**Exercise 2.**

A software company has constructed a relational database to keep track of its computers. Most of the computers remain on the company’s premises, in which case a list of projects that are authorised to use the computers is maintained. (Some specialised computers may be shared by several projects. A project typically requires access to several computers). The database must also record the members of staff assigned to each project. A member of staff is assigned to only one project at a time. Some computers are loaned to members of staff for use at home. Faculty equipment is sent to the supplier for repairs.

Unfortunately, the database was designed by someone with very little knowledge of relational theory. This person decided to hold all information in a single table with the following schema:

Equipment(Mach\_Num, Type, Manf, Mod\_Num, On\_Prem, Location,  
{P\_ID, P\_Name, Mgr\_ID, Start\_Date, End\_Date, Auth\_Period, {Staff\_ID, Staff\_Name, Staff\_Room}}, On\_loan?, Staff\_ID, Staff\_Name, Staff\_Room, For\_Repair?, Fault, Supp\_ID, Supp\_Name, Supp\_Add, Supp\_Phone)

Repeated groups are enclosed in {}. The meaning to be attached to individual attributes is given below:

1. Mach\_Num    A unique identifier for each computer.
2. Type    PC, Mac, Workstation etc
3. Manf, Mod\_Num   The name of the manufacturer and the model number.
4. On\_Prem?   Yes if on premises; No otherwise.
5. Location    Room Number, if on premises.
6. P\_ID, P\_Name   ID and the name of the project
7. Mgr\_ID    Staff ID of the project manager
8. Start\_Date, End\_Date  Start and end dates of the project.
9. Auth\_Period The period during which a project is authorised to use the equipment. Note that this may or may not coincide with the entire duration of the project
10. {Staff\_ID, Staff\_Name, Staff\_Room } The ID, name and room number of the staff member to whom the equipment is loaned.
11. For\_Repair? Yes, if the machine is away for repair; No otherwise.
12. Fault Fault description, if the computer is away for repair.
13. Supp\_ID, Supp\_Name, Supp\_Add, Supp\_Phone   ID, name, address and telephone number of the supplier.

Decompose the above relation into 3NF relations, taking care to identify primary and foreign keys in all relations.