Practical 2 – Normalization

Objectives of this practical

- Normalize database tables to 1NF, 2NF and 3NF

Contents

Normalization

Question 1

You are given the following student_course_module table containing data as shown:

adm_no	stud_name	crse_cd	crse_name	mod_cd	mod_name	mark
A001	Janice	DIT	Diploma in Information Technology	SC	Secure Coding	83
				DBS	Database Systems	72
				FOC	Fundamentals of Computing	78
				BED	Back-end Development	87
A002	Anita	DAAA	Diploma in AI and Analytics	DL	Deep Learning	87
				DENG	Data Engineering	83
				FOC	Fundamentals of Computing	78
				BED	Back-end Development	87
…	…	…	…	…	…	…

(a) Is the student_course_module table in 0NF? Justify your answer.
Yes, as there multi-valued cells with repeating groups.

(b) Write the table in the relational heading format.
student_course_module (adm_no, stud_name, crse_cd, crse_name, {mod_cd, mod_name, mark})

(c) What is a first normal form (1NF) table? Transform the table, if it is not already in the 1NF, into the first normal form. Present your 1NF table in

(i) a table form as shown above

adm_no	stud_name	crse_cd	crse_name	mod_cd	mod_name	mark
A001	Janice	DIT	Diploma in Information Technology	SC	Secure Coding	83
A001	Janice	DIT	Diploma in Information Technology	DBS	Database Systems	72
A001	Janice	DIT	Diploma in Information Technology	FOC	Fundamentals of Computing	78
A001	Janice	DIT	Diploma in Information Technology	BED	Back-end Development	87
A002	Anita	DAAA	Diploma in AI and Analytics	DL	Deep Learning	87
A002	Anita	DAAA	Diploma in AI and Analytics	DENG	Data Engineering	83
A002	Anita	DAAA	Diploma in AI and Analytics	FOC	Fundamentals of Computing	78
A002	Anita	DAAA	Diploma in AI and Analytics	BED	Back-end Development	87

(ii) relational heading format

student_course_module (adm_no, stud_name, crse_cd, crse_name, mod_cd, mod_name, mark)

(d) Using the 1NF table student_course_module, explain, what is insert, update and delete anomaly.

Insert Anomaly:

Unable to insert a row when a course exists but with no students enrolled, or when a student has yet to obtain a mark for their module.

Update Anomaly:

If course name or code changes, multiple rows (4 in this case) have to be updated, which can become troublesome and lead to inconsistencies.

Delete Anomaly:

When deleting all of Janice's rows, there will be an unintended loss of information as we will then lose module information for SC and DBS.

(e) Transform the 1NF relation of student_course_module into a set of 2NF relations.
student (adm_no, stud_name, crse_cd, crse_name)
module (mod_cd, mod_name, mark)

(f) What is a 2NF table?
A 2NF table satisfies the requirements of a 1NF table, and every non-key attribute is functionally dependent of the whole of its primary key. However, there may still be some functional dependencies between the non-key attributes.

(g) Transform the set of 2NF relations of into a set of 3NF relations.
student (adm_no, stud_name, crse_cd)
course (crse_cd, crse_name)
module (mod_cd, mod_name)
student_course_module (adm_no, crse_cd, mod_cd, mark)

Question 2

The following table stores the project charges of a software house:

project_charges

p_no	p_name	e_no	e_name	job_type	man_day_ rate	man_day_ billed	total_ charge
102	VesselSoft	565	Tan	PM	1000	5	5,000
		798	Lim	PL	800	20	16,000
		885	Gay	SE	400	50	20,000
201	Soft Machine	565	Tan	PM	1000	4	4,000
		698	Lin	PL	800	10	8,000
		888	Sia	SE	400	100	40,000
		555	Chan	Prog	200	100	20,000

Legend

p_no	Project Number which uniquely identifies a project
p_name	Project Name
e_no	Employee Number which uniquely identifies an employee
e_name	Employee Name
Job_type	Job designation held by an employee
man_day_rate	Rate charged per day for a specific job type
man_day_billed	Number of days to be billed for an employee working in a project
total_charge	Total amount charged for an employee in a project

- Each employee can only hold one job_type.
- The man_day_rate is dependent on the job_type
- The number of days an employee worked on a project is recorded in the man_day_billed column.

(a) The following is an *incorrect* first normal form (1NF) for the above project_charges table:

project_charges (**p_no**, p_name, {**e_no, e_name**, job_type, man_day_rate, man_day_billed, total_charges})

Primary key is given as:

p_no, e_no, e_name

Explain the error(s) in the given 1NF table, and write the corrected 1NF table.

Multiple duplicate cell values

Relational Heading Format

project_charges (**p_no**, p_name, **e_no,** e_name, job_type, man_day_rate, man_day_billed, total_charges)

(b) State if the following statement is True or False: False

Deletion anomalies cannot exist in second normal form tables.

(c) Derive the second normal form relation(s) from the corrected first normal form relation.
project (p_no, p_name)
employee (e_no, e_name, job_type, man_day_rate, man_day_billed, total_charges)

(d) Derive the third normal form relations from the second normal form relations in (c).
project (p_no, p_name)
employee (e_no, e_name, job_type)
job (job_type, man_day_rate)
proj_emp_job (p_no, e_no, man_day_billed, total_charges)