Papua New Guinea University of Technology

Department of Mathematics & Computer Science

FIRST SEMESTER EXAMINATIONS – 2021

SECOND YEAR BACHELOR OF SCIENCE IN COMPUTER SCIENCE

CS212 – DATABASE I

TIME ALLOWED: 3 HOURS

INFORMATION FOR CANDIDATES

1. Write your name and student ID number clearly on the front of the examination answer booklet.

2. You have 10 minutes to read this paper. You must not begin writing during this time.

3. There are two sections in this paper. Section A contains twenty (20) multiple choice questions. Section B contains five (5) short answer questions worth eighty (80 Marks). You must attempt ALL questions.

4. All answers must be written in the examination answer booklets provided. No other written material will be accepted.

5. Write out the question number clearly on the answer sheet beside each answers. Do not use red ink or pencil.

6. Notes and textbooks are not allowed in the examination room.

7. Mobile phones and other recording devices are not allowed in the examination room.

8. Scientific and Business Calculators are allowed in the Exam room.

MARKING SCHEME

Marks are indicated at the beginning of each question. The total is 100 Marks.

SECTION A – Questions 1 to 20 are multiple choice questions. Choose only one answer. You must answer all of them.

[1 MARK EACH = 20 MARKS]

1. Which activity does <u>not</u> involve application of database?
    (a) BSP mobile phone banking.
    (b) PNG NID registration.
    (c) Transportation of fresh produce.
    (d) Internal transfer of Inventory stock between warehouses.

2. Which statement is <u>not</u> correct. A database table
    (a) Consists of records and fields.
    (b) Is a relation.
    (c) Represents an entity.
    (d) Is also known as a tuple.

3. Database instance is a snapshot of
    (a) All the historical data from the archives.
    (b) All the monthly data from the database.
    (c) All the weekly data from the database.
    (d) All the data from the database at a point in time.

4. In Set theory, elements of a set
    (a) Can be derived from other sets.
    (b) Must be homogenous or similar in nature
    (c) May not be homogenous.
    (d) Is a subset of a Cartesian product.

5. Type of relationship in which the same entity participates twice in different roles is called a
    (a) Single relationship.
    (b) Binary relationship.
    (c) Recursive relationship.
    (d) Supervisory relationship.

6. One of the key attributes that does <u>not</u> exist naturally in a relation is called a
    (a) Simple key.
    (b) Surrogate key.
    (c) Composite key.
    (d) Foreign key.

7. Alternate names for relation, tuple and attribute are
   (a) Table, column, and row respectively.
   (b) File, row and column respectively.
   (c) File, record and row respectively.
   (d) Table, field and column respectively.

8. Data definition language (DDL)
   (a) Is the front-end language.
   (b) Performs database query.
   (c) Generates summary reports.
   (d) Defines data structure.

9. If an attribute is defined as Numeric(3,1). What is the maximum allowable value can it hold?
   (a) 9.99
   (b) 99.0
   (c) 99.1
   (d) 99.9
   (e) 999.9

10. You would usually perform SQL query using keyword '%LIKE%' on a
   (a) Numeric field.
   (b) Derived field.
   (c) Text field.
   (d) Date field.

11. An entity exists in both physical and abstract (logical) form. An example of a logical entity is
   (a) New student messing hall.
   (b) Air Niugini boarding pass
   (c) Television set to watch NRL rugby final.
   (d) Fleet of used vehicles on sale.

12. What is the main objective of the Normalisation process or technique?
   (a) Resolve data quality.
   (b) Enable seamless flow of data from data sources.
   (c) Resolve data redundancy.
   (d) Identify functional dependencies.

13. What is the major difference between a procedure and a function?
   (a) Procedure returns multiple values, function returns single value.
   (b) Function returns multiple values, procedure returns single value.
   (c) Function returns parameters, procedure receives parameters.
   (d) Procedure returns parameters, function receives parameters.

14. An Exception section in PL/SQL is
    (a) A mandatory block.
    (b) An optional block.
    (c) A main program block.
    (d) An execution block.

15. To declare a variable in PL/SQL, command %TYPE is used to replicate definition
    (a) Of a constant.
    (b) Of an existing table.
    (c) As advised by an end-user.
    (d) Of an existing attribute.

16. Which is an iteration code in programming?
    (a) Else.
    (b) For.
    (c) Then.
    (d) End.

17. Cursor is a term used in PL/SQL that does not
    (a) Access rows of data one at a time.
    (b) Act as a pointer.
    (c) Hold query results temporarily.
    (d) Print out error messages.

18. A called program uses parameters to
    (a) Return results.
    (b) Receive results.
    (c) Receive requests.
    (d) Both (a) and (c).

19. Which statement about JDBC is not correct?
    (a) Written in Java programming language.
    (b) JDBC is a programming language.
    (c) Collection of classes and interfaces.
    (d) Uses SQL statements.

20. An example of an ODBC enabled application is
    (a) Execution of SQL queries on MS Access.
    (b) Regular backup of system files by server administrator.
    (c) Stock market fluctuations through mobile BI (business intelligence) app.
    (d) Security checks at POM international airport.

SECTION B – Short Answer Questions

QUESTION 21.   **[3 + 3 + 3 + 3 =12 Marks]**

(a) List two (2) types of users in a DBMS environment and discuss their roles.

(b) The three (3) different types of schemas correspond to the three (3) layers or levels of the DBMS architecture. Name them and briefly explain.

(c) Differentiate between DDL (data definition language) and DML (data manipulation language).

(d) List two (2) limitations of a file-based approach compared to database approach.

QUESTION 22.   **[2 + 2 + 2 + (2 + 2 + 2 + 2) = 14 Marks]**

Given below is a relational schema of the three (3) entity types at PNG Unitech who are in a relationship.

Library {branchNo, location, studentID, staffID}
Student {studentID, name (fname, lname), DOB, age}
Lecturer {staffID, department, phoneNo)}

Attribute explanations
Derived attribute – age
Composite attribute – name
Multi-valued attribute - phoneNo

Business rules/constraints
- The library serves mostly students and lecturers from respective academic departments. The number of library users vary between an 'empty seat' in the beginning of the semester to a maximum 'full house' capacity usually towards the end of the semester.
- A lecturer is scheduled to teach students enrolled in a course in a semester. The university's requirement is that before a lecturer can teach a class, the class size of enrolled students must be 10 and above but not exceeding 50 students.

(a) Identify primary key attributes from the relations and explain their meaning(s).

(b) Identify foreign key attributes from the relations and explain their meaning(s).

(c) Distinguish between a composite attribute and a multi-valued attribute.

(d) Study the business rules/constraints, and construct an ER diagram using Chen's notation. The ER diagram must show:
  i.   Appropriate symbols.
  ii.   Relationships between entities.
  iii. Attribute types.
  iv.   Business rules/Constraints.

QUESTION 23.   **[2 + (2 + 2 + 2) + (3 + 3) = 14 Marks]**

Below is a *Student-Profile* relation in its unnormalised form (UNF) with sample records. Use this table to answer the following questions.

Student-Profile

StudentID	SName	UniCode	UniAddress	DeptCode	DeptName
ST01	Mary	Upng	Waigani, POM	EDU	Education
ST02	Parker	UoT	Taraka, Lae	MCS	MathCS
ST03	Jason	UoT	Taraka, Lae	ENG	Engineering
ST04	Clark	UoG	North, Goroka	EDU	Education
ST05	Dave	UoT	Taraka, Lae	MCS	MathCS

(a) Explain the term Normalization and state its main purpose.

(b) Explain the following classes of update anomalies using examples from *Student-Profile* relation.
  i.   Insertion anomaly.
  ii.   Deletion anomaly.
  iii. Modification anomaly.

(c) Transform Student-Profile into first normalized forms (1NF relations).
  i.   Create separate master tables from Student-Profile.
  ii.   Show unique tuples/records on these master tables.

QUESTION 24.   **[2 + 2 + 2 + 4 + 4 = 14 Marks]**

Study the table below and answer the following questions.

ItemMaster

StockNo	Name	Class	Unit	UnitCost	StockValue
STK4	A4 ream	Paper	10	25	
STK2	Lecture pad	Book	5	10	
STK1	Red pen	Pen	5	2	
STK3	DBMS textbook	Book	1	50	

(a) Calculate 'StockValue' from 'Unit' and 'UnitCost', and populate the rows. (NB: Copy the table and fill in the blanks).

(b) List down the attributes of the ItemMaster relation and assign appropriate data types.

(c) Use your completed table from (a) above and write an SQL statement that will show all the columns and rows, sequenced by its primary key attribute. Show the resulting query output. (use keywords – Select, From, Order By).

(d) Write an SQL statement that will produce resulting query output as shown below (use keywords - Select, From, Where).

StockNo	Name	Class	Unit
STK2	Lecture pad	Book	5

(e) Write a single SQL statement that will produce resulting query output as shown below (Keywords to use - Select, From, Where (optional), Group By, Order By, Sum, Count, AS).

Class	myCount	myTotalUnit
Book	2	6
Paper	1	10
Pen	1	5

QUESTION 25.   [8 + 16 + 4 = 28 Marks]

(a) Database Trigger (Event-Condition-Action) rule.

Staff members of a private firm who bank with BSP usually get alert messages on their mobile phones every fortnight pay day. The banking system is set to trigger off phone alerts once payroll is processed and funds posted into respective bank accounts. Account relation has five (5) attributes {AccountNo, Name, PayAmount, PayStatus, Remarks}.

After payroll processing is successful, a new tuple is added to Accounts table with the two (2) fields showing values as follows:
- PayStatus field reads 'Paid-new'.
- Remarks field reads 'Payroll-new'.

The trigger rule is configured to send phone alerts to account holders only when PayStatus and Remarks fields are added with respective values as stated above.

Identify the following trigger components and briefly explain them.

    i.   Event and whether it is Before-event or After-event.
    ii.   Action.
    iii.   Condition(s).
    iv.   Construct a meaningful phone alert message.

(b) PL/SQL bock & parameter validation.

Shown below is a sample of Passport relation maintained by PNG customs office.

Passport

PassportID	Fname	Nationality
PNG20	Jack	PNGian
FIJI45	Rose	Fijian

Program specification
PNG Customs officer uses a computer program to validate user entry values against *PassportID* records in the system. The system searches and retrieves *Nationality* of passport holders and display the information on the monitor screen with appropriate messages. If no matching record is found, the message is defaulted to read 'PassportID is not valid'.

Study the above program specification and complete the following PL/SQL blocks containing SQL (pseudo) codes.

    i.   Use keyword %TYPE and declare two (2) variables to hold input and return values.

    ii.   Write down the following codes, and replace the underlines with relevant variables and names, and apply appropriate comment lines for each block.

------Block1------

CREATE FUNCTION validatePassport
(IN variable)
RETURNS data type

------Block2 -----

BEGIN
     SELECT attribute to return
     FROM table
     WHERE variable = primary key
     RETURN (attribute to return)
     SET variable = attribute to return

```
------Block3 -----
    IF variable IS NOT NULL THEN
    display relevant message
    ELSE
    display relevant message
    ENDIF
END;
```

(c) Construct a simple flow chart diagram that reflects the process flow as described in (b) above. Ensure the diagram must
  - Show appropriate lines and shapes.
  - Indicate procedural processing logics.

END OF EXAM