一 選擇題 (每題 3 分)

1) Which of the following is *NOT* a property of relations?
   A.) No two rows in a relation are identical
   B.) Each attribute has a unique name
   C.) The order in which the rows are listed in a relation is important
   D.) None of the above

2) When translating a given ER model into relations, there may be more than one choice. What factors might affect your decision?
   A.) Time efficiency
   B.) Space efficiency
   C.) All of the above
   D.) None of the above

3) What does the following SQL statement do?

```
Alter Table Student_T
  Add (Type Varchar(2))
```

   A.) Alters the Student_T table to accept Type 2 Varchars.
   B.) Alters the Student_T table to be a Type 2 Varchar.
   C.) Alters the Student_T table by adding a 2-byte filed called "Varchar".
   D.) Alters the Student_T table, and adds a row called "Type".
   E.) None of the above

4) Which of the following relational operators states the conditions for column selection?
   A.) Select
   B.) Projection
   C.) Division
   D.) Union
   E.) Group By

5) Which of the following file types has least Delete cost?
   A.) Sorted
   B.) Clustered
   C.) Unclustered tree index

(背面仍有題目,請繼續作答)

D.) Unclustered hash index

6) Which of the following relational operators is especially useful to express the following kinds of queries: Find the names of sailors who have reserved all boats?
   A.) Union
   B.) Join
   C.) Division
   D.) Selection
   E.) Intersection

7) What is the technique to segment the data into equal-size partitions distributed over multiple disks?
   A.) Data striping
   B.) Data independence
   C.) Data integration
   D.) Data streaming

8) A relationship between the instances of a single entity type is called a(n) _____ relationship.
   A.) binary
   B.) unary
   C.) ternary
   D.) primary

二 問答題

1. Define the following terms: relation schema, domain, relation cardinality, and relation degree. (8 分)

2. Given two relations R1 and R2, where R1 contains N1 tuples, R2 contains N2 tuples, and N2 > N1 > 0, give the minimum and maximum possible sizes (in tuples) for the result relation produced by each of the following relational algebra expressions. In each case, state any assumptions about the schemas for R1 and R2 that are needed to make the expression meaningful:
   (1) $\sigma_{a=5}(R1)$, (2) R1∩R, (3)R1/R2, (4) R1×R2 (共 24 分)

3. For each of the following relations, identify the best normal form that the

relation satisfies (1NF, 2NF, 3NF, or BCNF). If the relation is not in BCNF, decompose it into lossless-join BCNF relations. In each relation, the key fields are underlined. Additional functional dependencies are shown where appropriate. (14 分)

(1) Class(Course_No, Section_No)
(2) Class(Course_No, Section_No, Room)
(3) Class(Course_No, Section_No, Room, Capacity) Room → Capacity
(4) Class(Course_No, Section_No, Course_Name, Room, Capacity)
Course_No → Course_Name, Room → Capacity

4. Consider the following relation schemas:
Sailors(sid: integer, sname: string, rating: integer, age: real)
Boats(bid: integer, bname: string, color: string)
Reserves(sid: integer, bid: integer, day: date)

The key fields are underlined, and the domain of each field is listed after the field name. Write the following queries in **relational algebra.** (每小題 5 分)

a. Find the names of sailors who have reserved a red boat.
b. Find the colors of boats reserved by the sailor Lubber.
c. Find the names of sailors who have reserved at least two boats.

Write the following queries in **SQL.** (每小題 5 分)

a. Find the names of sailors who have reserved boat number 103.
b. Find sailors whose rating is better than some sailors called Horatio.
c. Find the sailors with highest rating. (must use >=ALL in your answer)