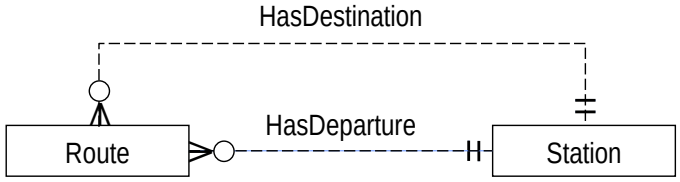
Does every route have to have a schedule? Verify with client.

EXERCISE 2: BUS COMPANY— RELATIONSHIP CARDINALITY & PARTICIPATION

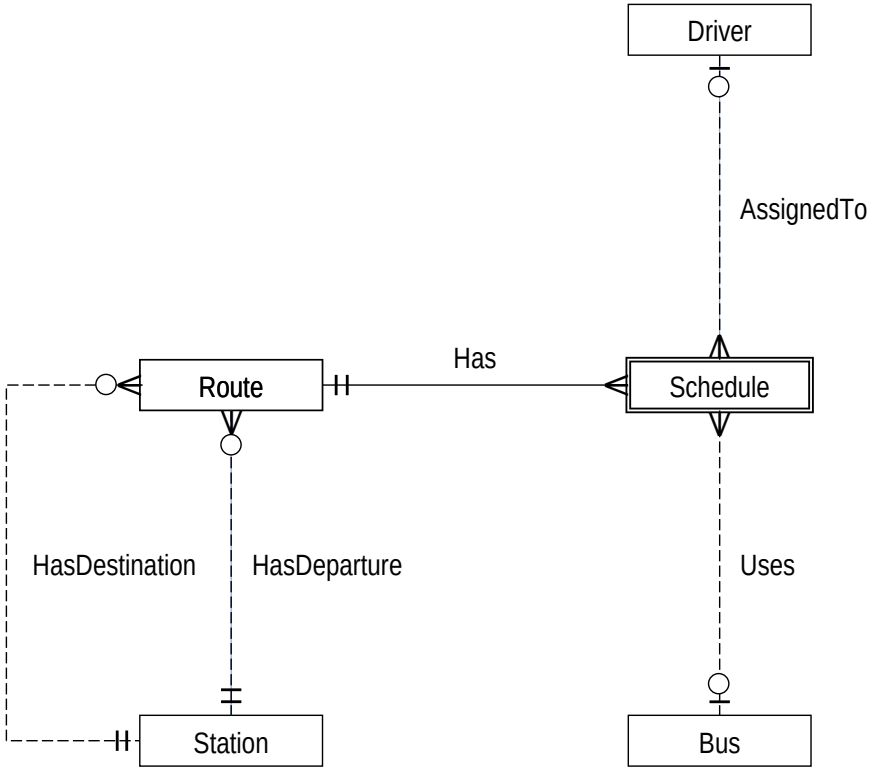
- For each departure time of each route, a driver and a bus can be assigned; however, information about the driver or the bus may sometimes be missing.

Does every driver/bus have to be assigned to/used by a schedule? Verify with client.

- Each bus route has a unique route number, a departure station and a destination station.



EXERCISE 2: BUS COMPANY—E-R DIAGRAM



Route	Schedule	Driver	Bus	Station
routeNo	departureTime	empId name phoneNo	licenseNo maxSeating	name