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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

V Semester B. E. Examinations Nov/Dec-19

Computer Science and Engineering

DATABASE DESIGN

Time: 03 Hours ***Maximum Marks: 100***

Instructions to candidates:

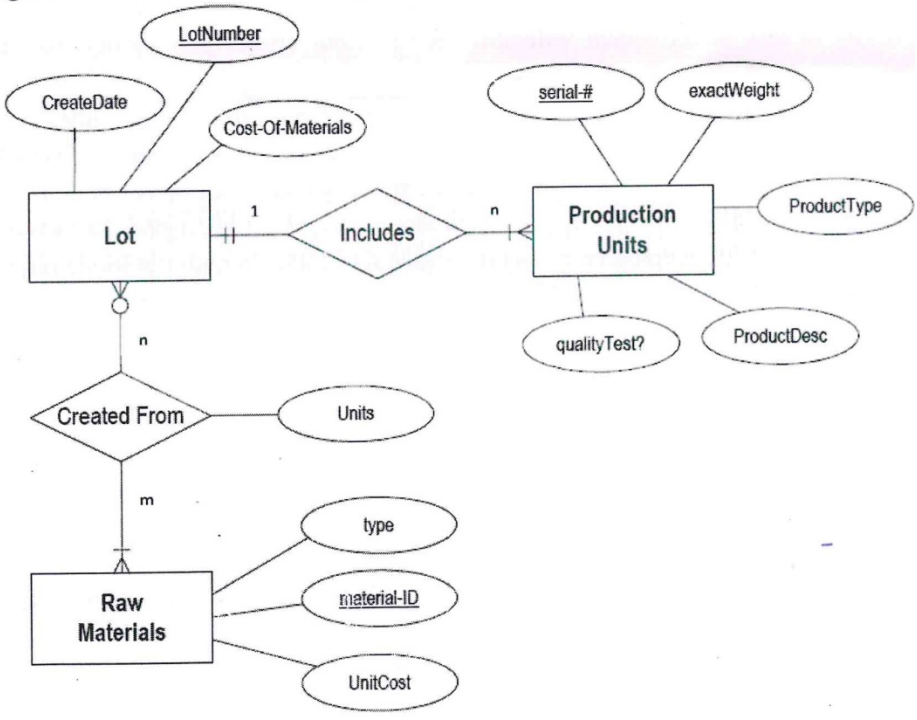
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART-A

1	1.1	Find the minimal cover for following set of functional dependencies. $P \rightarrow L, P \rightarrow CA, LC \rightarrow AP, A \rightarrow LC$	02
	1.2	For the following EMP relation $EMP(E\_ID, Ename, DeptNo)$, display the names of all employees whose names include either of the substring "TH" or "LL".	02
	1.3	Differentiate the working of the following aggregate functions: $COUNT(*)$ and $COUNT(COLUMN\_NAME)$.	02
	1.4	Determine the key for the following relation $R = \{A, B, C, D, E, F, G, H, I\}$ with respective to following set of functional dependencies: $A \rightarrow BH, BC \rightarrow E, ED \rightarrow AF, G \rightarrow IH, FH \rightarrow CG$	02
	1.5	A relation is in _____ normal form if an attribute of a composite key is dependent on an attribute of other composite key.	02
	1.6	List the two conditions that decides that given $MVD\ X \twoheadrightarrow Y$ is a trivial MVD.	02
	1.7	List different types of attributes in ER diagram and specify their ER notations.	02
	1.8	The following table has two attributes A and C where A is the primary key and C is the foregin key referencing A with on-delete cascade. AC --- 2 4 3 4 4 5 5 3 7 3 9 5 6 4 1 7 The set of all tuples that must be additionally deleted to preserve referential integrity when the tuple (3,4) is deleted is :	02
	1.9	Represent Aggregation function and GroupBy clause in relational algebra.	01
	1.10	An attribute of relational schema R is called a _____ if it is a member of some candidate key R.	01

	1.11	The main problem associated with the recoverable schedule is _____.	01
	1.12	_____ is a transaction property ensured by the concurrency control subsystem.	01

PART-B

2	a	Justify how three-schema architecture provides logical and physical data independence with a neat diagram. Which is harder to achieve?	06
	b	Illustrate the main phases of database design with respect to University Database.	06
	c	Distinguish between cardinality ratio and participation constraints with example.	04
3	a	Consider the following requirements for a simple database for the National Hockey League (NHL): • the NHL has many teams, • each team has a name, a city, a coach, a captain and a set of players, • each player belongs to only one team, • each player has a name, a position (such as left wing or goalie), a skill level, and a set of injury records, • a team captain is also a player, • a game is played between two teams (referred to as host_team and guest_team) and has a date (such as $May\ 11th, 1999$) and a score (such as 4 to 2). Construct a clean and concise ER diagram for the NHL database. List your assumptions and clearly indicate the cardinality mappings as well as any role indicators in your ER diagram.	08
	b	Design a Relational Schema for the given ER diagram.  	04
	c	Discuss the division operation in relational algebra with an example.	04

OR

4	a	For the following Database schema, write the Relational Algebra Queries. $author(\underline{author\ id};\ first\_name;\ last\_name)$ $author\_pub(\underline{author\ id};\ pub\_id;\ author\_position)$ $book(\underline{book\ id};\ book\_title;\ month;\ year;\ editor)$ $pub(\underline{pub\ id};\ title;\ book\_id)$ Assume editor in book is a foreign key referencing author (author_id) i) List the names of all authors who are not book editors ii) List the names of all authors who are book editors iii) List the names of all authors who have at least one publication in the database. iv) List the author_id authored a pub that was published in July	08
	b	Consider the following requirements of '*UPS* Pride' company which keeps up-to-date information on the processing and current location of each Shipped item. Shipped items are the heart of the *UPS* product tracking information system. Shipped items are be characterized by item number (unique), weight, dimensions, insurance amount, destination, and final delivery date. Shipped items are received into the *UPS* system at a single retail center. Retail centers are characterized by their type, uniqueID and address. Shipped items make their way to their destination via one or more standard *UPS* transportation events (i.e, flights, truck deliveries). These transportation events are characterized by a unique scheduleNumber, a type (e.g, flight, truck) and a driveryRoute. Construct a clean and concise *ER* diagram for the given database. List your assumptions and clearly indicate the cardinality mappings as well as any role indicators in your *ER* diagram.	08
5	a	For the following Database schema, write the *SQL* Queries. $Sailors\ (sid: integer, sname: string, rating: integer, age: real)$; $Boats\ (bid: integer, bname: string, color: string)$; $Reserves\ (sid: integer, bid: integer, day: date)$. i) Find all information of sailors who have reserved boat number 101. ii) Find the names of sailors who have reserved a red boat, and list in the order of age. iii) Find the ids of sailors who have reserved a red boat or a green boat. iv) Find the name and the age of the youngest sailor.	08
	b	Consider two sets of FDs, F and $G, F = \{A \rightarrow B,\ B \rightarrow C,\ AC \rightarrow D\}$ and $G = \{A \rightarrow B,\ B \rightarrow C,\ A \rightarrow D\}$. Are F and G equivalent?	04
	c	Discuss Project Join Normal form (*PJNF*) with an example.	04
		OR	
6	a	Compare and contrast *IN* and *EXISTS* operators by writing nested queries with respect to following schema. $Sailors\ (sid: integer, sname: string, rating: integer, age: real)$; $Boats\ (bid: integer, bname: string, color: string)$; $Reserves\ (sid: integer, bid: integer, day: date)$.	

		i) Find the names of the sailors who have reserved the boat number 103. ii) Find sid's of sailors who've reserved both a red and a green boat	08
	b	Let $R = ABCDE, R1 = AD, R2 = AB, R3 = BE, R4 = CDE$ and $R5 = AE$. Let the functional dependencies be: $A \rightarrow C$, $B \rightarrow C$, $C \rightarrow D$, $DE \rightarrow C$, $CE \rightarrow A$. Verify whether the given decomposition of R into $\{R1, R2, R3, R4, R5\}$ is lossless join decomposition or not.	04
	c	Let $R = (A, B, C, D, E, F)$ be a relation. The set of functional dependency on R is given as follows: $AB \rightarrow C$, $A \rightarrow D$, $E \rightarrow F$, $B \rightarrow EF$. Determine the key for R and decompose R into $3NF$.	04
7	a	Using MongoDB design a Employee database and write the following queries: i) Create Personal database and collection Employees (EmpId, Name, Age, Salary, Designation, Address) ii) Insert Minimum three documents into the collection iii) List all the employees having Salary >= 8000 and salary <= 15000. iv) Sort the documents in Employee collection in ascending order of their names and descending order of their Age v) List the EmpId, names and salary of all the employees who are managers.	08
	b	Define Tokenizer and Index in Elastic search.	04
	c	Differentiate between horizontal and vertical scaling. How MongoDB makes horizontal scaling manageable?	04
8	a	Consider the three transactions $T1, T2$ and $T3$ and two schedules $S1$ and $S2$. Verify whether the schedules are serializable or not. Write down the equivalent serial schedule for the serializable schedule. $T1: r1(x), r1(z), w1(x)$ $T2: r2(z), r2(y), w2(z), w2(y)$ $T3: r3(x), r3(y), w3(y)$ $S1: r1(x), r2(z), r1(z), r3(x), r3(y), w1(x), w3(y), r2(y), w2(z), w2(y)$ $S2: r1(x), r2(z), r3(x), r1(z), r2(y), r3(y), w1(x), w2(z), w3(y), w2(y)$	08
	b	Define Lock. Describe the types of lock used in concurrency control.	04
	c	Is deadlock possible in 2-phase locking protocol? Justify your answer with an example.	04