## CORK INSTITUTE OF TECHNOLOGY

## INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

### Examinations 2007/08

### Module Title: Database Systems II

**Module Code:** DBSY S3003

**School:** Computing and Mathematics

**Programme Title:**

Bachelor of Science in Computing in Information Technology Support – Award

**Programme Code:** **KITSU_7_Y3**
**KITSE_6_Y3**

**External Examiner(s):** **Mr. J. Greenslade**
**Mr. J. Walsh**
**Internal Examiner(s):** **Mr. A. Tobin**

**Instructions: Answer any FOUR questions.**

**Duration: 3 HOURS**

**Sitting:** Autumn 2008

**Requirements for this examination:**

**Note to Candidates:** Please check the Programme Title and the Module Title to ensure that you have received the correct examination paper.
If in doubt please contact an Invigilator.

1. (a) Describe some of the components of a DBMS. You may use examples from your knowledge of Advantage Ingres.

(5 Marks)

(b) What is the underlying data model used by Advantage Ingres? Briefly describe it.

(5 Marks)

(c) What is the role of the database administrator? (10 Marks)

(d) What is a DB Instance? (5 Marks)

2. (a) Consider a set of users U, V, W, X, and Y. Suppose that user U creates a relation R(A) and is thus the owner of relation R. Now suppose the following set of statements is executed in the following order, answer the questions that follow:

| stmt | user | operation |
|------|------|-----------|
| 1 | U | grant select on R to V,W with grant option |
| 2 | V | grant select on R to W |
| 3 | W | grant select on R to X,Y |
| 4 | U | grant select on R to Y |
| 5 | U | revoke select on R from V restrict |
| 6 | U | revoke select on R from W cascade |

(i) Once steps 4, 5, and 6 are completed, illustrate what privileges are available to all five users U, V, W, X and Y.

(ii) Draw a diagram illustrating the grants that have been issued. (10 Marks)

(b) What is an Authorization ID? (5 Marks)

(c) What privileges can be granted to Database users? (5 Marks)

(d) What are triggers in a database context? Explain how they work using an example to illustrate your answer. (5 Marks)

3. (a) Given the following schema for keeping track of hotel bookings. The primary key is underlined for all relations. Complete the questions that follow:

   *Hotel*     *(hotelNo, hotelName, city)*
   *Room*     *(roomNo, hotelNo, type, price)*
   *Booking*   *(hotelNo, guestNo, dateFrom, dateTo, roomNo)*
   Guest     (guestNo, guestName, guestAddress)

   (i) Create a view of all bookings in between the 15$^{th}$ of April and the 20$^{th}$ of May 2007.

   (ii) Create a view of rooms costing over €100 in Cork.     (8 Marks)

   (b) Given the following relational schema, answer questions (i) to (iii).

   **EMPLOYEE (PRSI#,** NAME, DOB, ADDRESS, SEX, SALARY, DEPT#)
   **DEPARTMENT** (DEPARTMENT-NAME, **DEPT#,** MANAGER-PRSI#)
   **PROJECT (PROJECT#**, PNAME, LOCATION, DEPT#)
   **WORKS-ON (PRSI# PROJECT#,** HOURS)
   **DEPENDENT** (**PRSI#, DEPENDENT-NAME**, SEX, DOB, RELATIONSHIP)

   (i) Write the SQL statements required to create the above relations, including appropriate versions of all primary and foreign key constraints, as well as stating whether a column is nullable.     (12 Marks)

   (ii) Write an SQL statement to add *'George Bush'* as an employee with *PRSI# =* 222, and *salary* = 100,000.     (3 Marks)

   (iii) Due to cutbacks, all employees are obliged to take a 15% pay reduction. Write an SQL statement carry out this operation.     (2 Marks)

4. (a) In terms of Advantage Ingres, describe the ISAM file organization and discuss the advantages and disadvantages of this type of file organization.     (6 Marks)

   (b) In hashing a **collision** is said to have occurred when the same address is generated for two or more records. Explain how a collision might be resolved as part of the hashing files organization method.     (6 Marks)

   (c) Explain the difference between each of the following:

   (i) Primary Vs. Secondary Indexes
   (ii) Dense Vs. Sparse Indexes
   (iii) Clustered Vs Unclustered Indexes     (6 Marks)

   (d) A B+ tree is a tree-like file organization. In your opinion, what makes it an effective file Organization?     (7 Marks)

5.    (a)   Explain what is meant by atomicity, consistency, isolation and durability in terms of a database transaction.       (5 Marks)

      (b)   In a multi-user environment certain problems can occur when concurrent access is allowed to a database Explain what is meant by the 'lost update' and dirty read' problem – use an example to illustrate your answer.       (6 marks)

      (c)   Some of the main techniques used to control concurrent execution of transactions are based on the concept of locking data items. In terms of locking explain what is meant by each of the following:
         (i)     Shared lock
         (ii)    Exclusive lock
         (iii)   Two-phase locking (2PL) protocol
         (iv)   Deadlock       (8 Marks)

      (d)   Define the concept of Serializability.       (6 Marks)