

Solutions to selected exercises and quizzes

Fall 2019, Term 2

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Lecture 2 and 3 – Entity-Relationship Model

The Solution for *Today's problem* has been uploaded to Course material / Additional notes.

Exercise 1

(4) N: N – one employee can work on several projects, and one project can have several employees who work on it.

Exercise 2

(3) 1:1 – we have assumed that one employee will not manage more than one department. One department can only have one manager.

Exercise 3

(4) Total / total – each employee must have a department (otherwise he/she is not an employee), each department has to have some employees (assuming that a department will not be created without a manager).

Exercise 4

(3) Partial / total – not every employee is a manager, but every department has a manager (same assumption as in Exercise 2).

Exercise 5

(3)

Exercise 6

(1)

Total – if we assume that each person in the university database is an employee, alumnus or student.

Overlapping – since e. g. an employee can be an alumnus at the same time (or a student might be an employee).

Exercise 7

(3)

Total since each project must be either Course, R&D project or Another.

Disjoint since it cannot be two at the same time.

Lecture 4 – Relational Model

Exercise 1

(2)

Exercise 2

(3)

Exercise 3

(2)

Since X is not in K , $K \setminus \{X\} = K$.

Lecture 5 – From (E)ER to the Relational Model

Exercise 1

Solution is in the lecture slides.

Exercise 2

Assuming id is a key attribute (and making it the PK in the relational model):

Employee(id, first_name, last_name)

EmployeeComment(id, comment)

Exercise 3

All options can be used to “translate” the given EER model to an ER model. Option (D) is the best way.

Exercise 4

(C) – since it cannot cover the case when an entity of type P is neither C1 nor C2.

Exercise 5

(A) – assuming “type” is a single name of the entity type. It cannot cover the case when an entity is both C1 and C2.

Exercise 6

Solution has been uploaded to Course material / Additional notes.

Lecture 6, 7, 8 – SQL

Problems and solutions have been uploaded to Course material / Exercises.

Lecture 9 and 10 – Functional dependencies and normalization

Quiz 1

(1)

Exercise 2

$\{A\}^+ = \{A\}$
 $\{B\}^+ = \{B\}$
 $\{A, B\}^+ = \{A, B, C, D, E\}$
 $\{C\}^+ = \{A, B, C, D, E\}$
 $\{D\}^+ = \{D\}$
 $\{C, D\}^+ = \{A, B, C, D, E\}$
 $\{E\}^+ = \{D, E\}$

Quiz 2

(3)

Exercise 3

See the separate lecture notes.

Quiz 3

(3).

$E \rightarrow D$ breaks 3NF since a non-prime attribute depends on another non-prime attribute.

Quiz 4

(4)

Quiz 5

(1)

UNIQUE(B, C) means that (B, C) is a candidate key, $C \rightarrow D$ breaks 2NF (D is a non-prime attribute and it depends on C which is a proper subset of a candidate key).

Lecture 11 – Indexes and transactions

Quiz 1

(4)

A hash-based index can only be used with $=$, but we have `employee.hour_salary < 200` in the WHERE-clause.

Quiz 2

(2)

Quiz 3

(1) is the best answer.

Quiz 4

(3) and (4)

(4) is the best answer, but requires to understand indexes on a little bit deeper level.

Quiz 5

(1) and (2)

Quiz 6

(5)

Quiz 7

(1)

Quiz 8

(1)

Lecture 12 – Users, authorization and security

Exercise 1

UPDATE(graduated) ON student
SELECT(id) ON student
SELECT(student_id, course_id, grade) ON record
SELECT(id, credit) ON course

Quiz 1

(1), (2), (6)

Quiz 2

(4)

Assuming Charlie does not have the SELECT on Student privilege.

Quiz 3

(2)

Bob did not grant the permission to Tim directly so he cannot revoke it.

From the PostgreSQL documentation:

A user can only revoke privileges that were granted directly by that user. If, for example, user A has granted a privilege with grant option to user B, and user B has in turn granted it to user C, then user A cannot revoke the privilege directly from C. Instead, user A could revoke the grant option from user B and use the CASCADE option so that the privilege is in turn revoked from user C. For another example, if both A and B have granted the same privilege to C, A can revoke his own grant but not B's grant, so C will still effectively have the privilege.

(Note: MySQL does not follow the standard when it comes to revoking privileges.)