

Fundamentals of Data Engineering (COE848)

Mid Term Exam

This is a CLOSED BOOK exam.

This is a 120-minute exam.

There are 5 questions with a total of 100 marks.

Please read each question carefully and write your answers legibly in the space provided. You may do the questions in any order you wish, but please
USE YOUR TIME WISELY.

Student Name: _____
Student ID
Score: _____ %

Question	Maximum Mark	Received
1	16	
2	15	
3	27	
4	20	
5	22	
Total	100	

Question 1: Explain the following terms in 2-3 sentences:

a) Transaction

b) Schema

c) Foreign key

d) Cartesian Product

Question 2: Express $R \bowtie S$ (Full *outer join*) using a subset of the following relational algebra operations (Project, Select, Rename, Union, Intersection, Set Difference, Cartesian product, Join (conditional or natural)). Explain your assumptions, if any.

We assume that attributes of S is denoted as $ATTR(S)$, attributes of R is denoted as $ATTR(R)$ and $(ATTR(R)-ATTR(S))$ denotes a set of attributes in R that does not belong to S . We also use the notation $M_{a_1, a_2, a_3, \dots, a_n} (NULL)$ to denote a relation M with attributes $(a_1, a_2, a_3, \dots, a_n)$ with one tuple whose values are all null. For example $M_{id, name} (NULL)$ will be

Id	Name
Null	Null

Response to Question 2:

Question 3: Given the following table definitions:

Enrollment (stdId, crsNumber, startDate, finalGrade)

Student (stdId, stdName, address, age)

Course (crsNumber, crsName, description, courseWeight)

Provide appropriate relational algebra expressions for each of the following queries:

- Find the name of courses in which that no student got a final grade more than 80.
- Find the name of students who enrolls in one or more course with the courseWeight 2.
- Find the name of courses in which one or more students got final grade more than 80.

d. Find the name of courses who have been enrolled by the same student in different dates.

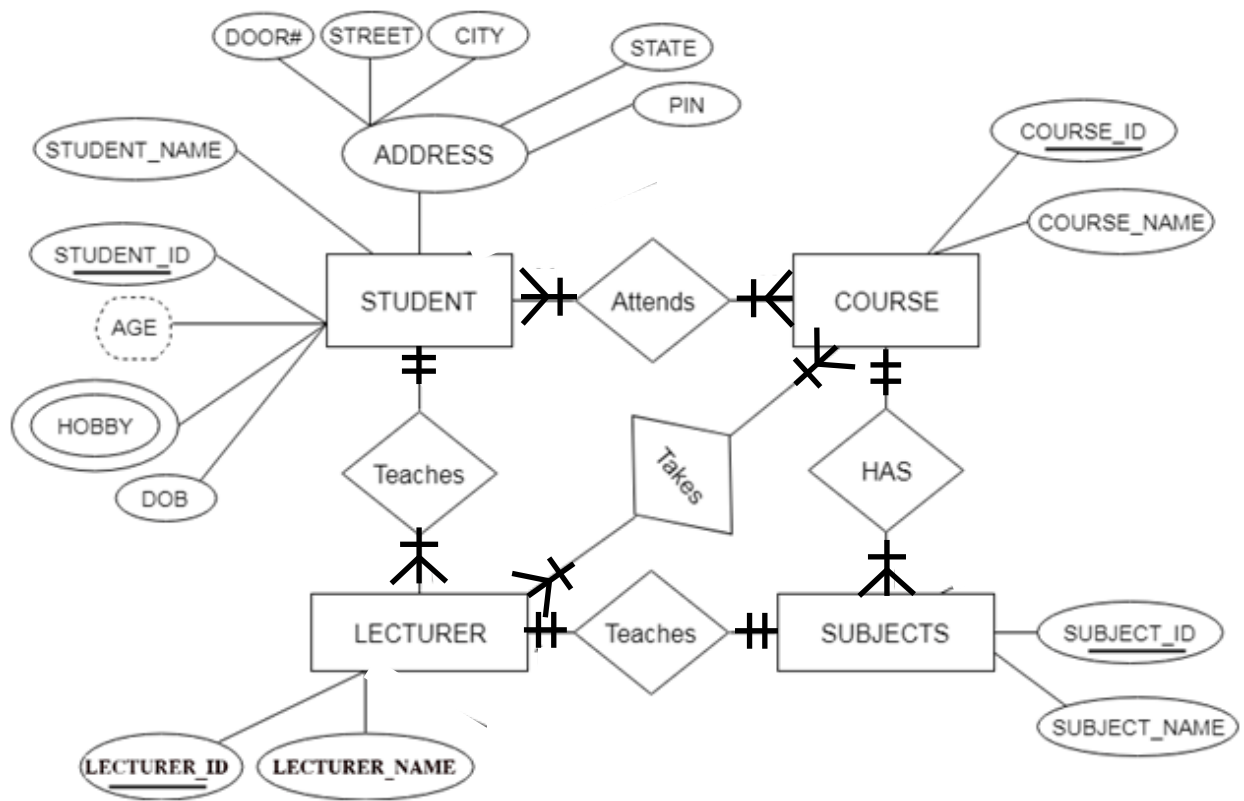
e. Find the name of students whose all enrolled courses have courseWeight 1.

Question 4: Convert the ER diagram in the next page to a database schema. Indicate the keys for each table in your answer.

In this diagram, a Lecturer can teach many students, but a student has one lecturer. Also , a course has one subject, but a subject may belong to many courses.

Note: For a table T with attributes k and p where k is the primary key, you can use the following notation in your answer:

$T(\underline{k}, p)$



Response to Question 4

Question 5 :

Construct a clean and concise ER diagram for the following scenario. List your assumptions and clearly indicate the cardinality mappings in your ER diagram.

- A driver identified by driver Sin number, name, birthday, address, city, and postal code
- A driver takes a driving exam in a DriveTest center.
- The DriveTest center has address, postal code, center id, phone, name
- A DriveTest center issues two type of licenses: driver license and learner license. A learner's license may contain restrictions and a driver license records if the driver has completed driver's education
- Each license has a unique license number and expiry date
- A driver may have one license (either learner or driver)

Response to Question 5