###### Question 4: (15 points)

Draw an entity-relationship diagram (ERD) in the third normal form for a “student database record” system based on the following situation:

* A student may live in only one residence hall, but each residence hall   
  usually has many students.
* Each student may register for many courses, and each course may have  
  many students.
* Each student may have many professors, and each professor may teach  
  many students.
* Each student may register for many sports, and each sport may have  
  many students.
* Each student may have many sport coaches, and each sport coach may coach  
  many students.

Identify relationships among the diagram entities as “one-to-one” and/or “one-to-many”, if any. Identify entities as “entity” or “associative entity”.

###### Question 5: (25 points)

Consider a project management system in which each employee is assigned to a specific department and employees from several departments often are assigned  
to special project teams, however, when a new product is launched or for major marketing events. Note that the project hours are the number of hours that employees charge to their assigned projects. The following is an example of an  
un-normalized PROJECT-DATA table for two projects.

**PROJECT-DATA**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Project Number** | **Project Name** | **Start Date** | **Employee Number** | **Employee Name** | **Job Title** | **Department Number** | **Department Name** | **Project Hours** |
| 2000 | Project MARS | 01/10/2012 | 89 | Smith | Manager | 1001 | Web Design | 150 |
|  |  |  | 18 | Jones | Engineer | 1001 | Web Design | 100 |
|  |  |  | 95 | Mike | Technician | 1005 | Desktop | 150 |
| 2010 | Project PDRS | 04/15/2012 | 36 | Catherine | Programmer | 1020 | Software | 1500 |
|  |  |  | 89 | Smith | Manager | 1001 | Web Design | 90 |

Perform the normalization process to convert the above un-normalized table to:

1. First normal form (1NF)

2. Second normal form (2NF)

3. Third normal form (3NF)

Please show all your work. Please show each step along the way and identify primary keys, if any, in each table in each step.