Data Management Coursework Year 1

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1 Relational Model

ex4

Faculties

FACULTIES(faculty,building,room,capacity,lecturer_email,lecturer_firstname,lecturer_surname)

Students

STUDENTS(student firstname,student surname,student id,student email,year,address,contact number,module id,module name,leader,
lecturer1,lecturer2,exam mark,coursework1,coursework2,coursework3)

ex5

Faculties

$lecturer\_email \rightarrow lecturer\_firstname$
$lecturer\_email \rightarrow lecturer\_surname$
$lecturer\_email \rightarrow faculty$

$building, room \rightarrow capacity$

Students

$studentid \rightarrow studentfirstname$
$studentid \rightarrow studentsurname$
$studentid \rightarrow studentemail$
$studentid \rightarrow year$
$studentid \rightarrow contactnumber$
$studentid \rightarrow moduleid$

$moduleid \rightarrow modulename$
$moduleid \rightarrow leader$
$moduleid \rightarrow lecturer1$
$moduleid \rightarrow lecturer2$
$moduleid \rightarrow coursework1$
$moduleid \rightarrow coursework2$
$moduleid \rightarrow coursework3$

$studentid, module \rightarrow exammark$

ex6

Faculties candidate keys

lecturer_email, building and room is the primary key because it is used for only one lecturer within the faculty, although they may teach in multiple rooms.

Students candidate keys

student id and module id is the primary key because it corresponds to only one student, although they may be enrolled on multiple modules.

2 Normalisation

ex7

Required for first normal form

- Elements are atomic
- No repeating groups

Making the data first normal form

The faculties relation is already in first normal form because every relation is atomic (each element is only one piece of data) and there are no repeating groups (each column is unique). We can keep our relation:

FACULTIES(faculty,building,room,capacity,lecturer_email,lecturer_firstname,lecturer_surname)

However, the students relation is not first normal form. Firstly, the address column is not atomic because it contains the postcode and street name. Secondly, there are repeated groups. The lecturer columns are repeated (lecturer1, lecturer2) and the coursework columns are repeated (coursework1, coursework2, coursework3). Therefore, we need a new set of minimal functional dependencies:

STUDENTS(student firstname,student surname,student id,student email,year,street,postcode,contact number)

MODULES(module id, module name, leader)

STUDENTMODULES(student id, module id, exam mark)

LECTURERMODULES(lecturer email, module id)

COURSEWORKMARKS(student id, coursework id, module id, mark)

ex8

Partial-key dependencies

A partial key is when one of the non-key columns depends on only a part of a composite key. There are partial-key dependencies in our data:

- $building, room \rightarrow capacity$
- $lecturer\_email \rightarrow lecturer\_firstname, lecturer\_surname$
- $building \rightarrow faculty$
- $lecturer\_email \rightarrow faculty$

Required for second normal form

- No partial key dependencies (as described above)

Our data in second normal form

FACULTIES(faculty)
BUILDINGS(building, faculty)
ROOMS(building, room, capacity)
LECTURERS(lecturer_email,lecturer_firstname,lecturer_surname)
LECTURERFACULTY(lecturer_email, faculty)
STUDENTS(student firstname,student surname,student id,student email,year,street,postcode,contact number)
MODULES(module id, module name, leader)
STUDENTMODULES(student id, module id, exam mark)
LECTURERMODULES(lecturer email, module id)
COURSEWORKMARKS(student id, module id, coursework id, mark)

ex9

Transitive dependencies

A transitive dependency is when a non-key attribute depends on another non-key attribute, which in turn depends on the primary key.

Required for third normal form

- $For every non-trivial functional dependency, A \rightarrow B, A is a superkey or B is a prime attribute$
- Attributes are determined only by the keys
- No transitive dependencies

Our data in third normal form

As it stands, our data is in third normal form. **Before** we normalised to second normal form, we had the following transitive dependency:

$(building, room) \rightarrow lecturer\_email \rightarrow faculty$

However, this transitive dependency was dealt with when we converted our data to second normal form. Therefore, our relations remain the same:

FACULTIES(faculty)
BUILDINGS(building, faculty)
ROOMS(building, room, capacity)
LECTURERS(lecturer_email,lecturer_firstname,lecturer_surname)
LECTURERFACULTY(lecturer_email, faculty)
STUDENTS(student firstname,student surname,student id,student email,year,street,postcode,contact number)
MODULES(module id, module name, leader)
STUDENTMODULES(student id, module id, exam mark)
LECTURERMODULES(lecturer email, module id)
COURSEWORKMARKS(student id, module id, coursework id, mark)

3 Modelling

4 Querying