EAST WEST UNIVERSITY

Department of Computer Science and Engineering

B.Sc. in Computer Science and Engineering Program

Final Examination, Fall 2023 Semester

Course:	**CSE 302 Database Systems (Section – 2)**
Instructor:	**Mahmuda Rawnak Jahan, Lecturer, CSE Department**
Full Marks:	**60 (30 will be counted for final grading)**
Time:	**1 Hour and 30 Minutes**

Note: There are **6 (SIX)** questions. Answer ALL of them. The Course outcome, Cognitive level, and Mark of each question are mentioned at the right margin.

1. **Consider the following information about a university database**.
Professors have an SSN, a name, an age, a rank, and a research speciality.
Projects have a project number, a sponsor name (e.g., NSF), 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 project's principal investigator). Each project is worked on by one or more professors (known as the project's 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 project's 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 chairman) 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.

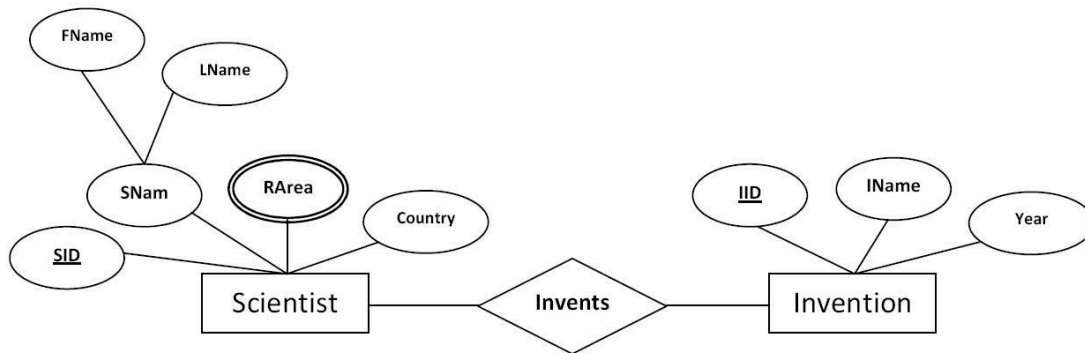   **Draw an Entity-Relationship (ER) diagram to represent data requirements described above.**

   [CO3, Marks: 15]

2. [CO3, Marks: 10]

Figure-1: ER diagram with Composite attribute, Multi-valued attribute and Many to Many relationship

Reduce the ER diagram in figure-1 to relational schema. Show the resulting schema diagram. Add justifications where necessary.

3. Consider the following set F of functional dependencies on the relation schema R (A, B, C, D,E,G): [CO3, Marks: 6+4+4+4+4 = 22]

$$A \rightarrow BCD$$
$$BC \rightarrow DE$$
$$B \rightarrow D$$
$$D \rightarrow A$$

a) List all candidate keys of the relation R.
b) Is R in BCNF? Why or why not?
c) If not then find BCNF decomposition of R.
d) For your decomposition, state whether it is lossless and explain why.
e) For your decomposition, state whether it is dependency preserving and explain why.

4. What is a database trigger? Discuss the potential benefits and drawbacks of using database triggers to enforce referential integrity in a database system. [CO3, Marks: 4]

5. Explain the difference between a weak and a strong entity set. [CO3 Marks: 5]

We can convert any weak entity set to a strong entity set by simply adding appropriate attributes. Why, then, do we have weak entity sets? Explain with examples.

6. What benefits does 3NF offer compared to BCNF? [CO3 Marks: 4]