

**PAN AFRICA CHRISTIAN UNIVERSITY  
EXAMINATIONS PAPER**



**EPAN AFRICA CHRISTIAN UNIVERSITY**

**BACHELOR OF BUSINESS INFORMATION TECHNOLOGY**

**END OF SEMESTER EXAMINATION**

**DEPARTMENT:                    COMPUTING AND INFORMATION TECHNOLOGY**

**COURSE CODE:                BIT 106**

**COURSE TITLE:                DATABASE SYSTEMS**

**EXAM DATE:                    DECEMBER, 2020**

**INSTRUCTIONS**

- This exam script has **TWO (2)** sections.
- Read all questions carefully before attempting.
- Answer All questions in Section **A** and any other Three questions in Section **B**.
- Write only your **student number** on the answer booklet provided.
- None programmable calculator permitted
- Calculators on phones, tablets and computers are NOT permitted in Theory Papers

**SECTION A**

**(Answer ALL questions in this section)**

**QUESTION ONE**

Consider a social network database, about people and their relationships. The database has two relations: Person(pid, name) Relationship (pid1, rel, pid2). Here Person.pid is a key, and Relationship.pid1 and Relationship.pid2 are foreign keys; rel is a string representing the relation type, and can be friend or enemy. Note that the relationship is not necessarily symmetric: if Alice is friend with Bob, this does not imply that Bob is friend with Alice.

- a) Write the SQL statements that define the relational schema for this database. Assume that pid's are integers, and name and rel are character strings.  
**[5 Marks]**
- b) Write a SQL query that computes, for each person, the total number of their friends. Your query should return results containing the pid, the name, and the count. Note that your query must return exactly one answer for every person in Person.  
**[5 Marks]**

**SECTION B (Answer Any Three (3) Questions)**

**QUESTION TWO**

Design an E/R diagram describing the following domain:

A Person has attributes pid (key) and name. A Skier is a type of Person with attribute aptitude.

A Snowboarder is a type of Skier. A PairOfSkis has attribute sid (key) and model. A Snowboard has attribute sid (key) and model.

A Skier owns zero or more PairOfSkis. The ownership relation has a purchase price.

A PairOfSkis is owned by at most one Skier. A Snowboarder owns zero or more Snowboards. The ownership relation has a purchase price. A Snowboard is owned by at most one Snowboarder. A Person can rent a PairOfSkis or a Snowboard.

A person cannot rent more than one PairOfSkis or one Snowboard at the same time. A person cannot rent a PairOfSkis and a Snowboard at the same time either.

A piece of equipment can be rented by at most one person at a time. The rental comes with a start date and an end date.  
**[10 Marks]**

### QUESTION THREE

- a) Discuss **TWO** scenarios where a view can be helpful in a database management system. **[5 Marks]**
- b) Explain why it is not always possible to perform SQL UPDATE/DELETE/INSERT statements on top of a view. **[5 Marks]**

### QUESTION FOUR

Consider a database consisting of a single relation R:

R:

|    |   |   |
|----|---|---|
| A  | B | 1 |
| 10 |   | 2 |
| 0  |   |   |

- (a) The following two transactions run concurrently on this database:

| Line | T1                               | T2                    |
|------|----------------------------------|-----------------------|
| 1    | begin transaction;               | begin transaction;    |
| 2    | update R set B = B-10 where A=1; | select sum(B) from R; |
| 3    | update R set B = B+10 where A=2; | commit;               |
| 4    | commit;                          |                       |

Is it ever possible for T2 to see a value of zero in its output? Explain why or why not.

- a) Identify **TWO** different kinds of data the system will use. **[4 Marks]**

- b) On the basis of your answers, describe kind of data storage format(s) do you recommend for this system. **[6 Marks]**

### **QUESTION FIVE**

Today, instead of purchasing physical machines, an alternate approach to running a database management system is to run it in the cloud. One of the key promises of the cloud is the illusion of infinite resources and the ability for users to elastically grow and shrink the resource consumption of their DBMS.

- a) Explain why it can be difficult to scale a relational DBMS. **[6 Marks]**
- b) Indicate **TWO** approaches that the so-called "NoSQL" systems take to overcome the above challenge. **[4 Marks]**

### **QUESTION SIX**

Company A recently bought company B. The two companies want to integrate their databases. Discuss **FOUR** challenges that the integration will face. For each challenge give a concrete example. **[10 marks]**