

CLOSE BOOK，考試時數四小時

第一部分：

1. In spite of the advantages of using a DBMS, there are a few situations in which a DBMS is not necessary and appropriate. Please state and explain those situations. (10%)
2. A database is being constructed to keep track of the teams and games of a sports league. A team has a number of players, not all of whom participate in each game. It is desired to keep track of the players participating in each game for each team, the positions they played in that game, and the result of the game. Design an ER schema diagram for this application, stating any assumptions you make. Choose your favorite sport (e.g., soccer, baseball, football). (10%)
3. List the three main approaches to database programming. What are the advantages and disadvantages of each approach? (10%)
4. What is meant by the attribute preservation condition on a decomposition? What is the dependency preservation property for a decomposition? What is the lossless (or nonadditive) join property of a decomposition? Why are these properties important? (10%)
5. Consider the following set of two-dimensional records:

RID	Dimension1	Dimension2
1	8	4
2	5	4
3	2	4
4	2	6
5	2	8
6	8	6

Use the  $K$ -means algorithm to cluster the data. We can use a value of 3 for  $K$  and can assume that the records with RIDs 1, 3 and 5 are used for the initial cluster centroids (means). (10%)

## 第二部分：

1. Discuss the similarities and differences between an ontology and a database schema. 5%
2. What is meant by a *safe expression* in relational calculus? 5%
3. Using the database schema
  - Product (maker, model, type)
  - PC (model, speed, ram, hd, rd, price)
  - Laptop (model, speed, ram, hd, screen, price)
  - Printer (model, color, type, price)
 write an SQL query that will find the maker(s) of the PC(s) with the fastest processor among all those PCs that have the smallest amount of RAM. 10%
4. Consider the universal relation  $R = \{A, B, C, D, E, F, G, H, I, J\}$  and the set of functional dependencies  $F = \{\{A, B\} \rightarrow \{C\}, \{A\} \rightarrow \{D, E\}, \{B\} \rightarrow \{F\}, \{F\} \rightarrow \{G, H\}, \{D\} \rightarrow \{I, J\}\}$ . What is the key for R? Decompose R into 2NF, then 3NF relations. **YOU MUST SHOW ALL YOUR WORKS.** 10%
5. Compare and contrast the two main approaches to conceptual schema design. 5%
6. How does a B-tree differ from a  $B^+$ -tree? Why is a  $B^+$ -tree usually preferred as an access structure to a data file? 5%
7. What are the important factors that influence physical database design? 5%
8. How do optimistic concurrency control techniques differ from other concurrency control techniques? Why are they also called validation or certification techniques? Discuss the typical phases of an optimistic concurrency control method. 5%