**Exercise 3.**

The Computer department of a large university has decided to provide students with a document that lists the various types of programming skills they have picked up on the course and the level they have reached in each.  The table below shows the attributes that need to be stored about each student along with some sample entries.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Student\_Email | Name | Address | Course | Course Director | Skill\_id | Skill\_Name | Skill\_date | Skill\_Level |
| D96abc | Jones | 6 Old Manor | Computing | Paul | 22 | Prolog | 2/4/99 | 6 |
| D96abc | Jones | 6 Old Manor | Computing | Paul | 23 | Java | 1/3/99 | 5 |
| D96cde | Stewart | 4 Coach Rd | Business | Thompson | 33 | Prolog | 3/5/99 | 8 |
| D96xyz | Rodgers | 1 New Row | Business | Thompson | 16 | Pascal | 1/3/99 | 4 |

 The Skill\_id is a number that is unique for each skill, but the skill name is not.  The Student\_Email is also unique for each student.

Students taking computing modules may come from outside courses such as Business.  This information along with the course director responsible is also recorded. There is a single course director for each course, but a member of staff can be course director for several courses.

Each programming skill that a student has been tested on is recorded with the date that the test took place and the skill level reached.  The test may be repeated, but only the latest result is to be stored.  Thus if Jones retakes the Prolog test then only the date and level attributes would be updated.

1. Explain, using the above example, the problems that may occur when insertions deletions and modifications are made.
2. Identify all functional dependencies among attributes.  If you decide that the information given is not sufficient for determining all functional dependencies, make whatever assumptions you think are necessary but state them clearly.
3. Define first, second and third normal forms
4. Decompose the above example into 3NF, taking care to identify primary and foreign keys in all relations.