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CICT PART II SECTION 3

DATABASE SYSTEMS

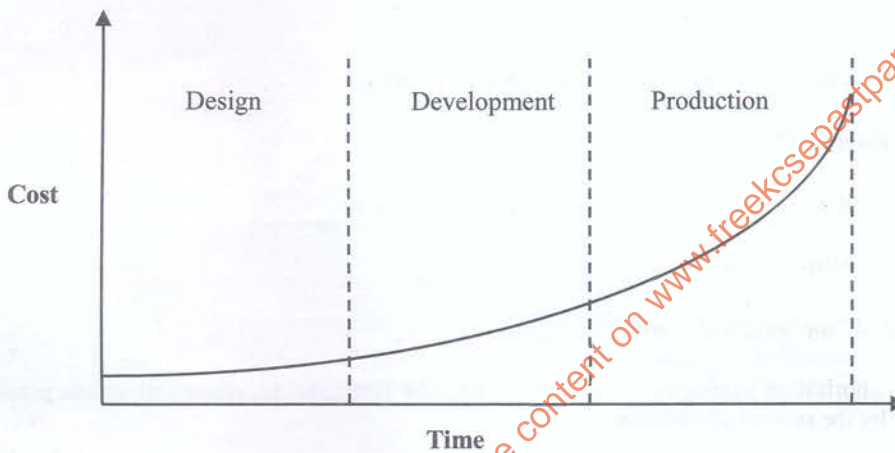**THURSDAY: 26 November 2020.**   Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question.

QUESTION ONE

(a)   (i)   Describe a weak-entity set as used in entity relationship modeling.   (2 marks)

(ii)   Using a diagram, demonstrate an example of a weak entity relationship scenario.   (3 marks)

(b)   The figure below shows a graph of cost of tuning a database against time:

Required:

(i)   Differentiate between proactive and reactive tuning of a DBMS.   (4 marks)

(ii)   Interpret the trend of the graph.   (3 marks)

(iii)   Explain three ways of tuning a database.   (3 marks)

(c)   Explain three benefits a storage area network (SAN) is likely to offer in an organisation.   (3 marks)

(d)   Explain two ways in which data mining approaches could be integrated in an organisation.   (2 marks)

(Total: 20 marks)

QUESTION TWO

(a)   Consider the schema below:

Staff (empno, name, salary, department, title, age)

Required:

(i)   Write a Structured Query Language (SQL) statement to display the total salary paid to the staff from each department, sorting the salary paid, from the highest paid department to the least paid department.   (4 marks)

(ii)   Write the SQL statement to insert a record to the table given the instance;

< 1425, "Kamau", 100000, "Sales", "Manager", 45>

< 1426, "Otieno", 95000, "HRM", "Registrar", 38>

(3 marks)

(iii)   Write an SQL statement to display the number of employees.   (1 mark)

(b)   Given the following relations:

$$account = \{branch\text{-}name, acc\text{-}no, bal\}$$

$$employee = \{branch\text{-}name, cust\text{-}name, rec\text{-}id, acc\text{-}no, bal\}$$

Required:
Write relational algebra statements to:

(i)   Extract the horizontal segment from account where the branch name is 'valley'.   (3 marks)

(ii)   Extract the vertical segment from employee named 'deposit' with acc-no, bal and rec-id.   (3 marks)

(c)   Database administrators assign roles, rights and privileges to users.

Discuss three reasons why it is important to define and assign roles to users.   (6 marks)

(Total: 20 marks)

QUESTION THREE

(a)   A bank has many branches and many customers. A customer can open different types of accounts with any branch of the bank. Any customer of the bank can take a loan from any branch of the bank. The bank has also installed automatic teller machines (ATMs) from which customers can withdraw money.

Required:

(i)   Formulate a 3NF schema table for the above problem description.   (8 marks)

(ii)   Sketch the ER diagram for the bank.   (6 marks)

(b)   Distinguish between the following terminologies as used in database systems:

(i)   "Dirty read" and "phantom row".   (2 marks)

(ii)   "Naive users" and "sophisticated users".   (2 marks)

(c)   Describe two types of authorisation to modify the schema besides the insert, delete, select and update priviledges that could be given to a user by the system administrator.   (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a)   Describe the role of the layers in a three-tier client/server architecture.   (6 marks)

(b)   Differentiate between each of the following database recovery algorithms:

(i)   "UNDO" and "REDO".   (2 marks)

(ii)   "UNDO" and "NO-REDO".   (2 marks)

(iii)   "NO-UNDO" and "REDO".   (2 marks)

(c)   Explain the following database technologies:

(i)   Cloud-Based databases.   (2 marks)

(ii)   Data Lake.   (2 marks)

(d)   Kobe Ltd. has been in existence since 1950. The company still uses the traditional file based system to manage its data.

Describe two challenges the organisation could be facing due to the continued use of such type of a file system.   (2 marks)

(e)   "Database systems are self-describing in nature". Explain the meaning of this statement.   (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Explain the following concepts as used in database systems:

    (i) Null value. (2 marks)

    (ii) Object oriented model. (2 marks)

(b) (i) Suggest four security features that should be considered in a database management system (DBMS). (4 marks)

    (ii) Draw a diagram to illustrate the transaction states in a DBMS. (4 marks)

(c) Outline two disadvantages of adopting object oriented database management system. (2 marks)

(d) Describe the two categories for database scaling. (4 marks)

(e) Justify the need for database integration. (2 marks)

(Total: 20 marks)

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