Homework assignment 1:
ERD, relational models and algebra

Please submit your answers in one PDF document on eDimension.

1. Consider the following information about a university database:

   - Professors have an SSN, a name, an age, a rank, and a research specialty.
   - Projects have a project number, a sponsor name (e.g., NRF), a starting date, an ending date, and a budget.
   - Graduate students have an SSN, a name, an age, and a degree program (e.g., M.S. or Ph.D.).
   - Each project is managed by one professor (known as the projects principal investigator).
   - Each project is worked on by one or more professors (known as the projects co-investigators).
   - Professors can manage and/or work on multiple projects.
   - Each project is worked on by one or more graduate students (known as the projects research assistants).
   - When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one.
   - Departments have a department number, a department name, and a main office.
   - Departments have a professor (known as the department head) who runs the department.
   - Professors work in one or more departments, and for each department that they work in, a time percentage is associated with their job.
   - Graduate students have one major department in which they are working on their degree.
   - Each graduate student has another, more senior graduate student (known as a student advisor) who advises him or her on what courses to take.

   a) Design and draw an ER diagram that captures the information about the university. Identify the entities, relationships, and attributes. Be sure to indicate any key and participation constraints.

b) Write SQL statements to create the corresponding relations and capture as many of the constraints as possible. If you cannot capture some constraints, explain why.

2. Consider the following two tables, T1 and T2:

T1		
A	Q	R
10	a	5
15	b	8
25	a	6

T2		
A	B	C
10	b	6
25	c	3
10	b	5

Show the results of the following relational algebra queries:

a) $T1 \bowtie_{T1.A=T2.A} T2$

b) $T1 \bowtie_{T1.Q=T2.B} T2$

c) $T1 \bowtie T2$

d) $T1 \bowtie_{T1.A=T2.A \text{ AND } T1.R=T2.C} T2$