诚信应考 ,考试作弊将带来严重后果！

华南理工大学期末考试

《数据库系统》试卷　(A)

注意事项： 1. 考前请将密封线内填写清楚；

2. 所有答案请答在答题纸上；

3. 考试形式：闭卷；

4. 本试卷共　两　大题，满分　100 分，　考试时间　120 分钟 。

题　号	一	二	总分
得　分			
评卷人			

Part I [20 pts.] (1pt each) Fill in the blanks with the best answer.

1. The collection of information stored in the database at a particular moment is called an _____ of the database. The overall design of the data base is called the database _____ .
2. A relation schema R is in _____ normal from if for all $\alpha \rightarrow \beta$ in $F+$, at least one of the following holds: $\alpha \rightarrow \beta$ is _____ ; α is a superkey for R ; Each attribute A in is contained in a candidate key for R .
3. Let R be a relation schema , R_1 and R_2 from a decomposition of R. Decomposition is a _____ if for all legal database instances r of R , $\Pi_{R_1}(r) \bowtie \Pi_{R_2}(r) = r$.
4. In E-R model , on entity is represented by a set of _____ . A _____ is an association among several entities .
5. Assume relation r has b_r blocks and relation s has b_s blocks , therefore , in the best case , only _____ block transfers would be required for $r \bowtie s$.
6. An ideal hash function is _____ and _____ , the former require that each bucket is assigned the same number of search-key values form the set of all possible values.
7. To generate query-evaluation plans for an expression we have to generate logically equivalent expressions using _____ .
8. Consider a $B+$- tree of order n ,if there are K search-key values in the file , the path form the root to the leaf mode is no longer than _____ .
9. A transaction has the following properties: _____ , _____ , isolation and durability.
10. When the final statement of a transaction has been executed , the transaction enters the _____ committed state . After a transaction has been rolled back and the database has been restored to its previous state , the transaction enter the _____ state .

11. A schedule S is _____ if a transaction T_j in S needs a data item previously written by a transaction T_i , then the commit operation of T_i appears before the commit operation of T_j .

12. _____ attribute values or _____ attribute values are not atomic .

13. A relation schema may have an attribute that corresponds to the primary key of another relation . The attribute is called a _____ .

Answer :

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____

Part Ⅱ [80 pts.] Answer the following question.

1. [16 points] Database design Ⅰ: Consider the following conditions

   i. The STUDENT may be taught by one and only one teacher . The TEACHER may be instructor of one or more STUDENT .

   ii. The TEACHER may be responsible for one and only one CLASS . The CLASS may be the responsibility of one and only one TEACHER .

   iii. The CLASS may be made of one of one or more STUDENT . The STUDENT must be a member of one and only one CLASS .

   iv. The CLASS must have one and only are ROOM . The ROOM may belong to one or more CLASS .

Notes : Assume entity CLASS has the following attributes : CID and CNAME , entity ROOM has the following attributes : RID and LOCATION , entity STUDENT has the following attributes : SID , LASTNAME , and FIRSTNAME , entity TEACHER has following attributes : TID ,TEACHERNAME , and TITLE .

a) [8 points] Construct an E-R diagram showing these relationships .

b) [4 points] Construct appropriate relation schemas for the above E-R diagrams .

c) [4 points] Create an index std_index on the **student** relation with **SID** as the search_key .

2. [6 points] In database design , how to represent relationship set as relational schemas ?

3. [14 points] Let $R=(A,B,C,D,E,F)$ be a relation with functional dependency $F=\{A\rightarrow CB,E\rightarrow FA\}$

   a) [2 points] Compute the candidate keys for R ;

   b) [6 points] Is R in 3NF ? If it is , justify your answer . If not , produce a decomposition of R into 3NF .

   c) [6 points] Is R in BCNF ? If it is , justify your answer . If not , produce a decomposition of R into BCNF .

4. [28 points]

BOOK (Bookid , Title , Publishername)

BOOK_AUTHORS (Bookid , Authorname)

PUBLISHER (Publishername , Address , Phone)

BOOK_COPIES (Bookid , Branchid , No_Of_Copies)

LIBRARY_BRANCH (Branchid , Branchname , Address)

BOOK_LOANS (Bookid , Branchid , Cardno , DataOut , Duedata)

BORROWER (Cardno , Name , Address , Phone)

a) [3 points] Write appropriate SQL DDL statements for declaring the BOOK_AUTHORS relation.

b) [6 points] Give an expressions in **relational algebra** to express the following queries :

Q1: Retrieve the name of all borrowers who do not have any books checked out.

Q2: For each book that is loaned out from the “ sharpstown ” branch and whose DueDate is today , retrieve the book title , the borrowe r ’ s name , and the borrower ’ s address .

c) [16 points] Give an expressions in SQL to express the following queries :

Q1: How many copies of the book titled The Lost Tribe are owned by the library branch whose name is “ sharpstown ” ?

Q2: For each library branch , retrieve the branch name and that the total number of books loaned out rom that branch .

Q3: Retrieve the name , address , and number of books checked out for all borrowers who have more than five books checked out .

Q4: For each book authored (or co- authored) by “ Stephen King “ , retrieve the title and the number of copies owned by the library branch whose name is “ central ” .

d) [3 points] Record the fact that the manager didn ’ t maintain information about the book named “ T&G ” ,i.e. remove information about . “ T&G ”

5. [16 points] Query Processing , Optimization and Transaction

a) [4 points] please describe the implementation process of selection operation $\sigma_{A=c}(r)$, where r is a relation . A is an attribute and is not a candidate key , r has a primary index on A . If there are n matching records , the B+ tree index is of height h , and each disk block contains at most d records , please analyze the overhead in the best case .

b) [4 points] Describe the process of Indexed nested-loop join .

c) [4 points] please describe the two-phase looking protocol and prove that it ensures conflict-serializable schedules and does not ensure freedom from deadlocks .

d) [4 points]