

**Government College of Engineering, Amravati**  
(An Autonomous Institute of Government of Maharashtra)



V Semester B.Tech. (Computer Sci. & Engg.)

Winter - 2009

Course Code : CS504

Course Name : Database Management Systems

Time : 2 Hrs.30 Min.

Max. Marks : 100

**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Figures to the right indicate full marks.

1. Solve any two questions 1

- a) List four significant differences between a file-processing system and a DBMS. Give any two disadvantages of a database system?
- b) i. Explain the difference between a weak and a strong entity set.  
ii .Explain the differences among the terms ( primary key, candidate key, and super key.

- (e) Define the concept of aggregation. Give two examples of where this concept is useful. (6)

3. Solve any two questions 12

- a) Let the relation schemas  $R = (A, B, C)$ ,  $S = (D, E, F)$  and t relations  $r(R)$  and  $s(S)$  be given. Give an expression in the tuple relational calculus that is equivalent to each of the following:

- a.  $\Pi_A(r)$
- b.  $\sigma_{B=17}(r)$
- c.  $r \times s$
- d.  $\Pi_{A,F}(\sigma_{C=D}(r \times s))$

- b) Let  $R = (A, B, C)$ , and let  $r_1$  and  $r_2$  both be relations on schema  $R$ . Give an expression in the domain relational calculus that is equivalent to each of the following:

- a.  $\Pi_A(r_1)$
- b.  $r_1 \sqcup r_2$
- c.  $r_1 \cap r_2$
- d.  $r_1 - r_2$

- c) Describe the circumstances in which you would choose to use embedded SQL rather than SQL alone or only a general-purpose programming language. (6)

3. Solve any two questions 12

- a) Give an example of a relation schema  $R$  and a set of dependencies such that  $R$  is in BCNF, but is not in 4NF. Explain why 4NF is a normal form more desirable than BCNF. (6)

- b) Write an SQL trigger to carry out the following action: On **delete** of an account, for each owner of the account, check if the owner has any remaining accounts, and if she does not, delete her from the *depositor* relation.
- c) i. What is the purpose of having separate categories for index authorization and resource authorization?
- ii. What are two advantages of encrypting data stored in the database?

#### 4. Solve any two questions

- a) Consider the following SQL query for bank database:
- ```
select T.branch-name  
from branch T, branch S  
where T.assets > S.assets and S.branch-city =  
“Brooklyn”
```
- Write an efficient relational-algebra expression that is equivalent to this query. Justify your choice.
- b) Let relations  $r_1(A,B,C)$  and  $r_2(C,D,E)$  have the following properties:  $r_1$  has 20,000 tuples,  $r_2$  has 45,000 tuples, 25 tuples of  $r_1$  fit on one block, and 30 tuples of  $r_2$  fit on one block. Estimate the number of block accesses required, using each of the following join strategies for  $r_1 \bowtie r_2$ :
- Nested-loop join
  - Block nested-loop join

c) List the ACID properties. Explain the usefulness of each. (6)

5. Solve any two questions

12

a) i. Justify the following statement:

Concurrent execution of transactions is more important when data must be fetched from (slow) disk or when transactions are long, and is less important when data is in memory and transactions are very short.

ii. Explain the distinction between the terms *serial schedule* and *serializable schedule*. (2)

b) i. When a transaction is rolled back under timestamp ordering, it is assigned a new timestamp. Why can it not simply keep its old timestamp? (3)

ii. In multiple-granularity locking, what is the difference between implicit and explicit locking? (3)

c) i. Compare the shadow-paging recovery scheme with the log-based recovery schemes in terms of ease of implementation and overhead cost. (3)

ii. Why stable storage cannot be implemented? How database systems deal with this problem. (3)

**Government College of Engineering, Amravati**  
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VI Semester B. Tech.(Information Technology)

Summer - 2009

Course Code : IT603

Course Name : Database Management System

Time: 2 hr.30min.

Max. Marks: 60

**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Figures to the right indicate full marks.

1. a) List and explain in brief advantages of DBMS 6 over file system.

b) Draw & name all the notations for ER – diagram. 3

c) Define / Describe following: 3  
1] Primary key  
2] Foreign key  
3] Candidate key

2. a) Explain insert, delete and update operations with 6 respect to views.

*Cont.*

b) Explain the concept of cursors.

3. a) Explain Index definition in SQL.

b) Define 1NF, 2NF and BCNF.

c) Explain with diagram the implementation of atomicity & durability

4. Solve any two:

a) Give the syntax for row level trigger. Define the trigger in effect of which the every deleted record from employees will be inserted into the emp\_history table.

b) Explain insertion operation on B+ trees with suitable example.

c) Given the schemas.  $R = (A, B, C)$  and  $S = (D, E, F)$ . Let relations  $r(R)$  and  $s(S)$  be given. Convert the following SQL statements in the relational algebra form.

1] select \* from r where  $B = 17$

2] select A, F from r,s where  $r.C = s.D$ .

3] update r set  $C = C * 15/10$  where  $A = 'aaa'$ .

5. Solve any two:

a) What is external sorting? Describe the external sort-merge algorithm.

Cont.

- b) Describe the steps in query processing in detail. 6
- c) Consider the following two transaction: 6

T1: read(A)  
read(B)  
if A=0 then B=B+1  
write(B)

T2: read(B)  
read(A)  
if B=0 then A=A+1  
write(A)

Let the consistency requirement be A=0 or B=0  
with A=B=0 the initial values.

- 1] Show that every serial execution of these transactions preserves the database consistency.
- 2] How many serial schedules are possible with above transactions
- 3] Write one of the concurrent schedules for above transactions.

**Government College of Engineering, Amravati**  
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**VI Semester B.Tech. (Information Tech.)**

**Summer- 2010**

**Course Code :IT 603**

**Name : Database Management System**

**Time : 2 hr.30min.**

**Max. Marks : 60**

**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

**1. Solve 12**

(a) Draw complete E-R diagram for a college DataBase with all attributes including Primary Key. Assuming that:

- A college contains many departments, Each department can offer any number of courses.
- Many instructors can work in a department, An instructor can work only in one department.
- For each department there is a Head, An instructor can be head of only one department
- Each instructor can take any number of courses, A course can be taken by only one instructor.
- A student can enroll for any number of courses,

**Cont.**

**12**

Each course can have any number of students.

- (b) What are the limitations of File Processing system?
- (c) Draw and name all the notations for E-R diagram.

2. Solve any two

12

- (a) Consider the insurance database where the primary keys are underlined, Construct SQL queries for this relational data base.

person(driver-id, name, address)

car(license, model, year)

accident(report-number, date, location)

owns(driver-id, license)

participated(driver-id, car, report-number, damage-amount)

- Find the total number of people who owned cars that were involved in accidents in 1989.
- Find the number of accidents in which the cars belonging to "John Smith" were involved.
- Add a new accident to the database assume any values for required attributes.

- (b) Let R=(A,B,C) and let  $r_1$  and  $r_2$  both be relations on R. Give an expression in SQL that is equivalent to each

1)  $\sigma_{B=17}(r_1)$

2)  $r_1 \cup r_2$

3)  $\Pi_{A,B}(r_1) \bowtie \Pi_{B,C}(r_2)$

4)  $r_1 - r_2$

- (c) Consider the schema

sailor(sid, sname, rating, age)

boats(bid, bname, color)

reserves(sid, bid, day)

Write down the relational algebraic expression for

- Find the names of sailors who have reserved a

red and green boat.

- 2) Find the names of sailors who have reserved all boats.
- 3) Find the names sailors who have reserved all boats called "XYZ".

**Solve any two**

12

- (a) Consider the following relational database
- employee(employee-name, street, city)
- works( employee-name, company-name, salary)
- company(company-name, city)
- manages(employee-name, manager-name)

Give an SQL DDL definition of this database.

Identify referential –integrity constraints that should hold, and include them in the DDL definition.

- (b) What is canonical cover? How to compute canonical cover? Explain it by finding it for  
 $F = \{A \rightarrow BC, B \rightarrow C, A \rightarrow B, AB \rightarrow C\}$ .
- (c) Explain with an appropriate example what triggers are. And explain what precautions are to be taken while using triggers.

**Solve any two**

12

- (a) Consider the relations  $r_1(A,B,C)$ ,  $r_2(C,D,E)$  and  $r_3(E,F)$  with primary keys A,C,E respectively. Assume  $n_{r1} = 1000$ ,  $n_{r2} = 1500$  and  $n_{r3} = 750$ . Estimate the size of  $r_1 \bowtie r_2 \bowtie r_3$  and give an efficient strategy for computing the join.
- (b) List and explain various equivalence rule.

- (c) Write an algorithm "external-sort merge" and explain with an example. Estimate the total disk access.

5

## Solve any Two

12

- (a) Consider the following two transactions:

**T1:** **read (A);**  
**read (B);**  
**if A=0 then B:=B+1;**  
**write (B).**

**T2:** **read (B);**  
**read(A);**  
**if B=0 then A:=A+1;**  
**write(A).**

Let the consistency requirement be  $A=0 \vee B=0$  with  $A=B=0$  initially.

- 1) Show that every serial execution involving these two transactions preserves the consistency of the database.
  - 2) Show a concurrent execution of T1 and T2 that produces a non serializable schedule.
- (b) With the help of example explain two phase locking Protocol.
- (c) With the help of example explain deferred database modification.

**Government College of Engineering, Amravati**  
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**V Sem. B. Tech. (CS/IT)**

**Winter - 2015**

**Course Code: ITU502**

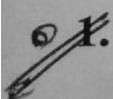
**Course Name: Database Management System**

**Time: 2 hr. 30min.**

**Max. Marks: 60**

**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.



**Attempt any two of the following**

**12**

a (a) Design a relational database for a university registrar's office. The office maintains data about each class, including the instructor, the number of students enrolled, and the time and place of the class meetings. For each student-class pair, a grade is recorded.

a (b) Define the concept of aggregation. Give two examples of where this concept is useful.

(c) What are five main functions of a database administrator?

**2. Attempt any two of the following**

**12**

(a) Consider the employee database given below, where the primary keys are underlined. Give an expression in SQL for each of the following queries.

**Cont.**

*employee (employee-name, street, city)*

*works (employee-name, company-name, salary)*

*company (company-name, city)*

*manages (employee-name, manager-name), city, street)*

i. Find all employees in the database who live in the same cities as the companies for which they work.

ii. Find all employees in the database who live in the same cities and on the same streets as do their managers.

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

**(b)** Consider the employee relational database, where the primary keys are underlined.

Give an expression in the relational algebra to express each of the following queries:

i. Find the names of all employees who work for First Bank Corporation.

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

iii. Find the names, street address, and cities of residence of all employees who work for First Bank Corporation and earn more than \$10,000 per annum.

**(c)** What are the aggregate functions in SQL? Explain each with example

**3.**

**Attempt any two of the following**

**12**

**(a)** Compute the closure of the following set  $F$  of functional dependencies for relation schema  $R = (A, B, C, D, E)$ .

$$A \rightarrow BC$$

$$CD \rightarrow E$$

$$B \rightarrow D$$

$$E \rightarrow A$$

(b) Explain why 4NF is a normal form more desirable than BCNF.

(c) Consider the following relational database:

*employee* (employee-name, street, city)

*works* (employee-name, company-name, salary)

*company* (company-name, city)

*manages* (employee-name, manager-name)

Give an SQL DDL definition of this database. Identify referential-integrity constraints that should hold, and include them in the DDL definition.

4. (a) What are the steps in query processing? 6

(b) What is query optimization? Explain with 6 example.

5. (a) Compare the deferred- and immediate- 6 modification versions of the log-based recovery scheme.

(b) During its execution, a transaction passes through 6 several states, until it finally commits or aborts. List all possible sequences of states through which a transaction may pass. Explain why each state transition may occur.

LEP29

**Government College of Engineering, Amravati**  
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**VI Sem B. Tech  
Summer Term 2009**

**Course Code: IT603**

**Course Name: Database Management Systems**

**Time: 2 hr.30min.**

**Max. Marks: 60**

**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
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- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

1. Solve ( any two) –

- |                                                                                                           |   |
|-----------------------------------------------------------------------------------------------------------|---|
| (a) Explain concept of storage manager in detail.                                                         | 6 |
| (b) Describe specialization using ex.                                                                     | 6 |
| (c) Describe in brief the major components in E-R diagram. Draw an E-R diagram for car insurance company. | 6 |

2. Solve ( any two) -

- (a) Explain natural join operation and division operation in relational algebra using ex. 6
- (b) Let  $R = (A, B, C)$  and let  $r_1$  and  $r_2$  both be relations on schema  $R$ . Give an expression in domain relational calculus that is equivalent to each of following - 6
- 1)  $\pi_A(r_1)$
  - 2)  $\sigma_{B=17}(r_1)$
  - 3)  $r_1 \cup r_2$
  - 4)  $r_1 \cap r_2$
  - 5)  $r_1 - r_2$
  - 6)  $\pi_{A,B}(r_1) \bowtie \pi_{B,C}(r_2)$
- (c) Describe concept of tuple variables in SQL using ex. 6

Using following employee database -

employee(empname, street, city)  
works(empname, companyname, salary)  
company(companyname, city)  
manages(empname, managername)

- 1) Find names and cities of residences of all employees who work for First Bank Corporation.
- 2) Find names, street addresses, and cities of residence of all employees who work for First Bank Corporation earn more than 30,000.

Solve ( any two ) -

- (a) Explain 6  
• Need for triggers  
• Authorization
- (b) Describe concept of assertion. 6  
Write an assertion to find –  
1) Sum of all loan amounts for each branch such that it must be less than sum of all account balance at the branch.  
2) Every loan has at least one customer who maintains an account with minimum balance of 1500.
- (c) Explain Lossless join decomposition with ex. 6

Solve ( any two ) -

- (a) Describe how evaluation of expression is done 6 using Materialization with ex.
- (b) Let relations  $r_1$  (A,B,C) and  $r_2$  (C,D,E) have following properties –  
 $r_1$  has 20,000 tuples and  $r_2$  has 45,000 tuples. 6 25 tuples of  $r_1$  fit on one block and 30 tuples of  $r_2$  fit on one block. Estimate no. of block accesses required, using each of following join strategies for  $r_1 \bowtie r_2$  –  
1) Nested loop join  
2) Block nested loop join  
3) Merge join  
4) Hash join

Cont.

3

(c) Explain Search algorithms A3(Primary index, equality on key), A4 (Primary index, equality on non key)and A5(secondary index,equality)

5. Solve-

(a) Explain View Serializability using ex.

(b) I) Describe rules for graph based protocol.  
II) Consider following two transactions :

$T_{31}$  : read (A);  
read(B);  
if  $A = 0$  then  $B := B + 1$   
write (B).

$T_{33}$ : read(B);  
read(A);  
if  $B = 0$  then  $A := A + 1$ ;  
write (A).

Add lock and unlock instructions to transactions  $T_{31}$  and  $T_{32}$ , so that they observe the two-phase locking protocol.

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V Semester B.Tech. (Computer Sci. & Engg.)

Winter - 2009

Course Code : CS504

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Max. Marks : 60

Instructions to Candidate

- 1) All questions are compulsory.
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- 3) Diagrams/sketches should be given wherever necessary.
- 4) Figures to the right indicate full marks.

Solve any two questions 12

- a) List four significant differences between a file-processing system and a DBMS. Give any two disadvantages of a database system? (6)
- b) i. Explain the difference between a weak and a strong entity set. (3)
- ii. Explain the differences among the terms primary key, candidate key, and super key. (3)

(c) Define the concept of aggregation. Give two examples of where this concept is useful. (6)

2. Solve any two questions 12

a) Let the relation schemas  $R = (A, B, C)$ ,  $S = (D, E, F)$  and t relations  $r(R)$  and  $s(S)$  be given. Give an expression in the tuple relational calculus that is equivalent to each of the following:

- a.  $\Pi_A(r)$
- b.  $\sigma_{B \sim 17}(r)$
- c.  $r \times s$
- d.  $\Pi_{A,F}(\sigma_{C \sim D}(r \times s))$

$\Pi_{T-b}$   
 $\sigma_{T-d}$

b) Let  $R = (A, B, C)$ , and let  $r_1$  and  $r_2$  both be relations on schema  $R$ . Give an expression in the domain relational calculus that is equivalent to each of the following:

- a.  $\Pi_A(r_1)$
- b.  $r_1 \sqsubseteq r_2 \quad \sqcup$
- c.  $r_1 \cap r_2 \quad \sqsupseteq$
- d.  $r_1 \dashv r_2$

c) Describe the circumstances in which you would choose to use embedded SQL rather than SQL alone or only a general-purpose programming language. (6)

3. Solve any two questions 12

a) Give an example of a relation schema  $R$  and a set of dependencies such that  $R$  is in BCNF, but is not in 4NF. Explain why 4NF is a normal form more desirable than BCNF. (6)

- b) Write an SQL trigger to carry out the following action: On delete of an account, for each owner of the account, check if the owner has any remaining accounts, and if she does not, delete her from the *depositor* relation.
- c) i. What is the purpose of having separate (3) categories for index authorization and resource authorization?

ii. What are two advantages of encrypting data (3) stored in the database?

$\sigma_{branch\_city = 'Brooklyn'}$

$\cap \sigma_{branch}$

Solve any two questions

12

- a) Consider the following SQL query for bank (6) database:
- ```
select T.branch-name  
from branch T, branch S  
where T.assets > S.assets and S.branch-city =  
"Brooklyn"
```
- Write an efficient relational-algebra expression that is equivalent to this query. Justify your choice.
- b) Let relations  $r1(A,B,C)$  and  $r2(C,D,E)$  have the following properties:  $r1$  has 20,000 tuples,  $r2$  has 45,000 tuples, 25 tuples of  $r1$  fit on one block, and 30 tuples of  $r2$  fit on one block. Estimate the number of block accesses required, using each of the following join strategies for  $r1 \bowtie r2$ :
- Nested-loop join
  - Block nested-loop join

List the ACID properties. Explain the usefulness of each. (6)

6. Solve any two questions (12)

a) i. Justify the following statement: (4)

Concurrent execution of transactions is more important when data must be fetched from (slow) disk or when transactions are long, and is less important when data is in memory and transactions are very short.

ii. Explain the distinction between the terms *serial schedule* and *serializable schedule*. (2)

b) i. When a transaction is rolled back under timestamp ordering, it is assigned a new timestamp. Why can it not simply keep its old timestamp? (3)

ii. In multiple-granularity locking, what is the difference between implicit and explicit locking? (3)

c) i. Compare the shadow-paging recovery scheme with the log-based recovery schemes in terms of ease of implementation and overhead cost. (3)

ii. Why stable storage cannot be implemented? How database systems deal with this problem. (3)

**Government College of Engineering, Amravati**  
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**V Semester B. Tech. (Computer Sci. & Engg.)**

**Winter - 2011**

**Course Code: CS504**

**Course Name: Database Management System**

**Time: 2 hr.30min.**

**Max. Marks: 60**

**InSTRUCTIONS TO CANDIDATE**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

**1. (a) Define concept of aggregation? Give example of 6 when this concept is useful.**

**(b) Explain different among the terms- 6**  
i) primary key  
ii) candidate key  
iii) super key

**2 Solve any two –**

**(a) Suppose Depositor schema(cust\_name,acc\_no) 6  
Customer schema (cust\_name,Cust\_street,cust\_city)  
Branch schema(branch\_name,branch\_city,asset)  
Loan schema(loan\_no,branch\_name,amount)  
Borrower schema(cust\_name,loan\_no)  
Draw E-R diagram for banking enterprise using  
above given data.**

- (b) Consider employee database -  
 Person(driver\_id, name, address)  
 Car(license, model, year)  
 accident(report\_number, date, location)  
 owns(driver\_id, license)  
 participated(driver\_id, car, report\_no, damage\_amount)
- Construct the following sql queries.

- i) Find the total number of people who owned cars that were involved in accidents.
- ii) Find the number of accidents in which the cars belonging to "John Smith" were involved

- (c) Let  $R = (A, B, C)$ , and let  $r_1$  and  $r_2$  both be relations on schema  $R$ . Give an expression in SQL that is equivalent to each of the following queries. 6

- i)  $r_1 \cup r_2$
- ii)  $r_1 \cap r_2$
- iii)  $r_1 - r_2$
- iv)  $\pi_{AB}(r_1) \quad \pi_{BC}(r_2)$

- 3 (a) What are the two advantages of encrypting data stored in database? 6

- (b) Explain the need of triggers with suitable example 6

#### 4 Solve any two -

- (a) Explain how functional dependencies can be used to indicate the following: 6

- i) A one-to-one relationship set exists between entity sets account and customer.
- ii) A many-to-one relationship set exists between entity sets account and customer

- (b) List the ACID properties. Explain the usefulness of each. 6
- (c) Give an example of a relation schema R and a set of dependencies such that R is in BCNF, but is not in 4NF. 6

**Solve any two –**

- (a) Justify the distinction between the terms serial schedule and serializable schedule. 6
- (b) Explain with diagram the transaction state diagram. 6
- (c) What benefit does strict two-phase locking provide? How does it compare with other forms of two-phase locking 6