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Reg. No:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2017

CS208: PRINCIPLES OF DATABASE DESIGN (CS, IT)

Max. Marks: 100 Duration: 3 hours

Limit answers to the required points.

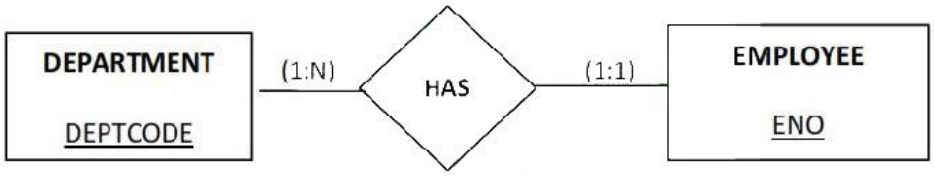
PART A

Answer *all* questions

1. List out any *three* salient features of database systems. (3)

2. How is DML different from DDL? Write a sample statement in DML and one in DDL. (3)

3. Can we represent the situation modelled by the following ER diagram without the relationship 'HAS'? If so, draw the new diagram. If not, give the reasons. (Entities are DEPARTMENT and EMPLOYEE. Attibutes names are given under entity names; keys are underlined.) (3)



4. Consider the a relation R(A,B,C,D) where A is a key of R. Write any three relational algebra expressions equivalent to $\prod_{A,B}(\sigma_{A=2 \text{ and } B=3}(R))$ (3)

PART B

Answer any *two full* questions

5. Study the tables given below and write relational algebra expressions for the queries that follow. (9)

STUDENT(ROLLNO, NAME, AGE, GENDER, ADDRESS, ADVISOR)
COURSE(COURSEID, CNAME, CREDITS)
PROFESSOR(PROFID,PNAME, PHONE)
ENROLLMENT(ROLLNO, COURSEID, GRADE)

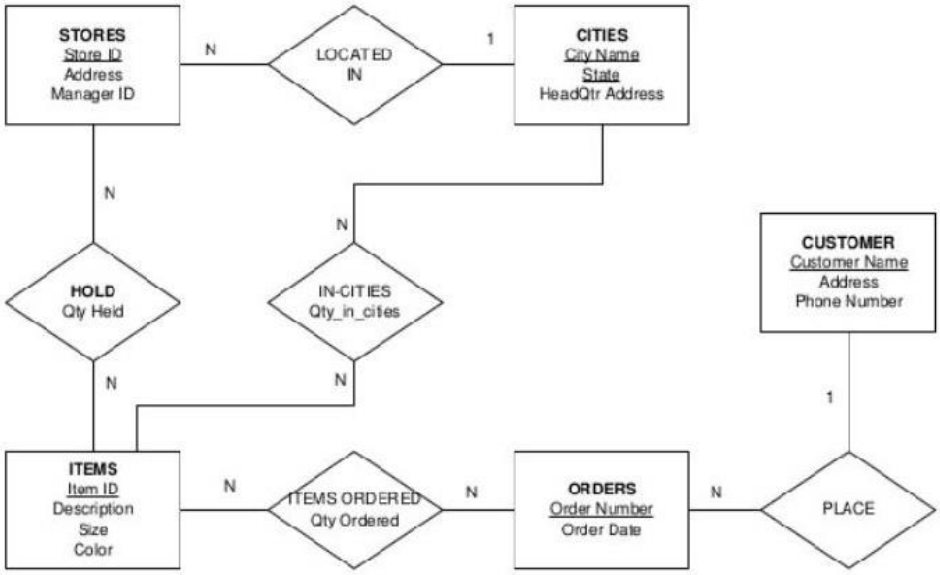
Primary keys are underlined. ADVISOR is a foreign key referring to PROFESSOR table. ROLLNO and COURSEID in ENROLLMENT are also foreign keys referring to THE primary keys with the same name.

(i) Names of female students
(ii) Names of male students along with adviser name
(iii) Roll Number and name of students who have not enrolled for any course.

6. A company has the following scenario: There are a set of salespersons. *Some* of them manage other salespersons. However, a salesperson *cannot* have more than one manager. A salesperson can be an agent for many customers. A customer is managed by *exactly*one salesperson. A customer can place any number of orders. An order can be placed by *exactly*one customer. Each order lists one or more items. An item may be listed in many orders. An item is assembled from different parts and parts can be common for many items. One or more employees assemble an item from parts. A supplier can supply different parts in certain quantities. A part may be supplied by different suppliers. (9)
   (i) Identify and list entities, suitable attributes, primary keys, foreign keys and relationships to represent the scenario.
   (ii) Draw an ER diagram to model the scenario using *min-max* notation.

7. a. Justify the importance of weak entity sets with the help of an example. (3)

   b. In the ER diagram below, names of entity sets and relationships are shown in capital and corresponding attributes are listed under each such name. Key attributes are underlined. All the *participations* are *total*. Use the standard synthesis procedure to convert the ER diagram into the corresponding relational schema. Clearly show primary and foreign keys. (6)



PART C
Answer *all* questions

8. Illustrate the GROUP BY clause with the help of a real example. (3)

9. Consider the query SELECT NAME, AGE FROM STUDENT WHERE GENDER = 'Male' on the table STUDENT(ROLLNO, NAME, AGE, GENDER, ADDRESS). Give a relational algebra expression corresponding to the query. Is result produced by the query and your expression always the same? Why? (3)

10. Determine any two candidate keys of the relation R(A,B,C,D,E,F) with FDs AB→C,C→AD, D→EF, F→B. (3)

11. Give an example for a relation that has insertion, deletion and update anomalies. Which type(s) of functional dependency can formally model these anomalies? Quote *one* such (3)

dependency from your example

PART D

Answer any *two full* questions

12. a. Illustrate the use of assertions with a typical example. (3)

b. Consider a relation (A,B,C,D,E,F) with A as the only key. Assume that the dependencies E→F and C→DEH hold on R. (6)

(i) Is R is in 2NF? If not, decompose to 2NF.

(ii) Is R is in 3NF? If not, decompose to 3NF.

13. In the following tables ADVISOR and TAUGHTBYare foreign keyd referring to the table PROFESSOR. ROLLNO and COURSEID in ENROLLMENT refer to tables with primary keys of the same name. (9)

STUDENT(ROLLNO, NAME, AGE, GENDER, ADDRESS, ADVISOR)
COURSE(COURSEID, CNAME, TAUGHTBY, CREDITS)
PROFESSOR(PROFID,PNAME, PHONE)
ENROLLMENT(ROLLNO, COURSEID, GRADE)

Write SQL expressions for the following queries:

(i) Names of courses taught by 'Prof. Raju'.

(ii) Names of students who have *not* enrolled for any course taught by 'Prof. Ganapathy'.

(iii) For each course, name of the course and number of students enrolled for the course.

14. Assume that the relation R(P,Q,S,T,U) with FDs P → S, Q → S, S → T, TU → S, SU → Pis decomposed into 5 relations: R1(P,T), R2(P,Q), R(Q,U), R4(S,T,U) and R5(P,U). Apply the standard algorithm to test if the decomposition is alossless-join decomposition. (9)

PART E

Answer any *four full* questions

15. Consider the tables R (A, B, C), T(D,E,F), S(G, H) and U(A,D, G, I) where A, D and G in U are foreign keys referring to the primary keys with the same names. Show an *initialquery tree* for the following query and optimize it using the rules of heuristics: (10)

select B, E, G, H, I
from R, T, S, U
where R.A = U.A
and T.D = U.D and S.G = U.G
and R.C = 'TEXT' and U.I > 20 and T.E = 25

16 Consider a file with 2,00,000 records stored in a disk with fixed length blocks of size 256 bytes. Each record is of size 50 bytes. The primary key is 4 bytes and block pointer is 6 bytes. Compute the following, assuming that multi-level primary index is used as access path: (10)

(i) Blocking factor for data records
(ii) Blocking factor for index records
(iii) Number of data blocks
(iv) Number of First level index blocks
(v) Number of levels of multi level index

17. a. Argue that two-phase locking ensures serializability. (4)

b. Illustrate *clustering* index and *secondary* index with typical, real examples. (6)

18. a. Show the generic structure of a B+-Tree clearly indicating the types keys and pointers and their significance. (5)

b. What is the significance of check-pointing? Illustrate with a typical example. (5)

19. a. Illustrate *lost-update* and *dirty-read* problems with suitable examples. (4)

b. Determine if the following schedule is serializable. (6)
r1(X), r2(Z), r1(Z), r3(X), r3(Y), w1(X), w3(Y), r2(Y), w2(Z), w2(Y)
(Note: ri(X)/wi(X) means transaction Ti issues read/write on item X)

20. a. Write a small RDF document and show its equivalent graph structure. (4)

b. List out any *three* salient features of Big data. (3)

c. How is GIS databases different from conventional databases? (3)