

## Week 4 Workshop (Solutions)

### Entity-Relationship Model

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#### 1 University Student Database

Consider the following data requirements for a university student database that is used to keep track of students' transcripts.

- The university keeps track of each student's name, student number, social security number, address, phone, and birthdate. Both social security number and student number have unique values for each student.
- Each student has exactly one major, and may have a minor (if any) with departments.
- Each department is described by a name, department code, office number, office phone, and college. Both name and code have unique values for each department.
- Each course has a course name, description, course number, number of semester hours, level, and offering department. The value of course number is unique for each course.
- Each section of a course has an instructor, semester, year, and section number and the section number distinguishes different sections of the same course that are taught during the same semester/year; its values are 1, 2, 3, ..., up to the number of sections taught during each semester.
- A grade record refers to each student and a particular section, consisting of a final mark and a letter grade from (F, D, C, B, A).

(1) *Design an EER diagram for this university student database. You can make more assumptions if necessary.*

**Suggested solution:**

Please refer to the provided ER diagram in Figure 1.

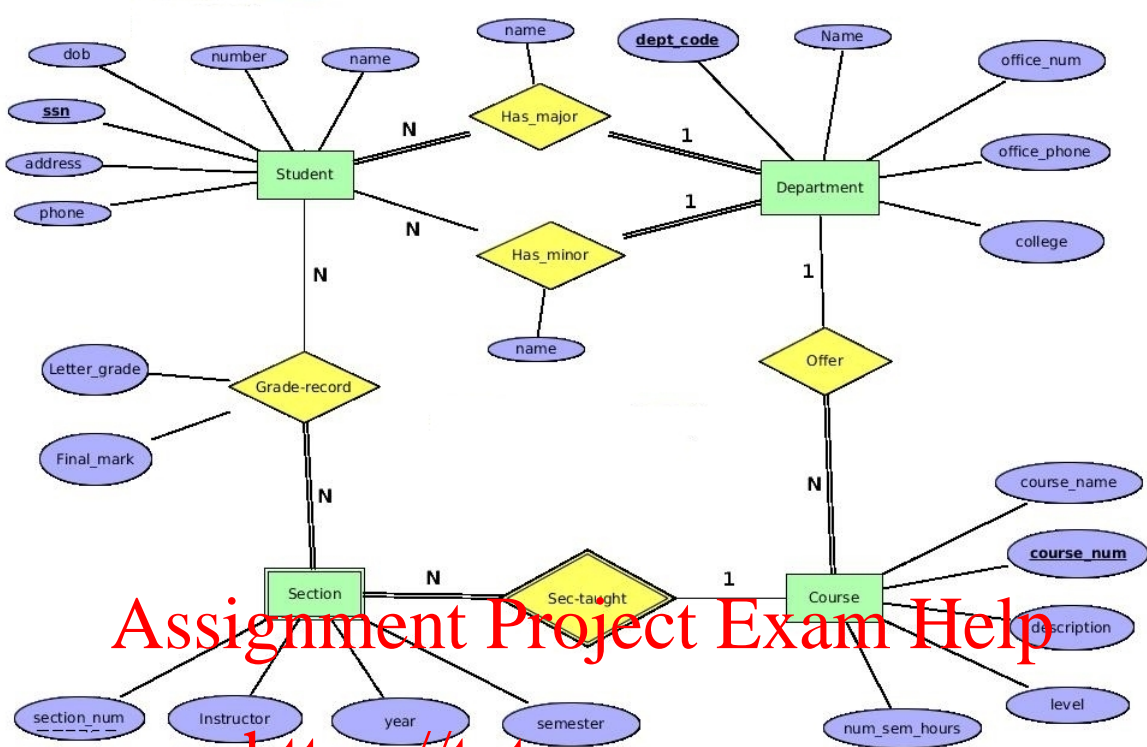


Figure 1: Sample ER diagram for Exercise (1)

- Identify cardinality ratios (add assumptions when they are not explicit from the description):
  - A student must have a major and a department may offer many majors: STUDENT - N – MAJOR - 1 - DEPARTMENT.
  - A student may have a minor and a department may offer many minors: STUDENT - N – MINOR - 1 - DEPARTMENT.
  - A course must be associated to a department and a department may offer many courses: DEPARTMENT – 1 - OFFER - N – COURSE
  - A section must be associated to a course and a course may have many sections: COURSE - 1 - SEC\_TAUGHT - N – SECTION.

## 2 Retailer Company Database

A retailer company wants to build a database application for managing information about its sale process. The company sells products in both local shops and

webstores on the Internet. Each local shop has a name, contact details (e.g., phone number and email), and a unique location. The database application also needs to store the URL(unique), name and last updated date of each webstore. Every product has a unique productID, a description, an item price, and a quantity in stock. The database application should also record customers' details such as their name, address and email. Every customer is assigned a unique ID. A customer may place an order that consists of at least one product and each order is from either a shop or a webstore. Customers have three payment options (i.e., cash, paypal, and credit card) but for each order only one payment option can be chosen. A delivery may be requested for each order. After full-payment is received, a delivery would be sent out subject to products' availability. Every delivery has a tracking number.

(2) Design an EER diagram for this retailer company. You can make more assumptions if necessary.

Please refer to the provided ER diagram in Figure 2.

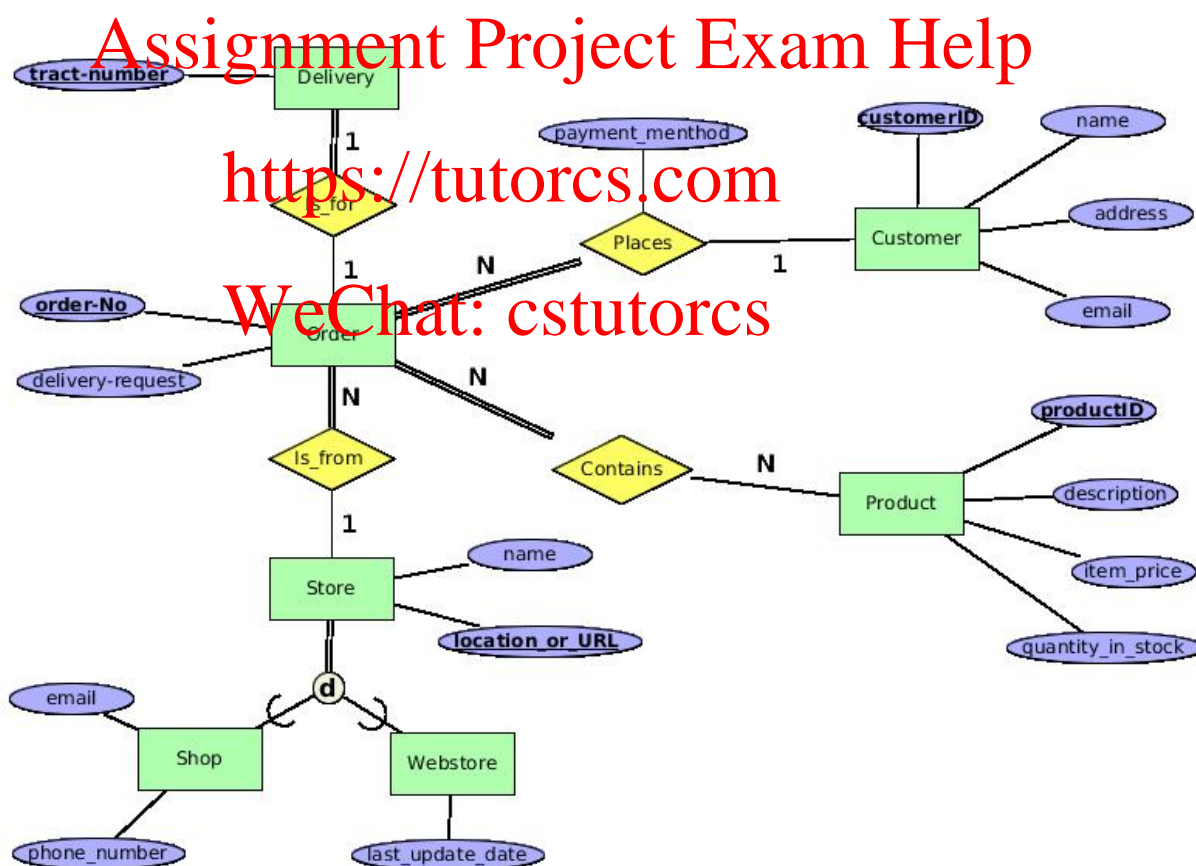


Figure 2: Sample ER diagram for Exercise (2)

(3) Are there any information or integrity constraints you are not able to represent in your EER diagram so far? If so, give examples.

For example, the following information or constraints cannot be represented in the EER diagram above.

- Customers have three payment options (i.e., cash, paypal, and credit card).
- After full-payment is received, a delivery would be sent out subject to products' availability.

### 3 Translating ER to Relations

(4) Translate the ER model in Exercise (1) into a relational database schema (be sure to indicate primary keys and foreign keys).

**Suggested solution:**

For the university student database presented above, we may translate the given sample ER model depicted in Figure 1 into the following relational database schema:

- DEPARTMENT(dept\_code, name, office\_num, office\_phone, college) with the primary key {dept\_code} (following Step 1 in the lecture slides)
- STUDENT(ssn, number, name, address, phone, dob, major\_dept, major\_name, minor\_dept, minor\_name) with the primary key {ssn}, and the foreign keys [major\_dept]  $\subseteq$  DEPARTMENT[dept\_code] and [minor\_dept]  $\subseteq$  DEPARTMENT[dept\_code]. (following Steps 1&4 in the lecture slides)
- COURSE(course\_num, course\_name, description, num\_sem\_hours, level, dept\_code) with the primary key {course\_num}, and the foreign key [dept\_code]  $\subseteq$  DEPARTMENT[dept\_code]. (following Steps 1&4 in the lecture slides)
- SECTION(section\_num, instructor, semester, year, course\_num) with the primary key {section\_num, course\_num}, and the foreign keys [course\_num]  $\subseteq$  COURSE[course\_num]. (following Step 2 in the lecture slides)
- GRADE\_RECORD(ssn, section\_num, course\_num, letter\_grade, final\_mark) with the primary key {ssn, section\_num, course\_num}, and the foreign keys [ssn]  $\subseteq$  STUDENT[ssn] and [section\_num, course\_num]  $\subseteq$  SECTION[section\_num, course\_num]. (following Step 5 in the lecture slides)