

**OLLSCOIL na hEIREANN**  
**THE NATIONAL UNIVERSITY of IRELAND**

**NATIONAL UNIVERSITY OF IRELAND, GALWAY**

**SPRING EXAMINATIONS 2000**

**Third University Examination in Information Technology**

**CT325 DATABASES I**

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**Time allowed: Three hours**

**Answer 4 questions including Question 1**  
**All questions carry equal marks**

**Q.1. i) Given the following company database schema:**

<b>EMPLOYEE:</b>	<u>RSI</u> , Fname, Lname, Salary, Address, Age, Dno
<b>DEPARTMENT:</b>	<u>Dno</u> , Dname, Description
<b>DEPT_LOCN:</b>	<u>Dno</u> , Location
<b>PROJECT:</b>	<u>Pno</u> , Pname, Budget, Proj_Desc
<b>WORKS_ON:</b>	<u>Ssn</u> , <u>Pno</u> , Hours

provide SQL queries for the following:

- Give the name and salary of all employees working in a department named "Testing".
- List all employees (Fname, Lname) who earn more than 35,000 and have worked more than 30 hours on any project.
- Using the join method, list all employees who work in the same department as "Tom Smith" and who earn more than "Tom Smith".
- List the average number of hours worked by all employees who have worked on more than 4 projects.
- Of all employees, who have worked on less than 3 projects, list the name(s) of the employee with the lowest salary.

- ii) Develop SQL code to provide a view *high\_earners* that includes those employees with a salary over 35,000. Explain what is meant by the view update problem and explain how it may arise.
- iii) Integrity constraints are used to ensure the integrity of the data in a database. Describe the integrity constraints usually enforced by a DBMS. Discuss, briefly, how users may apply their own integrity constraints and discuss the associated benefits and disadvantages.

**Q.2.** i) Explain briefly the importance of concurrency control in multi-user databases.

ii) Timestamping is a common approach to ensuring concurrency control. Outline this approach and present pseudo-code for the primitives used.

iii) Show how the following schedule would proceed under timestamping protocol.

Ta	Tb	Tc
read(Y)		
write(Y)		
	read(X)	
	write(X)	
		read(Z)
		write(Z)
read(X)		
write(X)		
	read(Z)	
		read(Y)
		write(Y)

iv) Discuss how the two phase locking protocol could be extended to work for distributed databases.

**Q.3.** i) Explain the terms: primary, clustering and secondary indexes

ii) Extendible, dynamic and linear hashing are three approaches to allow hashing to an dynamically expanding and contracting file.

Choose any of the three techniques and outline its operation. Illustrate how the file may contract and expand given deletions and insertions.

- iii) Describe the operation of a B+Tree. Your answer should include a description of its structure and the operation of an insertion algorithm.

Given records with the following key values:

16, 18, 21, 23, 6, 8, 35, 40, 44, 48

show how a B+Tree would expand.

- iv) Discuss the advantages of a B+Tree over a B Tree.

**Q.4.** i) With respect to deductive databases write short notes on:

- a) advantages of deductive databases
- b) forward and backward chaining
- c) rule safety

ii) With respect to parallel databases, explain with examples, the following terms:

- a) Interquery parallelism
- b) Intraquery parallelism
- c) Interoperation parallelism
- d) Interoperation parallelism

iii) Compare the Object-Oriented and object-relational models.

iv) Explain how an EER diagram may be mapped to an object oriented schema.

**Q.5.** i) Give an overview of the process of relational database design. Your answer should include explanations of conceptual design, mapping to relational schema, choice of keys, index strategies, etc.

ii) Define first, second, third and Boyce Codd normal forms.

iii) Describe the main advantages associated with distributed databases. Outline also the increased complexity involved with respect to query optimisation, concurrency control and recovery.