

Examination in CS5035 (Introduction to Database Systems)

17 January 2006

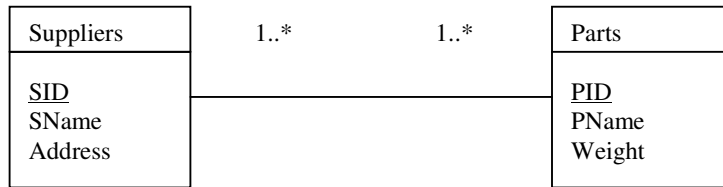
(15:00 – 17:00 Hrs)

Answer any Three questions.

Use a separate answer book for each question.

Each question is worth 25 marks; the marks for each part of a question are shown in brackets.

1. (a) How do you convince your friend who runs a small business using a file based approach to data management that he/she should manage his/her business data using database technology? (3)
- (b) Describe briefly what is meant by the term 'Relational Model'. (2)
- (c) In the context of relational databases, define and explain each of the following notions with the help of an example:
 - (i) Relation Integrity (also known as Entity Integrity) (3)
 - (ii) Referential Integrity (3)
- (d) Explain the difference between conceptual, logical and physical phases of database design. (3)
- (e) Transform the following EER model fragment representing the relationship between Suppliers and Parts into a set of relations, explaining in detail the steps you have followed. (6)



- (f) What is meant by third normal form (3NF)? Examine the following table to check if it is in 3NF. If yes, explain your answer. Else convert the table into 3NF. (Assume branchNo as Primary Key) (5)

<i>branchNo</i>	<i>branchAddress</i>	<i>telNo</i>	<i>mgrStaffNo</i>	<i>name</i>
B001	8 Jefferson Way, Portland, OR 97201	503-555-3618	S1500	Tom Daniels
B002	City Center Plaza, Seattle, WA 98122	206-555-6756	S0010	Mary Martinez
B003	14 – 8th Avenue, New York, NY 10012	212-371-3000	S0145	Art Peters
B004	16 – 14th Avenue, Seattle, WA 98128	206-555-3131	S2250	Sally Stern

The following questions (2, 3 & 4) refer to the relational tables listed below. These tables describe data related to a video rental shop.

Videos							
VideoID	Title	CopyrightYear	Rating	Length	Format	VideoCategoryID	rentPerDay
1	Under Siege 2	1995	18	100 Min	NTSC	3	£1.00
2	Die Hard 2	1990	18	124 Min	PAL	7	£2.00
3	Batman	1989	PG	126 Min	NTSC	8	£1.00
4	Speed	1994	15	114 Min	NTSC	4	£2.00
5	Frankie & Johnny	1991	15	117 Min	NTSC	2	£5.00
6	A Few Good Men	1992	12	138 Min	NTSC	3	£3.00

Customers					
CustomerID	fName	IName	Street	City	Tel
C1	Peter	Ross	34 Rose Street	Aberdeen	1224745689
C2	Rita	Smith	72 Kinmundy Drive	Westhill	1224456789
C3	David	Rooney	9 John Street	Aberdeen	1224623478
C4	Wayne	Bekham	15 Coronation Street	Peterculter	1224903421

Rentals				
Customer ID	VideoID	rentedDate	returnDate	number OfDays
C1	2	10/11/2005	13/11/2005	3
C2	3	12/11/2005	15/11/2005	3
C2	5	12/11/2005	16/11/2005	4
C3	1	20/11/2005	22/11/2005	2
C4	6	17/11/2005	22/11/2005	5

VideoCategories	
VideoCategoryID	Category
1	Biography
2	Comedy
3	Drama
4	Adventure
5	Police Drama
6	Police Comedy
7	Action
8	Science Fiction
9	Adventure
10	Music

2. (a) In SQL, give one example of each of the following types of statements (use the *Videos* table if you need to refer to a table in your answer)
- (i) a Data Manipulation Language (DML) statement (1)
 - (ii) a Data Definition Language (DDL) statement (1)
 - (iii) a Data Control Language (DCL) statement (1)
- (b) Write an SQL statement to add a new customer to the database with the following details (use only the data specified below; do not assume any new data):
- Name: your name
CustomerID: C8
Tel: 1224647890
City: Aberdeen (2)
- (c) Using only the *Videos* table, write an SQL query to show the oldest video (oldest video is the one with the earliest copyright year). (5)
- (d) Using only the *Rentals* table, write an SQL query to show the number of videos each customer borrowed and the total amount they need to pay. (5)
- (e) Write an SQL query to show the video title, rating and rentPerDay for the videos borrowed by Rita Smith. (5)
- (f) Write an SQL query to show the customer names of those customers who borrowed videos that are categorised as drama. (5)

3. (a) In the context of information retrieval, describe the method by which a search engine retrieves relevant documents for a given user query. (4)
- (b) Briefly explain the major steps involved in relational database query processing. (4)
- (c) The acronym “ACID” represents four fundamental requirements for database transactions. What does “ACID” stand for, and briefly describe the four requirements it represents? (4)
- (d) Explain how you would control access to a database using privileges and views. (4)
- (e) Consider the following SQL query which refers to the Rentals and Customers tables given above:

```
SELECT *
FROM Rentals R, Customer C
WHERE R.CustomerID = C.CustomerID
AND C.lName='Bekham'
AND C.fName='Wayne';
```

Using the relational algebra notation, σ_P for selection with predicate P , \times for a Cartesian product, \bowtie for a natural join, and \wedge for conjunction, write down three different but logically equivalent ways of expressing the above query in relational algebra. In your answers, use the given table aliases for brevity, use brackets as necessary to avoid ambiguities, and label your answers A, B and C. (6)

- (f) In the Video rentals database given above, suppose the Rentals and Customers tables have very many rows but have no indexes. Arrange your solutions (A, B, C) from (e) in order of efficiency and justify your answer. (3)

4. (a) What does the abbreviation 'BLOB' stand for? In the context of web-based database applications, give examples of three types of BLOB data. (4)
- (b) In relational databases, what is an index? With the help of the Customers table explain how indexing works. (5)
- (c) With the help of a sketch, explain the various stages in which a request for a php file that contains MySQL queries is processed by a web server. (4)
- (d) What is the 'Lost Update' problem? Explain how locks can prevent this problem to occur in a multi-user database environment. (4)
- (e) In the context of spatial databases, what do you understand by the term 'grid indexing'? (4)
- (f) With the help of a sketch, describe the various subsystems in a MySQL server. (4)