國立雲林科技大學資訊管理系

113 學年度第 1 學期博士班資格考 (Ph.D. Qualify Exam)

考試科目 (Subject)：資料庫系統 (Database Systems)

時數與方式 (Hour and type)：四小時 (4 hours)

Close book, 不可使用計算器 (Calculators not allowed)

Part 1: 60 points (Optional Questions: Answer 3 out of 4, 20 points each; if you answer more than 3 questions, only the first 3 answered questions will be graded.)

1. Explain in detail the basic concepts of the Entity-Relationship (ER) model and its applications. Use a real-world scenario to demonstrate how requirements analysis is transformed into an ER model, and subsequently into a relational database model. (Hint: Entities, attributes, relationships; constructing ER diagrams; the transformation process from requirements analysis; practical application example)

2. SQL is the standard query language for relational databases. Write an SQL script to create a database with three tables (Customers, Orders, Products). Each table should have at least five columns, and implement a query to calculate the total order amount for each customer.

3. Explain the fundamental concepts of transaction management and concurrency control in detail. Discuss the Two-Phase Locking Protocol's working principles and its role in ensuring database consistency.

4. Suppose a person has multiple contact information entries, each containing a contact type (e.g., email, address, Line, etc.) and corresponding details. For email-type contacts, the details include username and mail server; for address-type contacts, they include city, district, street, and number.
   (a) Explain the meaning and appropriate use cases for multivalued attributes and composite attributes, using the above example for illustration. (5%)
   (b) Explain the differences between multivalued attributes and the approach using weak entities, identifying relationships, and partial keys, and illustrate with the given example. (5%)
   (c) Using an ER diagram, illustrate the composite attributes, multivalued attributes, and the use of weak entities, identifying relationships, and partial keys based on the above example. (10%)

Part 2: 40 points (Optional Questions: Answer 4 out of 5, 10 points each; if you answer more than 4 questions, only the first 4 answered questions will be graded.)

5. Describe the normalization process through the different normal forms (from the First Normal Form to the Third Normal Form).
6. Describe the factors that influence physical database design.
7. Distinguish database, data warehouse, and data mining
8. Distributed database systems are increasingly prevalent in modern applications. Compare the main differences between centralized and distributed databases, and discuss the data replication techniques and challenges in distributed databases.
9. Database security is a crucial aspect of data management. Describe the major threats to database security and their countermeasures, and explain how the Role-Based Access Control (RBAC) model is implemented.