1. Single Choice

1) Which one of the following is NOT TRUE for database language? (_________)

A. Relational Algebra is a procedural database language.

B. SQL is a declarative database language.

C. SQL is both a declarative database language and a pure database language.

D. SQL is both data definition language and data manipulation language.

2) Which one of the following is NOT TRUE for relational model? (_________)

A. In a relation, a foreign key can be a subset of the primary key.

B. In a relation, the primary key can be a subset of a candidate key.

C. In a relation, a super key must contain a candidate key.

D. In a relation, a candidate key can include multiple attributes.

3) Given relation schema $R_1(A,B,C,D)$ and $R_2(B,C)$, the schema of the relation as the result of $R_1 \div R_2$ is (__________).

A. $(A, R_1.B, R_1.C, R_2.B, R_2.C)$

B. (A)

C. (A, B, C)

D. (A, D)

4) Which one of the following is NOT TRUE for SQL? (_________)

A. Views may be defined in terms of other views.

B. Result of where clause predicate is treated as false if it evaluates to unknown.

C. Set operations automatically eliminate duplicates.

D. 'DELETE TABLE r' deletes not only all tuples of r, but also the schema for r.

5) "Unique ((mike, Null), (mike, Null))" is evaluated to (_________)

A. TRUE

B. FALSE

C. UNKNOWN.

D. NULL

6) In "CREATE TABLE" statement, unique($\underline{A_1, A_2, \ldots, A_m}$) states that the attributes $\underline{A_1, A_2, \ldots A_m}$ form a (__________).

A. Primary key

B. Foreign key

C. Candidate key

D. Relation schema

7) If R is a one-to-many relationship set from entity set E_1 to E_2, Which one of the following is TRUE? (___________)

A. If R has any descriptive attribute it can be moved to E_1.

B. The primary key of R is the primary key of E_2.

C. E_1 can be a weak entity set

D. E_2 must totally participate in R

8) In the following statements about weak entity set, (__________) is incorrect.

A. Weak entity set is an entity set that does not have a super key

B. The existence of a weak entity set depends on the existence of an identifying entity set

C. Weak entity set is an entity set that does not have a foreign key

D. Weak entity set must relate to the identifying entity set via a total, many to one relationship set

9) If and only if (__________), K is a super key of R.

A. $K \rightarrow R$

B. $R \rightarrow K$

C. $K \rightarrow (K-R)$

D. $(R-K) \rightarrow K$

10) A decomposition of R into R1 and R2 is lossless join if (___________).

A. $R_1 \cap R_2 \rightarrow R_1$ is in F^+

B. $R_1 \cap R_2 = \Phi$

C. $R_1 \cap R_2 \neq \Phi$

D. $R_1 - R_2 \rightarrow R_1$

2. Fill in the following blanks

1) Database systems provide an abstract view of the data, which is achieved through 3 level of abstraction: physical level, logical level, and (_________________).

2) r and s are two relations. Suppose a tuple occurs 3 times in r and 5 times in s, then it occurs (____________) times in the execution result of the SQL statement "r **intersect all** s".

3) Relation r has 100 tuples, among these tuples, only 2 have null values on attribute A, the result of the SQL statement "**select count**(*), **coun**t(A) **from** r" is (_________________).

4) The *grant* statement is used to confer authorization, and the (_____________) statement is used to reclaim authorization.

5) Collection of operations that form a single logical unit of work in database system is called (__________________).

3. Answer the following questions

1) Briefly describe what is referencing constraint.

2) Briefly describe the following concepts about keys in a relational model: Super Key, Candidate Key, Primary Key.

3) In a bank database, if a loan can be borrowed by more than one customer, should we divide relation schema (customer_id, loan_number, amount), into two schemas (customer_id, loan_number) and (loan_number, amount)? Describe why.

4) Briefly describe the ACID properties of transactions.

4、Relational Algebra

Give the result of the following relational algebra expressions.

R

A	B	C
a1	6	7
a2	2	3
a1	2	3
a4	4	5
a2	6	7
a3	7	9

S

B	C
6	7
2	3

1) $R1 = \Pi_{B, C, 200}$（R）
2) $R2 = \sigma_{B>2}$（R）
3) $R_3 = R \bowtie S$
4) $R_4 = {}_{A}\mathcal{G}_{sum(B)}$

5. Compose SQL

Consider the following relations (the primary keys are underlined):

Students(<u>*snum*:integer</u>, *sname*:string, *major*:string, *level*:string, *age*:integer)
Faculty(<u>*fid*:integer</u>, *fname*:string, *deptid*:integer)
Class(<u>*cname*:string</u>, *meets at*:string, *room*:string, *fid*:integer)
Enrolled(<u>*snum*:integer</u>, <u>*cname*:string</u>)

The meaning of these relations is straightforward; for example, *Enrolled* has one record per student-class pair such that the student is enrolled in the class. Note that *snum* and *cname* in *Enrolled* should correspond with *snum* in *Students* and *cname* in *Class* respectively.

1) Write a SQL statement to create relation *Class.* Declare a primary key and foreign keys (if any) on this relation.

2) Write a SQL statement to insert into the database the fact that the 22 year-old senior CS student ‘Kobe Bryant’, with snum 111, is enrolled in class CS411. (hint: Both Students and Enrolled tables need to be updated.)

3) Write a SQL statement to delete all the classes taught by “Joe Smith”.

4) Create a view BusyFaculty that records the ids and names of faculties who teach more than 3 classes.

5) Find the names of all students that enroll in a class where students meet in room R128 (i.e., Class.room = R128) or a class in which five or more than five students enroll.

6) Find the names of all students who are enrolled in two classes that meet at the same time

6、E/R Diagram

The club *Travel-Often-And-A-Lot* organizes shorter and longer tours for its members. Help them to make a model of their mini world.

Travel-Often-And-A-Lot has members. Each member is represented by her/his full name, address, and birth date.

Some members belong to the board of *Travel-Often-And-A-Lot.* Some members are organizers (of tours). Organizers must be stored with their cell phone number so that they can be reached anytime. Organizers organize tours. Sometimes a tour is organized by several organizers.

Each tour is denoted by a name, e.g. "Museums of Paris, 2004" or "Iceland, 2005". Tours can take place multiple times. "Museums of Paris, 2004", for instances, takes place twice: May 22nd to May 29th, 2004 and June 5th to June 12th, 2004. The cost of a tour depends on the date, e.g. "Museums of Paris, 2004" was cheaper in May than in June. Each *travel* – such as "Museums of Paris, 2004" at June 5th to June 12th, 2004 – is lead by one organizer members participate in travels.

Travel-Often-And-A-Lot wants to keep track of the payments made by its members. A payment can e.g. be the annual club fee, a donation, ***etc.*** but also the payment for a travel. Mind the subtle distinction between *tour* and travel.

1) Create an E-R model that fulfill above requirements.
2) Translate the E-R model into relation schemas.

7、Normalization and Schema Design

Consider a relation with schema R={A, B, C, D, E, F} and F={AB→CD; A→D; D→AE; E→F}holds on R.

1) Give all candidate keys of this relation, motivate. (**3 points**)

2) Indicate all extraneous attributes in F, motivate. (**3 points**)

3) Is this relation in 3NF？ If it is not, decompose it into relations in 3NF. (**6 points**)