

2023

COMPUTER SCIENCE

Paper : CSMC-201

(Advanced Database Management System)

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer **question nos. 1, 2** and **any four** questions from the rest.

1. Answer **any five** questions :

2×5

- (a) Distinguish between shared lock and exclusive lock.
- (b) Consider the universal relation $R = \{A, B, C, D, E, F, G, H, I, J\}$ and the set of functional dependencies are $AB \rightarrow C, A \rightarrow DE, B \rightarrow F, F \rightarrow GH, D \rightarrow IJ$. Find out the primary key for the above relation.
- (c) What is the CAP theorem in distributed database?
- (d) State the motivation for using checkpoint in transaction.
- (e) Define serializable schedule.
- (f) State two disadvantages of log-based recovery system.
- (g) What is allocation transparency in distributed database management system? Write one importance of it.

2. Answer **any five** questions :

4×5

- (a) Explain the different kinds of anomalies present in database management system with examples.
- (b) Differentiate between cascade schedule and recoverable schedule.
- (c) Suppose a book file contains 20000 records stored in 4000 blocks. For nonlinear search, assume the level is 4. Find out cost of following select operations for any two searching techniques:
 - (i) $\sigma (ID = 002 \text{ (CATALOG)})$
 - (ii) $\sigma (\text{year} > 1995 \text{ (CATALOG)})$where year and ID are attributes and CATALOG is relation.
- (d) Explain shadow paging with the help of a suitable diagram.
- (e) Write following query for local transparency and location transparency level :
Select SNAME from SUPPLIER where SNUM = "S003".
where relation is :
SUPPLIER (SNUM, SNAME, CITY).

Please Turn Over

(f) Explain document database with the help of a suitable example.

(g) How do you prevent deadlock using wait-die and wound-wait deadlock prevention technique?

3. (a) What is extendible hashing?

(b) Insert following data using extendible hashing technique :

16, 4, 6, 22, 24, 10, 31, 7, 9, 20, 26

(c) Calculate time complexity of above specified technique.

2+6+2

4. (a) What is conflict serializability?

(b) Consider each of the following locking protocols and justify whether conflict serializability holds or not for these :

(i) Always hold an exclusive lock before writing, hold exclusive lock until end-of-transaction. No shared locks are ever obtained.

(ii) In addition to (i), obtain shared lock for reading. Shared lock can be released at any time.

(iii) With (ii), two-phase locking.

(iv) As in (ii), in addition all the locks held until end-of-transaction.

2+8

5. (a) What is a precedence graph?

(b) Explain the rules to make precedence graph. Prepare precedence graph for following schedule.
S : R1(Y), R1(Z), R5(V), R5(U), W5(U), R2(Y), W2(Y), W3(Z), R4(Y), W4(Y), R4(Z), W4(Z), R1(V), W1(V).

(c) Check whether the schedule is conflict serializable or not by using the precedence graph.

2+4+4

6. (a) Explain ARIES recovery protocol with an example.

(b) How is it better from Validation based scheme?

7+3

7. (a) What is heuristic query optimization?

(b) Optimize the following query using heuristic query optimization technique :

Select Lname from EMPLOYEE, PROJECT, WORKS_ON where Pname = "Aquaries" and PROJECT. PNo. = WORKS_ON. PNo. and EMPLOYEE. SSN = WORKS_ON. SSN and Bdate > '1957-12-31',

where relations are as follows :

EMPLOYEE (Fname, Lname, SSN, Bdate, Add, Gender, Salary)

PROJECT (Pname, PNo., Plocation, Dnum)

WORKS_ON (SSN, PNo., Hours)

2+8

8. (a) Explain reconstruction, disjointness and completeness property during fragmentation.

(b) Explain horizontal fragmentation and vertical fragmentation with suitable examples.

5+5