Total No. of printed pages = 5

PG/1st Sem/PCSE 103

2022

ADVANCED DBMS

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Explain the difference between two-tier and three-tier architectures. Which is better suited for web applications ? Why ? 8

   (b) Describe at least 3 tables that might be used to store information in social-networking system such as Facebook. 6

   (c) Given a relation schema r(A, B, C, D), does $A \rightarrow BC$ logically imply $A \rightarrow \rightarrow B$ and $A \rightarrow \rightarrow C$? If yes prove it, else give a counter example. 6

[Turn over

2. (a) The following relations keep track of airline flight information :

Flights(**flno: integer**, from: string, to: string, distance: integer, departs: time, arrieves:time, price:integer)

Aircraft(**aid: integer**, aname: string, cruising-range: integer)

Certified(**eid: integer, aid:integer**)

Employees(**eid: integer**, ename: string, salary:integer)

Note that the Employees relation describes pilot and other kind of employees as well; every pilot is certified for some aircraft, and only pilots are certified to fly.

Write each of the following queries in SQL :

(i) Find the names of aircraft such that all pilots certified to operate them earn more than Rs. 90000.

(ii) Print the name and salary of every non-pilot whose salary is more than the average salary for pilots.

(iii) Print the names of employees who are certified only on aircraft with cruising range longer than 1000 miles.

(iv) Find the aid of all aircraft that can be used on routes from Los Angeles to Chicago. 16

(b) What is co-related sub query ? Give an example. 4

3. (a) Why are certain functional dependencies called trivial functional dependencies ? Give example. 4

(b) Use Armstrong's axioms to prove the soundness of the union rule. 5

(c) Use Armstrong's axioms to prove the soundness of the pseudo-transitivity rule. 5

(d) Consider the following set F of functional dependencies for relation schema :

$R = (A, B, C, D, E)$.

$A \rightarrow BC$

$CD \rightarrow E$

$B \rightarrow D$

$E \rightarrow A$

Compute the canonical cover Fc. 6

4. (a) Construct a B+ tree for the following set of key values :

2, 3, 5, 7, 11, 17, 19, 23, 29, 31, 35, 40, 50.

Assume that tree is initially empty and values are added in ascending order.

Order of the tree is five. 10

(b) When is it preferable to use a dense index rather than a sparse index ? Explain your answer. 4

(c) Define query processing. What is the goal of query optimization ? What is query evaluation plan ? 6

5. (a) What is pipeline evaluation ? What is its benefits ? Give example. 5

(b) Explain the External Sort-Merge algorithm with example. 8

(c) Consider the university database : 7

Instructor(id, name, dept_name, salary)

Teaches(id, course_id, sec_id, semester, year)

Course(course_id, title, dept_name, credits)

Transform the following query to an efficient query. Provide the justification for the efficiency. Also, show the expression tree.

Π name, title (σ dept_name = "CSE" (instructor $\times$ (teaches $\times$ Π course_id, title (course)))).

6. (a) State seven important equivalence rules. 7

(b) What is two phase locking protocol ? What is its disadvantage ? How to solve it. 8

(c) What is cascadeless schedule ? Why cascadelessness of schedules is desirable ? 5

7. (a) In multiple granularity locking, what is difference between implicit and explicit locking ? 4

(b) Explain Timestamp-Ordering protocol. 8

(c) Explain the difference between the three storage types-volatile, non-volatile and stable. 8