

Sample questions only for references

1. i. **Database Management System** makes data management more efficient and effective. (05 marks)
Justify this Statement.
- ii. What **type of database** does a large online retail store utilize to manage its products, customer orders, and sales, while granting access to multiple employees across various departments? (05 marks)
- iii. How does the **conceptual model** differ from the **internal model** in database management systems? (05 marks)
- iv. Explain the **logical** and **physical data independence** in the context of database design. (05 marks)
- v. State two consequences of **data redundancy** in file systems. (05 marks)

(Total: 25 marks)

- a) i. Consider the following information about a university database: (18 marks)
 - Professors have an SSN, a name, an age, a rank, and a research specialty.
 - 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.

Design and draw an ER diagram that captures the information about the university. Use only the basic ER model here; that is, entities, relationships, and attributes. Be sure to indicate any key and participation constraints

ii. Use the following ER Diagram in Figure 1 to answer the following questions. (07 marks)

- a) Is the VEHICLE entity a Generalization or a Specialization of the entities CAR and TRUCK?
- b) Can a single VEHICLE entity be found in both the CAR entity set and the TRUCK entity set? Why and why not?

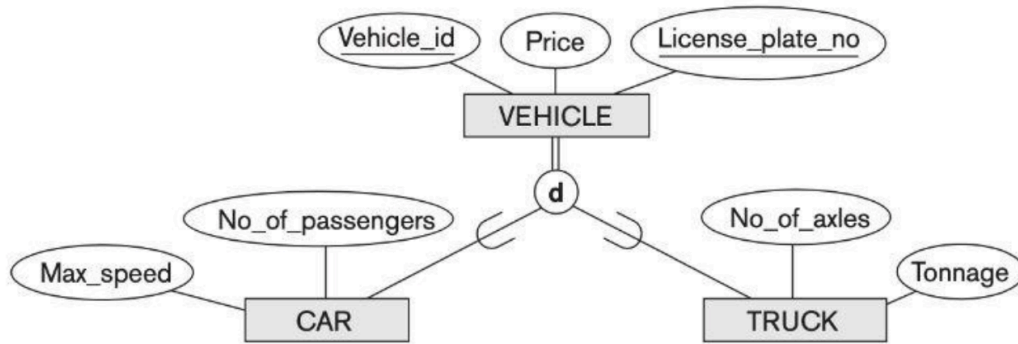


Figure 1: ER diagram- Vehicle

(Total: 25 marks)

3. i. Define **entity integrity** and **referential integrity constraints**. (05 marks)
- ii. Consider a database system where you're performing an **INSERT** operation to add a new record into a table. Explain three possible types of constraint violations that could occur during this INSERT operation. (06 marks)
- iii. Consider the following ER-Diagram of LIBRARY in Figure 2 which is used to keep track of books borrowers; and book loans. Convert the given ER-Diagram to equivalent **Relational Schema**. Show **Primary keys** and **Foreign keys** in the resulting schema. (14 marks)

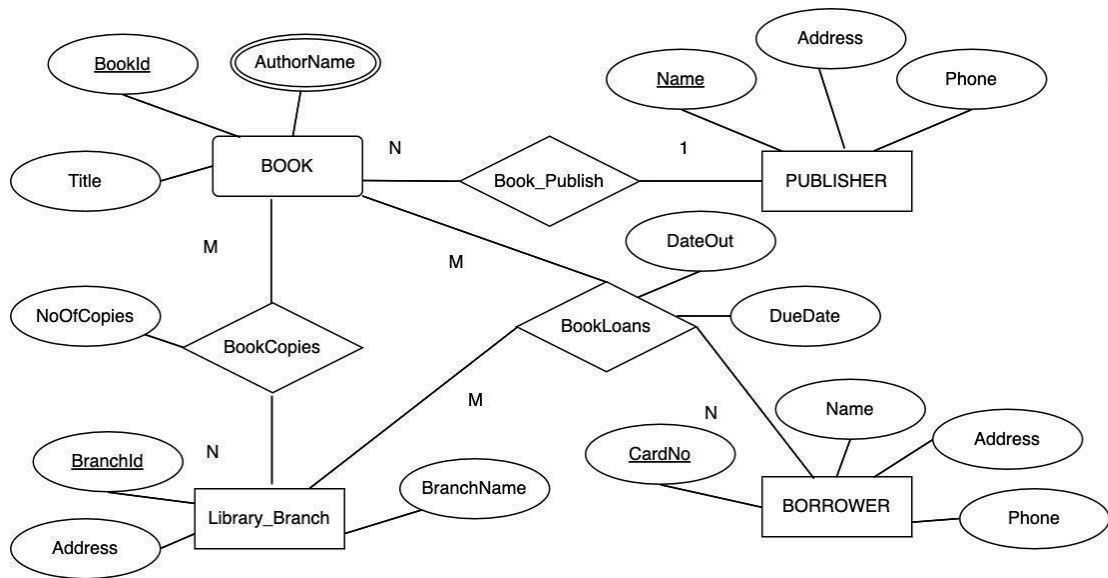


Figure 2: ER diagram of a LIBRARY

(Total: 25 marks)

4. i. Implement the schema described below using SQL statements, including constraints.

(20 marks)

- a) Create the table **Employee** shown in below Table 1

Table 1: Employee.

ATTRIBUTE (FIELD) NAME	DATA DECLARATION
EMP_NUM	CHAR(3)
EMP_LNAME	VARCHAR(15)
EMP_FNAME	VARCHAR(15)
EMP_INITIAL	CHAR(1)
EMP_HIREDATE	DATE
JOB_CODE	CHAR(3)

- b) Having created the table structure in question 4 i. a), write the SQL code to insert a row into the Employee table based on the information shown in Figure 3. You can write the INSERT code for record 1.

	EMP_NUM	EMP_LNAME	EMP_FNAME	EMP_INITIAL	EMP_HIREDATE	JOB_CODE
▶	101	News	John	G	08-Nov-00	502
	102	Senior	David	H	12-Jul-89	501
	103	Arbough	June	E	01-Dec-96	500
	104	Ramoras	Anne	K	15-Nov-87	501
	105	Johnson	Alice	K	01-Feb-93	502
	106	Smithfield	William		22-Jun-04	500
	107	Alonzo	Maria	D	10-Oct-93	500
	108	Washington	Ralph	B	22-Aug-91	501
	109	Smith	Larry	W	18-Jul-97	501

Figure 3. Employee table with data

Use Figure 3 to answer the questions below.

- c) Write the SQL code to change the job code to 501 for the person whose personnel number is 107.
- d) Write the SQL code to delete the row for the person named William Smithfield, who was hired on June 22, 2004, and whose job code classification is 500. (Hint: Use logical operators to include all the information given in this problem.)
- e) Write the SQL code to group employees by their job code and retrieve each distinct job code along with the total number of employees assigned to each job code. Only include job codes where the total number of employees exceeds 5 and employees who were hired before the year 2000.

ii. Suppose you are given a relation

(05 marks)

$R = (A, B, C, D, E)$ 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, 3NF, or BCNF).

(Total: 25 marks)