THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATIONS
BCS Level 6 Professional Graduate Diploma in IT

ADVANCED DATABASE MANAGEMENT SYSTEMS

29th April 2008, 10.00 a.m.-1.00 p.m.
Answer THREE questions out of FIVE. All questions carry equal marks.
Time: THREE hours

*The marks given in brackets are **indicative** of the weight given to each part of the question.*

Calculators are **NOT** allowed in this examination.

1.

a) Traditionally Data Definition Language (DDL) is used to define the database structures and Data Manipulation Language (DML) is used to manipulate the data stored in a relational database. Explain:

i) What can "Object Definition Language (ODL)" and "Object Query Language (OQL)" be used for and their relationship with Relational Database Management System (RDBMS)

(5 marks)

ii) The main advantages of ODL and OQL in database management systems?

(5 marks)

b) A summer school maintains its database for the enrolment of students. The following ODL is a class definition for an object type, Student, instances of which represents students of the summer school.

```
class Student : Person_IF
(extent students
key student_ID)
{
attribute String<ccode_length>
student_ID;
relationship List<Enrolment>
request_enroll
inverse Enrolment::enrolled_by;
Enrolment request_enroll
(List<EnrolLine> details;)
raise (course_doesnot_exist);
}
```

Explain the meanings of each statement for the above ODL.

(10 marks)

c) The following OQL will partition property objects such that there are four partitions, respectively containing:

- properties located in Leeds with average price lower than £180,000;
- properties in Leeds with average price £ 180,000 or more;
- properties not in Leeds with average price lower than £180,000;
- properties not in Leeds with average price £ 180,000 or more.

A property object type includes 'location' and 'averageprice' attributes.

```
select *
from properties p
group by
    Which_city ? :
p.location = "Leeds", LessExpensive?: p.avergeprice < 180,000;
```

Explain the meaning of each statement for the above OQL.

(5 marks)

2. Database security is the mechanisms that protect database against threat.

i) Breach of database security is a serious issue. List 5 typical situations where the database security has been breached; and for each of your case provide reason(s) of why the database security has been deemed as breached.

(7 marks)

ii) For the following five specific problem areas (listed below): 1) give one example of the problem which has occurred in each area; 2) propose possible countermeasure(s) to rectify each problem that you have given in the five specific areas.

- Authorisation,
- Inappropriate access to data,
- Loss of or damage to data,
- Denial of service,
- Repudiation.

(12 marks)

iii) What is the purpose of using the following Standard Query Language (SQL) syntax in database security control?

```
GRANT SELECT ON Student_tbl TO PUBLIC;
GRANT All On Student_tbl To former_student;
```

(6 marks)

3. The increase in global communication through the internet results in a rise in the deployment of web services in distributed systems.

a) Describe the four key features of XML technologies (listed below) which are deployed for web services:
- Integration with the Web,
- Data can freely travel over theWeb,
- Strong Data independence,
- Simple Object Access Protocol (SOAP), Web Services Description Language (WSDL), and Universal Description Discovery and Integration (UDDI).

(13 marks)

b) Security for e-business over Internet is vital. Explain the meaning of the following concepts within the context of information security:
- Confidentiality,
- Authentication,
- Data Integrity.

(12 marks)

4. *Modern businesses are building* **Data Warehouses** *or* **Data Marts** *and use OLAP (On Line Analytical Processing) - (either* **Relational OLAP** *or* **Multi-dimensional OLAP***) tools to access information regarding the organisation and its environment. However, building a data warehouse is not an easy task. The data population (also referred to as the Extract-Transform-Load (***ETL***)) process is one of the most frequently cited reasons for delays in, or cancellation of, a data warehousing project.*

Explain, within the context of the above statement, the meaning of each term highlighted (in a bold font). Illustrate your answer with examples.

(25 marks)

5.

a) State the four essential properties of a transaction that ensure data reads and writes do not compromise the data integrity of a database.

(4 marks)

b) Explain how these properties would be applied given the following Transactions that have been submitted to a DBMS engine concurrently from different user sessions: Session_1 and Session_2. Give examples to illustrate your answer.

(8 marks)

Session_1: user 1 issues a request to execute the following transaction

```
USE DATABASE ORDERS
BEGIN TRANSACTION
UPDATE Customers SET ContactName = 'Bill Smith'
WHERE CustomerID ='ABC'
SELECT ContactName FROM Customers WHERE CustomerID =
'ABC'
ROLLBACK TRANSACTION
SELECT ContactName FROM Customers WHERE CustomerID =
'ABC'
```

Session_2: user 2 issues a request to execute the following code

```
USE DATABASE ORDERS
BEGIN TRANSACTION
SELECT * FROM Customers WHERE CustomerID = 'ABC'
UPDATE Customers SET ContactName = 'Bill Smith'
WHERE CustomerID = 'ABC'
```

c) Explain the affect of each of the following statements in the above transactions.

```
SET TRANSACTION ISOLATION LEVEL SERIALIZABLE
SET TRANSACTION ISOLATION LEVEL READ COMMITTED
```

(6 marks)

d) Describe the range of tools and mechanisms that a Database Administrator of an e-commerce OLTP (On Line Analytical Processing) type of application can use to trade-off the need to achieve both high performance (via fast throughput of transactions) against maintaining data integrity.

(7 marks)