

**Examination Control Division**  
**2081 Bhadra**

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEI	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

**Subject:** - Data Base Management Systems (CT 610)

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- ✓ Attempt All questions.
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1. Define data and Database Management system. What are the latest trends in Database Management? [3+2]
2. a) Differentiate between degree with the cardinality of a relationship in an ER diagram. Explain briefly about generalization in context to ER diagram with an example. [4]
  - b) A General Hospital consists of a number of specialized wards (such as Radiology, Oncology, etc). Information about ward includes unique name, total numbers of current patients. Each ward hosts a number of patients, who were admitted by a consultant (doctors) employed by the Hospital. On admission, the date and time are kept. The personal details of every patient include name, Medical Recode Number (MRN), set of phone number and one address (city, street, code). A separate register is to be held to store the information of the tests undertaken. Each test has unique episode number, category and the final result of test. Number of tests may be conducted for each patient. Doctors are specialists in a specific ward and may be leading consultants for a number of patients. Each patient is assigned to one leading consultant but may be examined by other doctors, if required. Draw an ER diagram for the above case implementing necessary design constraints. [8]
3. a) Consider the following relational schema. [2×4]
 

Employee(empid,ename,address, title, headid)  
 Project(pid, pname, budget, location)  
 Work(empid, pid, responsibility,duration)

  - (i) Write relational algebra to find the name and salary of employees working in 'kathmandu'.
  - (ii) Write the relational algebra to show the employee name along with their head name.  
 (Note: the data in headid is empid of their corresponding head)
  - (iii) Write relational algebra to display the details of those employee who live in the same location of their project.
  - (iv) Write relational algebra to display employee's title, name along with their project name, salary if the project duration is more than 5 years.
- b) Consider the following relational schema. [2×4]
 

Employee(empid,ename,address, title, headid)  
 Project(pid, pname, budget, location)  
 Work(empid, pid, responsibility,duration)  
 Payment(title, salary)

  - (i) Write SQL code to create the above relational schemas.

- (ii) Write SQL to count the number of project with duration more than 2 years.  
(iii) Write SQL query to find the name of engineers working in ICT project and earning more than 20 K.  
(iv) Write SQL to update the salary of employees by 15% if salary is less than 50 K, by 10% if salary is in between 50 K to 100 K and by 5 % if salary is greater than 100 K
4. Define Functional Dependence. Explain types of functional dependency in detail. Let a relation be R (A, B, C, D, E, F) and set of Functional Dependencies (F) = {AB→C, BC→AD, D→EF}. Find the Candidate Keys. [2+4+4]
5. Explain about the steps involved in query processing with necessary diagram. Briefly explain about the pipelining approaches used for evaluation of query. [4+4]
6. What do you mean by RAID? Explain different levels of RAID. What do you mean by hashing? Explain how hashing helps to organize the file with an example. [8]
7. Explain ACID properties in database transaction with an example. Explain how wait-die scheme and wound-wait scheme helps to prevent deadlock. [8]
8. Define a log based recovery method. Explain the conditions of using redo and undo operations during recovery process. [2+5]
9. Write short notes on:  
a) Distributed Database System.  
b) Data warehouse [2×3]

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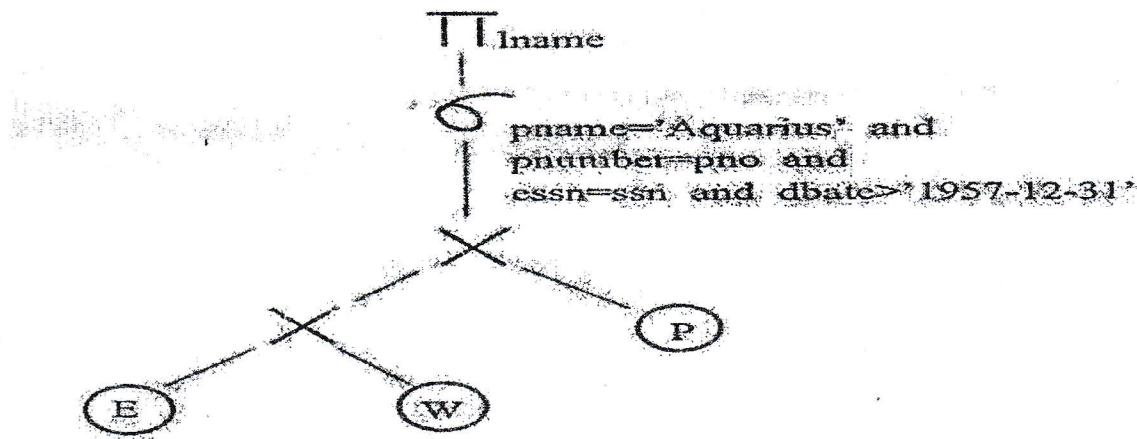


1. Define Database system. Explain the four components of Database System. [1+4]
2. What are an instance and scheme? Explain three schema architecture in DBMS. [2+2]
3. Define the following terms briefly: Attribute and its types, entity, participation constraint, weak entity set. Also construct an E-R diagram for a car insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents. Each insurance policy covers one or more cars, and has one or more premium payments associated with it. Each payment is for a particular period of time, and has an associated due date, and the date when the payment was received. [3+5]
4. Consider the relational database as follows: [2x6]
 

department (dept\_name, building, budget)  
 Course (course\_id, title, dept\_name, credits)  
 instructor (ID, name, dept\_name, salary)  
 section (course\_id, sec\_id, semester, year, building, room\_number, time\_slot\_id)  
 teaches(ID, course\_id, sec\_id, semester, year)  
 student (ID, name, dept\_name, total\_credit)

  - a) Write an SQL to add a check constraint in semester attribute.[winter, fall, spring, summer] of table “section”.
  - b) Write an SQL to find the names of all instructors that have a salary value greater than that of each instructor in the Computer department.
  - c) Write an SQL to find the list of the entire department relation in descending order of budget. If several departments have the same budget, order them in ascending order by department name.
  - d) Write an SQL to Delete the records of all instructors with salary below the average at the university.
  - e) Write an SQL to update all instructors with salary over 10,00,000 receive a 5 percent raise, whereas all others receive a 10 percent raise.
  - f) Write a Relation Algebra expression to find the name of student whose department name and total credit are same as Shyam's department name and total credit.
5. Explain view with example. How is it different from table? [3+2]
6. What is Decomposition? Briefly explain about 3NF and BCNF with example. Computing a canonical covering of the given FD. R = (A, B,C) and F = { A → BC, B → C, A → B, AB → C}. [1+3+4]

7. Briefly outline the Query Processing and optimization. Optimize the given query tree. [3+5]



8. What is secondary index? Explain with example. Explain about Dynamic hashing techniques in details. [2+6]
9. Check whether the given schedule S is conflict serializable or not. If yes, then determine all the possible serialized schedules. [2+6]
10. Explain about Checkpoints with example. Explain about immediate-database modification techniques with example. [3+5]
11. What is spatial data? How do you store spatial data in a database? What are differences between object oriented and relational database management system? [1+2+3]

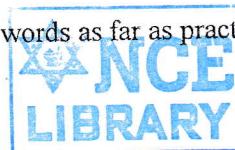
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TRIBHUVAN UNIVERSITY  
 INSTITUTE OF ENGINEERING  
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1. Define Database and DBMS. How DBMS is differed from file system? Explain z-tier architecture in DBMS. [1+2+2]

2. Define Attributes and explain its type with example. [4]

3. List the entities, attributes and their relationships and draw an ER diagram for the university database. “A lecturer, identified by his or her number, name and room number, is responsible for organizing a number of course modules. Each module has a unique code and also a name and each module can involve a number of lectures who deliver part of it. A module is composed of a series of lectures and because of economic constraints and common sense, sometimes lectures on a given topic can be part of more than one module. A lecture has a time, room and date and is delivered by a lecturer and a lecturer may deliver more than one lecture. Students, identified by number and name, can attend lectures and a student must be registered for a number of modules. We also store the date on which the students first registered for that module. Finally, a lecturer acts as a tutor for a number of students and each student has only one tutor.” [8]

4. Consider the employee database Schema. [2×6]

employee (employee name, street, city)

works (employee name, company name, salary)

company (company name, city)

manages (employee name, manager name), where the primary keys are underlined. Give an expression in SQL and RA for each of the following queries.

a) Find the names and cities of residence of all employees who work for First Bank Corporation.

b) Find the names, street addresses, and cities of residence of all employees who work for First Bank Corporation and earn more than \$10,000 and employee name must not start with the letter “z”.

c) Find all employees in the database who do not work for First Bank Corporation.

d) Find all employees in the database who earn more than each employee of Small Bank Corporation.

e) Assume that the companies may be located in several cities. Find all companies located in every city in which Small Bank Corporation is located.

f) Find the company that has the most employees.

5. Why normalization is an important in DBMS? Explain anomalies in DBMS with example. In relation R = (A, B, C, D, E). The set of functional dependencies is : (A → BC, CD → E, B → D, E → A.) decomposed it into R1 = (A, B, C), R 2 = (A, D, E). Show that this decomposition is a lossless-join decomposition. [1+3+4]

6. Explain basic steps of query processing. Transform the following relational algebra expression using equivalence rule. Show each step involved. [2+6]

instructor (ID, name, dept\_name, salary)

teaches (ID, course\_id, sec\_id, semester, year)

course (course\_id, title, dept\_name, credits)

$\Pi_{name, title} (\sigma_{dept\_name = "Music"} \wedge year = 2017$

(instructor ⋈ (teaches ⋈  $\Pi_{course\_id, title} (course)$ )))

7. What is the role of index in DBMS? Explain primary index and secondary index with example. What are the characteristics of B<sup>+</sup> tree? [1+4+3]

8. Explain about the state diagram of transaction. How do test Conflict Serializability of a Schedule S, explain in details with example. [3+5]

9. What are the different types of failure in DBMS? Explain shadow page recovery technique with example. [3+5]

10. Define transaction. What are the ACID properties in DBMS. [5]

11. Explain Distributed Database System with its type. What are different data fragmentation techniques? [4+2]

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1. Distinguish between logical and physical data independence. Define DDL, DML and DCL with examples. [2+3]
2. What is keys and explain different types of keys. "A football club has a name and a ground and is made up of players. A player can play for only one club and a manager, represented by his name manages a club. A footballer has a registration number, name and age. A club manager also buys players. Each club plays against each other club in the league and matches have a date, venue and score." Create an ER diagram for above scenario. [2+8]
3. Consider the following insurance database.
 

PERSON (lisenceNO, name, address)  
 CAR (modelNo, brand, year)  
 ACCIDENT (reportNo, date, location)  
 OWNS (lisenceNo, modelNo)  
 PARTICIPATED (lisenceNo, reportNo, damage Amount)

a) Write relational algebra expression for the given queries:

  - (i) Find the Person name and car he/she owns and the car was manufactured on 2010.
  - (ii) Find the total number of accidents occurred on jan 20, 2022 location wise.
  - (iii) Find the details of accident where the damage amount exceeds 50000.
  - (iv) Find name of all person who met an accident. [4×2]

b) Write SQL expression for the given queries:

  - (i) Find the Person detail whose name starts with 'A' and is involved in some accident.
  - (ii) Find the car details that are involved in accident and calculated more than 40000 as a damage amount.
  - (iii) Delete the information of car which is owned by person living in Humla.
  - (iv) Create a view named PERSON\_REPORT which contains lisenceNO, name and reportNo as its member and the person's address is Ktm. [4×2]
4. a) Define integrity constraints and domain constraints. [4]
 

b) What is normalization? Explain the role of function dependency in normalization of data. [2+2]
5. Define query processing with necessary figure. Explain the differences between cost-based and heuristics based methods of query optimization. [3+5]
6. a) What is the difference between ordered indices and hash indices in a database? What are the advantages of using sparse index? [4]
 

b) What do you mean by RAID? Explain the types of RAID and mention how to select an appropriate level of RAID. [4]

7. a) Database-system implementers have paid much more attention to the ACID properties than have file-system implementers. Why might this be the case? [4]
- b) Briefly explain two phase locking protocol with an example. [4]
8. a) Explain the purpose of the checkpoint mechanism. How often should checkpoints be performed? [4]
- b) What is deferred-database modification technique in context to log based recovery approach? Explain. [4]
9. Differentiate between data warehousing and data mining with an example. What are the types of data fragmentation in distributed databases? Write any four advantages of distributed database. [3+3+3]

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1. What are the advantages of Database Management System? List roles and responsibilities of Database Administrator. [3+2]
2. a) Design an E-R diagram for a company human resource database, "The Company has a set of branch offices. Each branch office has a set of departments. Each department has a set of employees, a set of projects. Each employee has a job history, academic qualification. For each job type, the employee also has a salary history." [7]
  - b) What is key attribute? List out the types of keys and explain them briefly. [3]
3. a) Consider the following relational database model: [4×2]
 

Product (product\_id, pname, price, pdescription)  
  Customer (customer\_id, cname, address, phone)  
  Purchase (product\_id, customer\_id, quantity, sales\_mid)  
  Salesman (sales\_mid, sname, salary)

Write SQL statement for the following:

  - (i) Create table Purchase (use foreign key)
  - (ii) List name and address of all customers who purchased the product SSD
  - (iii) Find the name of the product which purchase quantity is maximum
  - (iv) Increase the salary of all salesman by 5% who have sold at least 10 SSD
- b) For the relational database model given in the Question No. 3(a). Write relational algebraic expression for the following: [4×2]
  - (i) Display name of the customers who are from Kathmandu and name start with 'R'.
  - (ii) List the name of the product purchased by customer 'Sita' from the salesman 'Ram'
  - (iii) Find the product wise total purchased quantity
  - (iv) Update the price of all products by 8%
4. What is Normalization? Why is it important? How can you convert a Unnormalized table to Third Normal Form? Explain with example. [1+2+5]
5. Explain the steps of query processing with examples. Compare cost based evaluation and heuristic optimization method. [4+4]
6. What is record organization? Explain the way of file organization. Compare secondary index and multilevel indexing techniques. [2+2+4]
7. Define transaction and explain its ACID properties. Define schedule and give proper examples. What is a serializable schedule? [1+3+2+2]
8. Define checkpointing with example. How REDO and UNDO operations performed in log based recovery mechanism? [3+5]
9. Write short notes on: [3×3]
  - a) Advantages of object oriented database model
  - b) Parallel database architecture
  - c) Data warehousing