

Question 1 (Compulsory)

- (a) Name one *advantage* and one *disadvantage* of centralised database design. [2]
- (b) List *three* characteristics of the database approach. [3]
- (c) Identity the four types of *data model* that may be used in database design. [4]
- (d) Briefly explain the term *functional dependency*, and show how this relationship can be illustrated. [3]
- (e) Identify the functional dependencies of the following relations.
 - (i) Project (project no, project_name)
 - (ii) Project_worked_on (project no, employee no, name, hours_worked) [3]
- (f) For each of the following relations, indicate which normal form it is in.
 - (i) Project (project no, project_name)
 - (ii) Project_worked_on (project no, employee no, name, hours_worked) [2]
- (g) What do the following DDL commands do?
 - (i) GRANT.
 - (ii) REVOKE. [2]
- (h) A database design includes logical database design and physical database design. Briefly explain each of these terms. [2]
- (i) For each of the following, provide a definition and draw the entity-relationship symbol that represents it.
 - (i) Multi-value attribute.
 - (ii) Unary relationship.
 - (iii) Weak entity. [6]
- (j) List three drawbacks of *denormalisation*. [3]

Please turn over

Question 2

- (a) The function of data administration function is essential to manage data resources so that data is not poorly utilised. Briefly explain two causes of poor data utilisation. [4]
- (b) Define the term *concurrency control*. [2]
- (c) One of the PRODUCT table's attributes is a product's quantity on hand (PROD_QOH). Assume a product whose current PROD_QOH value is 35. Now assume two concurrent transactions, T1 and T2, which update the PROD_QOH value for some item in the PRODUCT table. The transactions are:

TRANSACTION	COMPUTATION
T1: Purchase 100 units	$\text{PROD_QOH} = \text{PROD_QOH} + 100$
T2: Sell 30 units	$\text{PROD_QOH} = \text{PROD_QOH} - 30$

Scenario A

TIME	TRANSACTION	STEP	STORED VALUE
1	T1	Read PROD_QOH	35
2	T2	Read PROD_QOH	35
3	T1	$\text{PROD_QOH} = 35 + 100$	
4	T2	$\text{PROD_QOH} = 35 - 30$	
5	T1	Write PROD_QOH	135
6	T2	Write PROD_QOH	5

Scenario B

TIME	TRANSACTION	STEP	STORED VALUE
1	T1	Read PROD_QOH	35
2	T1	$\text{PROD_QOH} = 35 + 100$	35
3	T1	Write PROD_QOH	135
4	T2	Read PROD_QOH	135
5	T2	$\text{PROD_QOH} = 135 - 30$	
6	T1	****ROLLBACK****	35
7	T2	Write PROD_QOH	105

Identify the types of problem that occur in Scenario A and B respectively. In each case, briefly explain why the problem arises. [6]

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- (d) What is the problem that arises in the following scenario? Explain how it occurs.

[3]

TIME	TRANSACTION	STEP
1	T1	Lock record X
2	T2	Lock Record Y
3	T1	Request Record Y
4	T2	Request Record X
5	T1	Wait for Y
6	T2	Wait for X

Please turn over

Question 3

- (a) Draw an entity-relationship based on the following loan receipt. [10]

LOAN RECEIPT		
Library : ABC Community Library	Location : City Hall	
Loan Date : 13/05/2002	Time : 6:10pm	
Member ID : 1234567I	Member Name : Agnes Chan	
Items Borrowed		
<u>ID</u>	<u>Title</u>	<u>Due Date</u>
B11783321D	System Analysis And Design	03 Jun 2002
B12305023E	Database Management System	03 Jun 2002

- (b) Convert the entity-relationship diagram of part (a) into relations. [5]

Please turn over

Question 4

- (a) What is *normalisation*? [2]
- (b) When is a table in *2NF*? [2]
- (c) When is a table in *3NF*? [2]
- (d) Suppose you are given the following business rules to form the basis for a database design. The database must enable the manager of a company dinner club to mail invitations to the club's members, to plan the meals, to keep track of who attends dinners, and so on.

Perform normalisation (up to 3NF) based on the given structure. [9]

Attribute name	Sample value
MEMBER_NUM	214
MEMBER_NAME	Alice
MEMBER_ADDRESS	325 Meadow Park, Murkywater, 12345.
DINNER_DATE	8/23/1999
DINNER_DESCRIPTION	Sea Delight
ENTREE_CODE	3
ENTREE_DESCRIPTION	Stuffed Crab
DESSERT_CODE	8
DESSERT_DESCRIPTION	Chocolate mousse with raspberry sauce

Please turn over

Question 5

Consider the following tables.

STUDENT

StudID	Name	Courses	RegisterDate
1001	KING	DCS	01-Dec-00
1002	ADAM	DCS	10-Jan-01
1003	SMITH	DCS	08-Jan-01
1004	AGNES	DCS	05-May-02
1005	MARY	DCS	06-Jun-02

SUBJECT

SubID	Title
CS111	Computer system
CS112	Program Design
CS113	Mathematics

RESULT

StudID	SubID	Mark
1001	CS111	60
1001	CS112	40
1001	CS113	55
1002	CS113	70
1003	CS111	65
1003	CS112	50
1004	CS111	63
1005	CS111	62

- (a) Write an SQL query to display the average mark for all subjects. [3]
- (b) Write an SQL query to display the details of student who registered before 2002. [3]
- (c) Write an SQL query to display subject titles in which students have scored marks in the range 50-65 (inclusive). [3]
- (d) Write an SQL statement to change all marks for student ID 1001 from to 0. [3]
- (e) Write an SQL query to display all results for student name KING via a subquery. [3]

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