



University of Colombo, Sri Lanka

Sing * OCT 2024

University of Colombo School of Computing

BACHELOR OF SCIENCE HONOURS IN INFORMATION SYSTEMS

BACHELOR OF SCIENCE IN INFORMATION SYSTEMS

Third Year Examination - Semester I – UCSC AY21 [held in Sept./ Oct. 2024]

IS3116 - Database Management System II

(Two (2) Hours)

Answer ALL questions

Number of Pages = 15

Number of Questions = 4

To be	completed by	the candi	date	
Index Number:				

Important Instructions to candidates:

- I. Students should answer in the medium of English language only using the space provided in this question paper.
- II. Note that questions appear on both sides of the paper. If a page or a part of this question paper is not printed, please inform the supervisor immediately.
- III. Write your index number CLEARLY on each and every page of this Question paper.
- IV. This paper consists of 4 questions in 15 pages (including the Cover Page).
- V. Answer ALL questions.
- VI. Programmable Calculators and any electronic device capable of storing and retrieving text including electronic dictionaries, smart watches and mobile phones are **not allowed**.
- VII. Non-Programmable calculators are allowed.
- VIII. Do not tear off any part of this answer book. Under no circumstances may this book, used or unused, be removed from the Examination Hall by a candidate

To be completed by the examiners

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Total	

Index	No:	 	 	

Question 1

(a) Briefly explain what inherent model-based constraints are and provide two (02) examples of such constraints.

	[04 Marks]
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(b) Imagine you are designing a database system for a bookstore. This system will manage information related to authors, books, orders, and publishers. You need to create the necessary tables and implement constraints to maintain data integrity.

Author

Column	Туре	Null	Default
AuthrId	int(11)	No	
Name	varchar(90)	Yes	NULL

Order

Column	Туре	Null	Default
OrderNmber	int(11)	No	
OrderDate	date	Yes	NULL
Quantity	int(11)	Yes	NULL
ISBN	varchar(13)	Yes	NULL

Books

Column	Type	Null	Default
ISBN	varchar(13)	No	·
Title	varchar(90)	Yes	NULL
Quantity	int(11)	Yes	NULL
CostPrice	decimal(6)	Yes	NULL
SellPrice	decimal(6)	Yes	NULL
AuthrId	int(11)	No	
PublishId	int(11)	No	

Publishers

Column	Туре	Null	Default
PublishId	int(11)	No	
Email	varchar(90)	Yes	NULL
Phone	varchar(12)	Yes	NULL
Address	varchar(90)	Yes	NULL
City	varchar(90)	Yes	NULL

In this design:

The primary keys are as follows:

- AuthrId for the Author table.
- OrderNmber for the Order table.
- ISBN for the Books table.
- PublishId for the Publishers table.

The foreign keys are as follows:

- AuthrId in the Books table references the Author table.
- PublishId in the Books table. references the Publishers table.
- ISBN in the Order table references the Books table.

(i)	Based on the provided table details, write the SQL statements	to create the
	structure for each of the specified tables in MySQL.	[08 Marks]
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	(ii)	Add a constraint to the <i>Order</i> table to ensure that the purch greater than 1.	
······································			[02 Marks]

	(iii)	Create a trigger to deduct the order quantity from the Books list is received, ensuring there is sufficient stock available.	st once an order
		is received, ensuring there is sufficient stock available.	[06 Marks]
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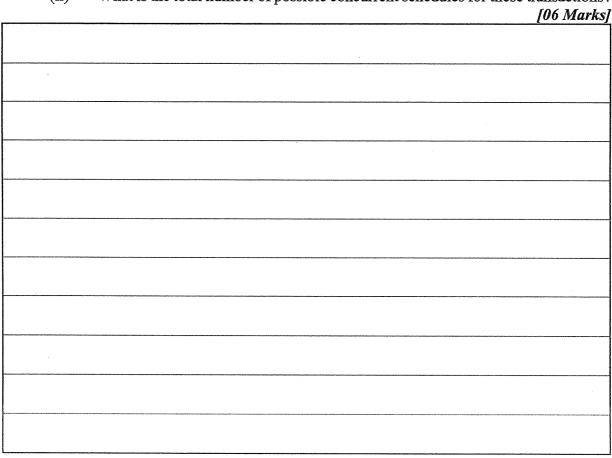
	amount, calculated based on the selling price and cost price.	[05 Marl
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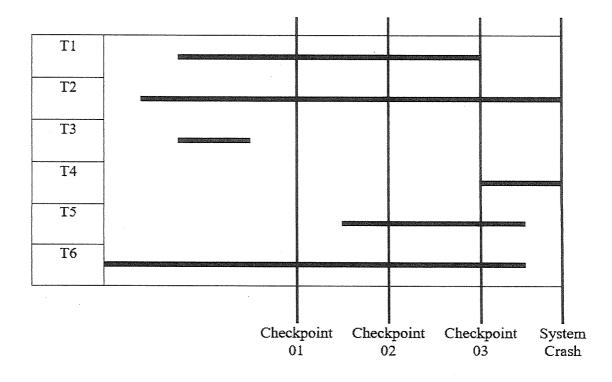
(b) Brief			Y	F 1 11 0 L				 	[04 Ma	<u>ark</u>
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(c) Refer	r to the fo	ollowing	transact	ion sche	dule (Sv) to ansv	ver the qu	estions	below.	
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(ii) What is the total number of possible concurrent schedules for these transactions?



(d) Consider the following concurrent schedule.



(i)	If <i>deferred update recovery</i> is used as the recovery methodology, vexpected outcome of these transactions?	what is the
		[03 Marks]
· · · · · · · · · · · · · · · · · · ·		103 Mains
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(ii)	If <i>Immediate update recovery</i> is used as the recovery methodology expected outcome of these transactions?	
		[03 Marks]
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HERRICH OF CHARLES AND		
Duestion 3		
(a) Briefly	y explain how database indexing improves query performance.	
		[02 Marks]
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(b) Briefly explain the difference between the dense index and the spars	se index using
suitable examples.	[03 Marks]
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(c) B+ trees serve as dynamic multi-level indexing structures in database Briefly explain the internal node and leaf node structures of B+ trees.	management.

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	Employee (EmployeeID, EmployeeName, DepartmentName, Position, NIC
•	An employee file contains 400,000 employee records stored on a disk with block size (B) of 2048 bytes. The file records have a fixed size of 100 byte each and are unspanned. The employee records are ordered based on the key field EmployeeID. Additionally, the NIC represents the National Identity Card number, unique to each employee.
(i)	Calculate the number of blocks needed to store the above relation on the dis [03 Main]
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Addard September September 114 (1984)	
(ii)	Assume that we have constructed a single-level index on the key fi EmployeeID of the file. Consider that a block pointer is P = 8 bytes, a
	and retrieve a record for a given EmployeeID using the index.
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	and retrieve a record for a given EmployeeID using the index. [05 Man
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	(iii)	Suppose another single-level index is created on the non-ordering key field NIC where NIC is 16 bytes, and the block pointer is 12 bytes long. Calculate the number of block accesses required to perform a binary search using the index. [04 Marks]
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	(iv)	Suppose the index created on the non-ordering key field NIC is converted into a multi-level index. Calculate the number of blocks at each level for the multi-level index on the NIC. [04 Marks]
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to NoSQL.	·		[04 Mark

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(b) Briefly explain two (02) required p	roperties for cont	fidentiality in the '	Bell-LaPadul
multilevel security model.			[04 Mark
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Question 4

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(c) Briefly explain th	a accentic 1 ston	s of public lea	v encrention is	n data securit	L7
(c) Brieffy explain in	e essentiai stepi	s of public ke	y eneryption if	u data scourity	y. [05 Marks]
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(0	d) Cons	sider the scenario related to a Hospital Management Database.
	Tł Do	ne hospital database administrator has created the following two (02) relations: octor and Patient. Primary keys are underlined, and foreign key is in italics.
	Do Pa	octor (<u>DoctorID</u> , DoctorName, Specialization, DepartmentName) atient (<u>PatientID</u> , <i>DoctorID</i> , Diagnosis, Age, Address, InsurancePolicyNumber)
	Tł	ne database administrator has created three user accounts: D1, J1, and J2. D1 is the doctor in charge. J1 and J2 are junior doctors.
	Th fo	ne database administrator wants to create the following roles and assign the llowing permissions: Junior Doctors: SELECT privilege on the relation "Patient" to view patient records.
		Doctor in Charge : SELECT privilege on the relation "Patient" and UPDATE privilege on the "Diagnosis" field of patient records.
	W	rite SQL statements to perform the following tasks on the database.
	(i)	Create a role for junior doctors with the password "HMJunior" and assign them the necessary privileges.
		[02 Marks]
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	(ii)	Create a role for the doctor in charge with the password "HMDoctor" and assign the necessary privileges. [04 Marks]
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	(iii)	Assign the users to the appropriate roles. [02 Marks]
		·
	(iv)	Assume that the hospital wants to enhance security by limiting the data accessible to junior doctors. Therefore, junior doctors are now restricted to view only certain fields from the relation Patient: PatientID, DoctorID, and Diagnosis. [04 Marks]
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