



NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI-ABUJA
FACULTY OF SCIENCE
DEPARTMENT OF COMPUTER SCIENCE
2021_1 EXAMINATION

COURSE CODE: CIT843
COURSE TITLE: INTRODUCTION TO DATABASE MANAGEMENT SYSTEM
CREDIT UNIT: 2
TIME ALLOWED: 2HRS
INSTRUCTION: ANSWER QUESTION ONE AND ANY OTHER THREE

- 1.a. Using your own examples list 4 items that constitute or make up the following data management concepts.
- i. Database-level data validation and its implementation **(2 marks)**
 - ii. User-interface data security and its implementation **(2 marks)**
 - iii. Database-level redundancy, its problems and minimization **(2 marks)**
 - iv. User-interface data validation and its implementation **(2 marks)**
 - v. Database-level data security and its implementation **(2 marks)**
- b. Database recovery is one of the main services provided by database management systems **(2.5marks)**
- i. Describe five types of failure that may occur in a database environment
 - ii. Discuss how the log file is a fundamental feature in any recovery mechanism by describing: **(4 marks)**
 - the contents of the log file
 - the write-ahead log protocol
 - how the log file is used in forward and backward recovery
 - how checkpoints affect the recovery protocol
- c. A Database can be defined as a self-describing collection of integrated records **(2 marks)**
- Explain the meaning and the importance of the term “self-describing”.
- d. A company wants to move its current file-based system to a database system. In many ways, this can be seen as a good decision. Identify and describe four disadvantages in adopting a database approach **(2.5marks)**
- e. Briefly explain the UNION and INTERSECTION and show an example of SQL statement of how the terms are implemented **(4 marks)**
- (i). Union

(ii). Intersection

2.a. The table shown below stores details of students and the overall grade each student obtained in different modules. The Primary Key is (StudentID, ModuleID). **(8marks)**

Results

| <u>StudentID</u> | StudentName | <u>ModuleID</u> | ModuleName | Grade |
|------------------|-------------|-----------------|------------|-------|
| S001 | Smith | M01 | Java | A |
| S001 | Smith | M02 | Databases | B |
| S002 | Ford | M01 | Java | B |

- Which Normal Form does the above table violate and why?
- Give an example of an update anomaly and an example of a delete anomaly that may occur if the table is left un-normalized. Explain the problems that are caused.
- Show how you would normalize the table

b) An important concept in the theory of relational databases is that of a functional dependency. **(3marks)**

- Explain what is meant by a functional dependency and give an example **(1mark)**
- Identify two functional dependencies in the following table (A, B and C are the attributes)

| A | B | C |
|----------|----------|----------|
| a1 | b1 | c1 |
| a1 | b1 | c3 |
| a1 | b2 | c1 |

c. Discuss the "ACID" properties of transactions. Give examples to illustrate your answer. **(4marks)**

3. a. A company uses the table below to record details of staff. Each staff has up to three qualifications: **(7marks)**

| <u>StaffID</u> | StaffName | Qualifications |
|----------------|-----------|----------------|
| S01 | Ibanga | BSc, MSc, PhD |
| S02 | Kumar | BSc, MSc |
| S03 | Grant | BSc, PhD |

- (i) Explain why this table is not in “First Normal Form” (1NF)
 - (ii) Show how this table can be transformed into 1NF tables. Give two possible solutions.
 - (iii) b. Explain what the term *data validation* means. Using 5 examples, describe the various data validation techniques that may be embedded into a forms-based interface to a database.
- b. Explain what the term data validation means. Using 5 examples, describe the various data validation techniques that may be embedded into a forms-based interface to a database. **(6marks)**
- c. Contrast the following terms: **(2marks)**
- (i) Stored attribute; derived attribute.
 - (ii) Entity type; relationship type.

4. Demonstrate, with an example, **Temporary Update Problem, Lost Update Problem and Unrepeatable Read Problem** that can occur in a multi-user environment when concurrent access to the database is allowed. **(15 marks)**

5. A company uses the table below to record details of its projects. Each project is attached to a department and runs for a certain duration (in months). The primary key for this table is (projnbr, deptnbr): **5 marks**

| <u>PROJNBR</u> | <u>DEPTNBR</u> | PROJNAME | DEPTNAME | DURATION |
|----------------|----------------|----------------|------------|----------|
| P01 | D03 | Web Portal | HR Dept | 10 |
| P01 | D07 | Web Portal | Sales Dept | 10 |
| P02 | D07 | Data warehouse | Sales Dept | 7 |
| P02 | D03 | Data warehouse | HR Dept | 7 |

- i. Give examples of “Update Anomaly” that may occur in this table.
 - ii. Identify any partial dependencies in the above table
 - iii. Identify any partial dependencies in the above table
 - iv. Remove any partial dependencies from the above table by performing a normalization process and show skeletal designs of the resultant tables
- (b) The following table keeps record of medical consultations conducted in a medical practice. Each consultation takes place in a room and is conducted by a doctor on a patient. A patient cannot have two consultations on the same day. Identify **three candidate keys** for this table. (3 marks)

| PATIENTNBR | CONSULTATIONDATE | CONSULTATIONTIME | DOCTORNBR | ROOMNBR |
|------------|------------------|------------------|-----------|---------|
| P01 | 17-Aug-17 | 09:30 | D01 | R01 |
| P01 | 20-Aug-17 | 14:00 | D02 | R02 |
| P02 | 17-Aug-17 | 11:00 | D01 | R01 |
| P03 | 17-Aug-17 | 11:00 | D02 | R02 |
| P04 | 23-Aug-17 | 09:30 | D01 | R02 |

c. The following table has attributes A, B, C and D:

| A | B | C | D |
|----|----|----|----|
| a1 | b1 | c1 | d1 |
| a2 | b1 | c2 | d1 |
| a1 | b2 | c1 | d1 |
| a2 | b2 | c2 | d1 |
| a1 | b3 | c1 | d2 |
| a2 | b3 | c2 | d2 |

- i. Explain what is meant by “**functional dependency**” in a table. **1 mark**
- ii. Identify **three** functional dependencies from the above table. **6 marks**