Course: Database management
Unit: Database Design. Normalization
Material: Normalization exercises solution
Teamwork: Groups of two or three

Here you will find a solution of one of the exercises. Evaluate the work of you classmates and let them evaluate your work.

1NF

The original table is not in the 1NF because it has multi-value attributes. We modify it as follows to get rid of the multi-valued attributes:

SID	CID	S_NAME	C_NAME	GRADE	FACULTY	F_PHONE
1	IS318	Adams	Database	A	Howser	60192
1	IS301	Adams	EC	B	Langley	45869
2	IS318	Jones	Database	A	Howser	60192
3	IS318	Smith	Database	B	Howser	60192
4	IS301	Baker	EC	A	Langley	45869
4	IS318	Baker	Database	B	Howser	60192

Students(SID, CID, S_NAME, C_NAME, GRADE, FACULTY, F_PHONE)

2NF

The database we obtained in the previous step is not in 2NF because we found some columns that depend functionally on only part of the primary key.
SID->SNAME
CID->CNAME
CID->FACULTY
CID->F_PHONE

To address this situation, we split the table in three different tables as follows.

Student(SID, S_NAME)

Takes(SID*, CID*, GRADE)
Course(CID, C_NAME, FACULTY, F_PHONE)

Student

SID	S_NAME
1	Adams
2	Jones
3	Smith
4	Baker

Takes

SID*	CID*	GRADE
1	IS318	A
1	IS301	B
2	IS318	A
3	IS318	B
4	IS301	A
4	IS318	B

Course

CID	C_NAME	FACULTY	F_PHONE
IS301	EC	Langley	45869
IS318	Database	Howser	60192

3NF

The database we obtained in the previous step is not in 3NF because there is a column that functionally depends on another column that is not part of the PK.

FACULTY->F_PHONE

To address this issue, we split the table Course in two different tables as follows

Student(SID, S_NAME)
Takes(SID*, CID*, GRADE)
Course(CID, C_NAME, FACULTY*)
Faculty(FACULTY, F_PHONE)

Student

SID	S_NAME
1	Adams
2	Jones
3	Smith
4	Baker

Takes

SID*	CID*	GRADE
1	IS318	A
1	IS301	B
2	IS318	A
3	IS318	B
4	IS301	A
4	IS318	B

Course

CID	C_NAME	FACULTY*
IS301	EC	Langley
IS318	Database	Howser

Faculty

FACULTY	F_PHONE
Langley	45869
Howser	60192

These tables are already in BCNF because there are no alternative candidate keys and all the attributes that are not part of the primary key depend fully functionally on it.