



008

SOUTH EASTERN UNIVERSITY OF SRI LANKA  
FACULTY OF TECHNOLOGY  
FIRST EXAMINATION IN BACHELOR OF ICT SEMESTER 2020/2021  
SEMESTER I – MAY 2023

CIS-11022 DATABASE DESIGN

Answer ALL Questions

Time allowed: TWO (02) Hours

- 1 a) Define the following terms:
- Data
  - Data model
  - Data warehouse
  - Database
- (20 Marks)
- b) Explain followings with suitable examples:
- Logical data independence
  - Physical data independence
- (20 Marks)
- c) What are the benefits of a database management system over a manual system? Provide five (05) examples
- (30 Marks)
- d) Explain the three-tier architecture of DBMS with a clear illustration along with the mappings.
- (30 Marks)

[Total 100 Marks]

- 2 a) Define the following terms:
- Cardinality
  - Weak entity
  - Composite attribute
  - Relationship
- (20 Marks)
- b) Consider a university database system. Design an entity-relationship (ER) diagram for the given scenario, identifying entities, attributes, relationships, and cardinalities. Provide a detailed explanation of your design choices. Students are identified by StudentID, Name, Email, and Date of Birth. A student can enroll in multiple courses, and a course can have multiple students. A course belongs to only one department, but a department can have multiple courses. Courses being provided to the students and the course is identified by CourseID, Title, and Description. Respective departments offer the courses and department is identified by DepartmentID, Name, and Location. Instructors are teaching the courses and they are identified by InstructorID, Name, Email, and Office. An instructor can teach multiple courses, and a course can be taught by multiple instructors. An enrollment record associates a student with a course.

Design and draw an ER diagram based on above scenario that captures the information about by identifying entities, relationships, cardinality ratio and attributes. Be sure to indicate any key and participation constraints and state any assumption you made.

(80 Marks)

[Total 100 Marks]

Student (Student ID, name, Email, Date of B)

Course (Course ID, Title, Description)

Department (Department ID, name, location)

Instructors (Instructor ID, name, Email, Office)

3 a) Define the following terms:

- a. Relation schema
- b. Tuple
- c. Relation instance
- d. Relation cardinality

(20 Marks)

b) What is the difference between a candidate key and the primary key for a given relation? What is a super key? Briefly explain with suitable arguments.

(25 Marks)

c) Why is normalization important in database design? Explain with examples.

(25 Marks)

d)

- i. Suppose you are given a relation  $R = (A, B, C, D, E)$  with the following functional dependencies:  
 $\{CE \rightarrow D, D \rightarrow B, C \rightarrow A\}$

- a. Find all candidate keys.
- b. Identify the best normal form that R satisfies (1NF, 2NF, or 3NF)

- ii. Suppose a relational schema R (A B C D E) and set of functional dependencies

$F: \{A \rightarrow B, B \rightarrow E, C \rightarrow D\}$  Check out that relation is in 3NF or not? If not decompose it in 3NF.

(30 Marks)

[Total 100 Marks]

4 a) Consider the following schema and answer the questions given below using relational algebraic notations.

- student (no, name)
- entrolledIn (no, code)
- subject (code, lecturer)

- i. What are the names of the students enrolled in CS1425?
- ii. Which subjects is "Raja" taking?
- iii. Who teaches IT1589 or IT2358?
- iv. What are the names and Nos of all the students?
- v. Who are the students taking a subject taught by "Mala"?

(50 Marks)

- b) Answer the following questions using SQL statements by referring the following relational schema. Note that the keys of the relations are underlined.

Student (Name, Student\_No, Class, Major)

Course (Course\_name, Course\_No, Credits, Department)

Section (Section\_ID, Course\_number, Semester, Year, Instructor)

Grade\_report (Student\_Num, Section\_ID, Grade)

- i. Insert a new course  
{ 'Information Technology', 'IT1259', 3, 'CS' } to the relation 'COURSE'
- ii. Retrieve the names of all the students who are majoring in 'IT'
- iii. Retrieve the total number of credits offered by each of the Department
- iv. Retrieve the names of all the courses with their credits taught by the instructor 'Manimaran' in the year 2023
- v. Retrieve the Student\_No and transcript of each of the student. A transcript includes course name, course number, credits, semester, year, and grade for each course completed by the student.

(50 Marks)

**[Total 100 Marks]**