MULUNGUSHI UNIVERSITY

Pursuing the frontiers of Knowledge

SCHOOL OF ENGINEERING AND TECHNOLOGY

Department of Computer Science and Information Technology

ICT 372

Advanced Databases

Final Examination

June 2023

Duration: 3:00 HRS

INSTRUCTIONS:

There are TWO sections in this paper. Answer ALL questions in section A and ANY three questions in section B.

The total marks for this paper are 100.

Present tidy and readable work.

Write your student ID on your answer booklet.

SECTION A

Question 1 (Mandatory)

For today's web developers, the ability to design and implement databases has become a very critical skill. Presented below are the data requirements of a company called Granite Sales Company.

Scenario:

Granite Sales Company keeps information on employees and the departments in which they work. For each department, the department name, internal mail box number, and office phone extension are kept. A department can have many assigned employees, and each employee is assigned to only one department. Employees can be salaried, hourly, or work on contract. All employees are assigned an employee number, which is kept along with the employee's name and address. For hourly employees, hourly wages and target weekly work hours are stored; for example, the company may target 40 hours/week for some employees, 32 for others, and 20 for others. Some salaried employees are salespeople who can earn a commission in addition to their base salary. For all salaried employees, the yearly salary amount is recorded in the system. For salespeople, their commission percentage on sales and commission percentage on profit are stored in the system. For example, John is a salesperson with a base salary of 150,000 Kwacha per year plus a 2 percent commission on the sales price for all sales he makes, plus another 5 percent of the profit on each of those sales. For contract employees, the beginning date and end date of their contracts are stored along with the billing rate for their hours.

Using the above scenario, answer the tasks that follow below.

Tasks:

(a) Describe the conceptual modeling phase in database development **(5 Marks)**

(b) Describe the logical modeling phase in database development **(10 Marks)**

(c) Using your answer in (a), construct a conceptual model for the above scenario **(10 Marks)**

(d) Using your answer in (b), show the logical model for the above scenario clearly highlighting the primary and foreign keys. **(15 Marks)**

SECTION B

Question 2

a) Discuss how the characteristics of data warehouses (OLAP) differ from operational databases (OLTP) **(10 Marks)**

b) Extraction, Transformation and Loading (ETL) processes are very critical during the development of a data warehouse. Explain these processes in detail. **(10 Marks)**

Question 3

The following tables below present part of a schema for a database of a University.

Student

studentNo	fname	lname	gender	dob	phone
1	John	Banda	M	23/05/1990	0977365468
2	Joseph	Phiri	M	15/01/1993	0777736786
3	Mary	Tembo	F	04/04/2001	0977736648
4	Josephine	Chileshe	F	21/05/1989	0966365468
5	Faith	Phiri	F	15/01/1995	0976736786
6	Jones	Banda	M	10/01/2001	0777736644

Table 1

Course

code	name
Ict 221	Computer Architecture
Ict 271	Databases
Ict 261	Programming
Ict 211	Discrete Maths

Table 2

CourseGrade

studentNo	code	grade	session
1	Ict 221	A	2021/2022
1	Ict 271	C	2021/2022
1	Ict 211	A	2021/2022
2	Ict 271	B	2021/2022
2	Ict 221	A	2021/2022
2	Ict 211	A	2021/2022
2	Ict 261	A	2021/2022
3	Ict 211	A	2021/2022

Table 3

a) Write DDL statements for creating each of the above tables **(6 Marks)**

b) Write a query that retrieves all details of students whose firstnames begin with letter "J" and lastnames end with letter "a" **(2 Marks)**

c) Write a query that retrieves the gender with the most number of students. **(6 Marks)**

d) Write a query that retrieves the name of a student with the highest number of "A" grades. **(6 Marks)**

Question 4

Database management systems execute transactions concurrently and this helps to increase the throughput of database systems. However, to avoid corruption of data, concurrently executing transactions should be carefully management.

a) What is a transaction? **(1 Mark)**

b) Explain the properties of transactions. **(4 Marks)**

c) Discuss problems that arise when concurrently executing transactions are not carefully managed. The problems should be clearly presented with the aid of application scenarios **(8 Marks)**

d) Explain the locking mechanism in detail and show how the problems highlighted in (c) can be avoided using this mechanism. **(7 Marks)**

Question 5

a) Describe the advantages and disadvantages of distributed database systems **(8 Marks)**

b) Discuss the transparencies that must be achieved in distributed database systems. **(12 Marks)**

[Total: 100 Marks]

----------END OF EXAM----------