

BITS Pilani, Dubai Campus, DIAC

Comprehensive Examination

II Semester 2012-2013

Course No : CS F212 / CS C352 Course Title: Database Systems

Date: 08/06/13 Saturday Time: 3 hours (AN) Total marks: 70 Weight-age: 35%

Data provided are complete. *Closed Book*.

This question paper has two parts A and B.

Write each part in separate answer booklets.

PART A

Answer **all** Questions

1. As a Database Designer, You are required to **create** a B TREE INDEX **OR** B+TREE-STRUCTURED INDEX (organize records using a tree-like data structure; all paths from the root to a leaf in your tree are of same length) for the given below student data.

- The tree is initially empty.
- The insertions are to be done in the given order only (read from top to bottom) for the input data.
- Take the IDNO as the key field. Date of Birth is a non-key field.
- The nodes of the tree can store at the most 3 data elements and 4 pointers.

(here you have to **draw the diagram only**).

[08 M]

STUDENT DATA (*insert the keys in the given order*)

<u>IDNO</u>	<u>Date of Birth</u>
10	15/10/1996
12	27/12/1997
14	15/1/1996
16	16/2/1996
18	18/3/1996
20	20/03/1996
02	02/01/1996
04	04/03/1996
08	05/07/1996
11	15/10/1996
13	27/12/1997
15	15/01/1996
19	16/02/1996
17	18/03/1996
09	20/03/1996
05	05/03/1996
07	20/03/1996
01	20/03/1996
03	20/03/1996
06	06/10/1996

P.T.O.

2. BITMAP INDEXES: Encoding and Decoding

[4+4 M]

a) ENCODE **000000000000000010100001** using Run Length Code in Compressed BITMAP.

b) DECODE **10111011110111** into Actual BIT vector in BIT MAP index scheme.

3.a) What are the steps in **cost-based query optimization** in database systems? [2 M]

b) Writing of an **Optimized Query** (in relational algebra) using appropriate equivalence rule and **drawing of the initial expression tree and transformed expression tree (in relational algebra)** as stated below: [5 M]

Consider the following relational schema:

Faculty (<i>facultyid</i> , facultyname)	has 2000 records
Journal (<i>journalid</i> , journalname)	has 500 records
Review (<i>journalid</i> , <i>facultyid</i> , no_of_articles_reviewed)	has 20000 records

Write the **optimized query** (in R.A.) and draw the **initial expression tree** (in R.A.) and **transformed expression tree** (in R.A.) for the following scenario:

“Find the names of all Faculty who have reviewed more than 100 articles in the Journal ‘IEEE Transactions on Database Systems’ “.

4. Define the following w.r.t. Disk Access Characteristics: [3 M]

a) SEEK TIME b) ROTATIONAL LATENCY c) TRANSFER TIME

5. What information is stored in a RECORD HEADER

w.r.t. representing data elements? [2 M]

6. What is the function of a Query Pre-Processor? [2 M]

7. **Relational Database Design using 3NF**

[5 M]

An employment agency offers a service in which the skills of prospective applicants are matched against the skills, or combination of skills, required for available jobs. Similar types of jobs may be offered by a number of employers, and any employer may offer more than one job. Each job is given a unique job number when it is entered into the system, and, in addition to the title of the job, a range of salaries and the length of time for which the job is available are recorded. Applicants are given unique applicant numbers, and a brief job history may be recorded giving job titles, salaries and dates, in addition to name, address, and age. The information on jobs and applicants is to be recorded in a database, together with the date(s), if any, on which a particular applicant is matched to a particular job, and whether or not the match is successful (i.e., whether or not the applicant actually gets the job). You required to design the database (comprising of requisite number of tables or relations along with attributes and keys) in using 3NF.

END OF PART A

(P.T.O).

PART B
Answer **all** Questions

1. Using the EER diagram representation, represent the statement that a part in a manufacturing plant can either be purchased or manufactured or both. The part is identified by Part_No and description. 2M

2. a. The major characteristics of a banking application are derived after a set of interviews with the database users and the designers of the database application, you are required to model all these requirements in an ER diagram.

The bank is organized into branches. Each branch is located in a particular city and is identified by a unique name, the bank monitors assets of each branch. Bank customers are identified by their customer-Id values, the bank stores the customers name and address , customers can have accounts and can take loans, a customer may be associated with a particular employee who may act like a loan officer or a personal banker for that customer.

Bank employees are identified with their employee_id values, the bank stores the name, telephone number, names of the employees dependents and the employee_id number of the employee's manager. The bank also keeps track of the employees's start date hence his duration of service.

The bank offers two types of accounts- savings and current account, accounts can be held by more than one customer and a customer can have more than one account. Each account is assigned a unique account number. The bank maintains a record of each accounts balance and the most recent date on which the account was accessed by the customer. Each saving account has an interest rate and current accounts have an overdraft amount recorded.

A loan originates at a particular branch and can be held by one or more customers, a loan is identified by a unique loan number, for each loan the bank keeps track of the loan amount and the loan payment, a payment number (i.e. installment) identifies a particular payment for a specific loan. The date and amount are recorded for each payment. 4M

- b. Convert the ER diagram you have drawn into the relational model in a step by step manner and represent all primary and foreign keys, specifying which table a specified key is derived from. 4M

3. a. Represent the following queries for a student registration system in **both SQL and Relational Algebra**. The schema for the system is given below where the attributes in bold indicate the primary key.

Student (**StudId**, Name, Addr, Status)
Professor(**ProfId**, Name, DeptId)
Course (DeptId, **CrsCode**, CrsName, Descr)
Transcript (**StudId**, CrsCode, Semester, Grade)
Teaching(**ProfId**, **CrsCode**, Semester)
Department (**DeptId**, Name)

- i. Find Ids of all professors who taught at least two courses in the same semester
- ii. Find professors (ProfId's and names) who taught courses in all departments.
- iii. List all courses which were not taught in S2000 (Semester 2000).
- iv. Find all professors (ProfId's and names) in the CS department and all professors who have taught CS courses.

[SQL 4 X 1.5 = 6 M RA 4 X 1.5 = 6 M]

- b. Give SQL commands for the following

- i) Create a table called Items which has the following attributes item_code , description, ROL, QOH, where the item_code is the primary key of the table and there is a constraint on the table that the value of ROL must be less than the QOH. Assume data types for each of the attributes. 2M

4. Specify if each one of the given schedules A, B, C (shown in next page) are Serial / Serializable or Equivalent to any given schedule with proper justification; Draw a precedence graph for each schedule to justify your answer.

(2 X 3 = 6M)

(PTO)

T1	T2
Read(X) $X = X - N$ Write (X) Read (Y) $Y = Y + N$ Write (Y)	 Read(X) $X = X + M$ Write(X)

Schedule A

T1	T2
Read(X) $X = X - N$ Write(X) Read (Y) $Y = Y + N$ Write(Y)	 Read(X) $X = X + M$ Write(X)

Schedule B

T1	T2
Read(X) $X = X - N$ Write (X) Read(Y) $Y = Y + N$ Write(Y)	 Read(X) $X = X + M$ Write(X)

Schedule C

(P.T.O.)

5. Given the following schedule with two transactions T1 and T2 requesting locks on database objects A, B whose initial value is 25. In the given schedule indicate if the requested lock can be granted or is denied, and at each stage show the value of the database objects A and B, note that the lock allows the transaction to perform both read and write and L1(A) indicates a lock is requested by transaction 1 on database object A and U1(A) indicates that transaction 1 unlocks the database object A.

3M

T1	T2	A
B		25
25		
L1(A); R1(A);		
A=A + 100;		
W1(A);l1(B); U1(A);	L2(A);r2(A);	
	A = A * 2;	
	W2(A);	
	L2(B)	
R1(B); B = B +100;		
W1(B); U1(B);	L2(B); U2(A); R2(B);	
	B = B * 2;	
	W2(B); U2(B);	

6. In Transaction Management, **Explain** the significance of **WAITS-FOR GRAPH** in Deadlock Detection with an example.

2 M

END OF PART B

BITS, Pilani, Dubai Campus, DIAC
Comprehensive Examination **Marking / Answering Scheme**
SECOND Semester 2012-2013
Course No : CS F212 / CS C352 Course Title: **Database Systems**
Date: 08/06/13 Sunday Time: 3 hours AN Total marks: 70 Weight age:35%
Data provided are complete. **Closed Book.**

Answer **all** Questions

3.a) What are the steps in **cost-based query optimization** in database systems? [2 M]

1. Generate logically equivalent expressions using **equivalence rules**
2. Annotate resultant expressions to get alternative query plans
3. Choose the cheapest plan based on **estimated cost**

4. Define the following w.r.t. Disk Access Characteristics: [3 M]

a) SEEK TIME b) ROTATIONAL LATENCY c) TRANSFER TIME

Time to position the head assembly at the proper cylinder.

Time for the disk to rotate so that the first sectors containing the block reaches the head.

Time for the sectors and gaps to rotate past the head. states the rate at which data is moved in / out w.r.t. secondary storage device.

5. What information is stored in a RECORD HEADER
w.r.t. representing data elements? [2 M]

record type, record length, time stamp.

6. What is the function of a Query Pre-Processor? [2 M]

QPP performs semantic checks on query; performs tree transformations for the initial query plan.

7. 3NF design for the given problem.
requisite number of tables or relations along with attributes and keys. [5 M]

Part A

①

BITS, Pilani, Dubai Campus, DIAC

Comprehensive Examination **Marking / Answering Scheme**

SECOND Semester 2012-2013

Course No : CS F212 / CS C352

Course Title: Database Systems

Date: 08/06/13 Sunday Time: 3 hours AN Total marks: 70 Weight age: 35%

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Answer all Questions

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[2 M]

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7. 3NF design for the given problem.

requisite number of tables or relations along with attributes and keys. [5 M]

2) COMPRESSED BITMAPS

A) ENCODE 000 000 000 000 000 000 1 0 1 0 0 0 0 1
using Run length code in compressed BITMAP.

NO of zeros (L)	NO of bits to represent L (R)	Encoded value (R-1) ones, a single 0, R bits to represent L
15	4	<u>1111</u> 0 <u>1111</u>
1	1	<u>1</u> 0 <u>1</u>
4	3	<u>111</u> 0 <u>100</u>

ANS: ENCODED VALUE = 11110111101110100

i.e. INPUT = 23 bits OUTPUT = 16 bits

B) Decode 10111011110111 into Actual BIT vector in BIT MAP index Scheme.

RUN	Position of first zero (k)	Next k bits	i (value of k in decimal)
<u>10111011110111</u>	2	11	3
<u>1011110111</u>	2	11	3
<u>110111</u>	3	111	7

Ans: Decode: Last Column by concatenation
i.e. 3, 3, 7. Each entry denotes
No of zeros followed by a 1.

ANS: 0001000100000001

(3)

2y optimization

Part A 3

Faculty (facultyid, facultyname)

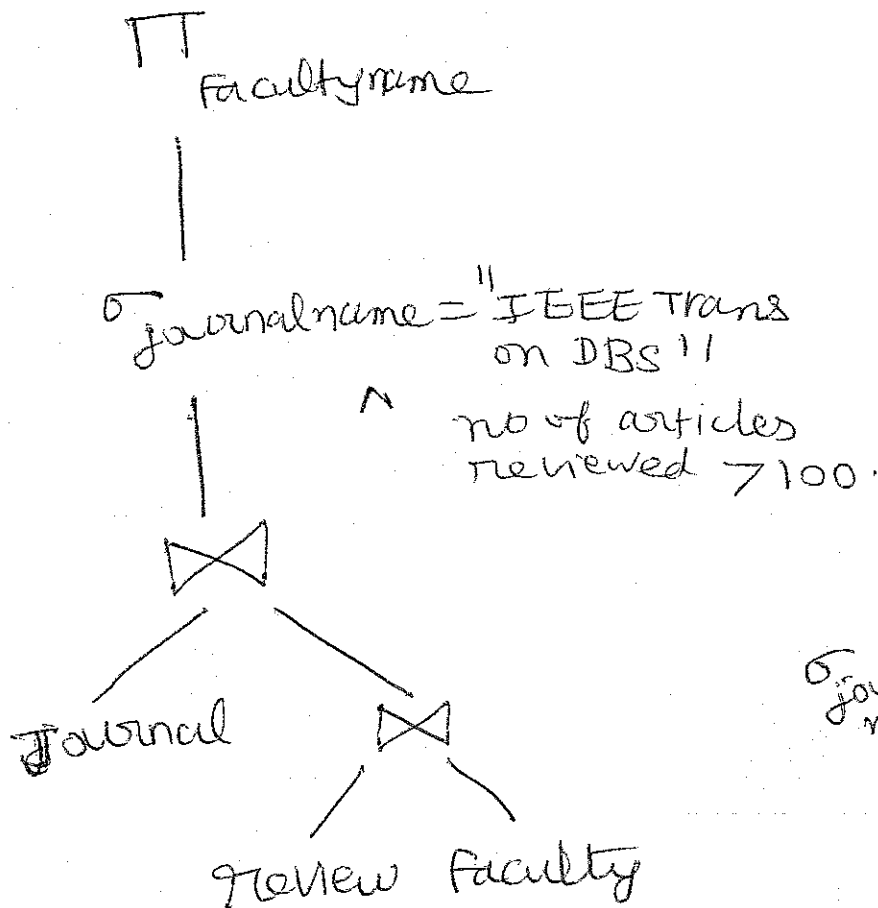
Journal (journalid, journalname)

Review (journalid, facultyid, no of articles reviewed)

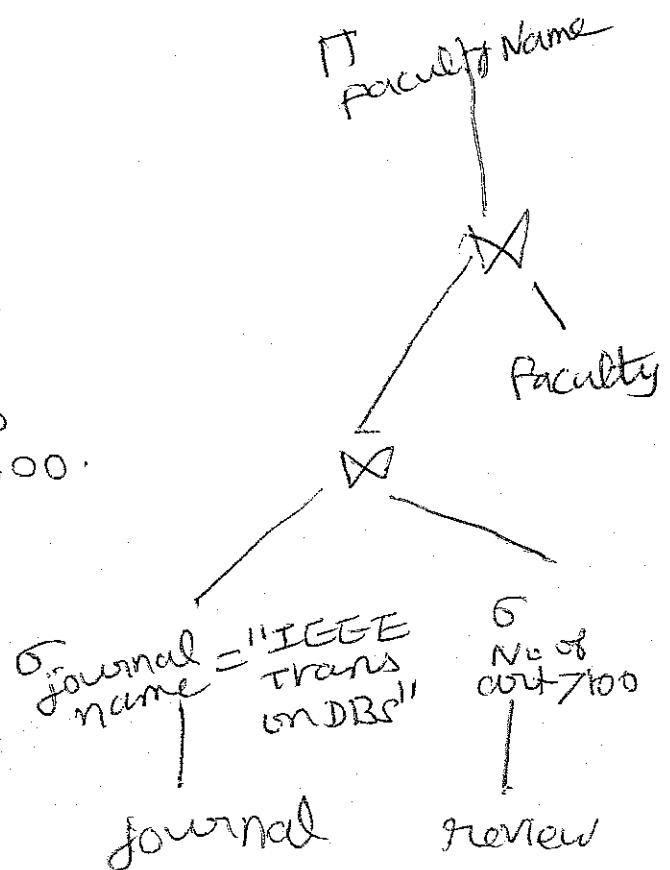
Find the names of all Faculty who have reviewed more than 100 articles in the Journal

"IEEE Transactions on Database Systems".

(i)



(ii)



PART A-4

Salary range, length of time for which job is available.
 ↳ minimal max salary

① Job (jobno, jobtitle, skillset)
 ↳ 1 to n times

or

J (jobno, skillset)
needed

② Employer (employerno, employername)

③ Jobdescription (employerno, jobno, salaryrange, length of time available)

can be reached after normalization.

④ Applicant (Applicantno, Name, add, age, skillset-1-m times)
 or A (applicantno, skillset available)

⑤ Jobhistory (applicantno, jobtitle, salary date, date of match, from, to)

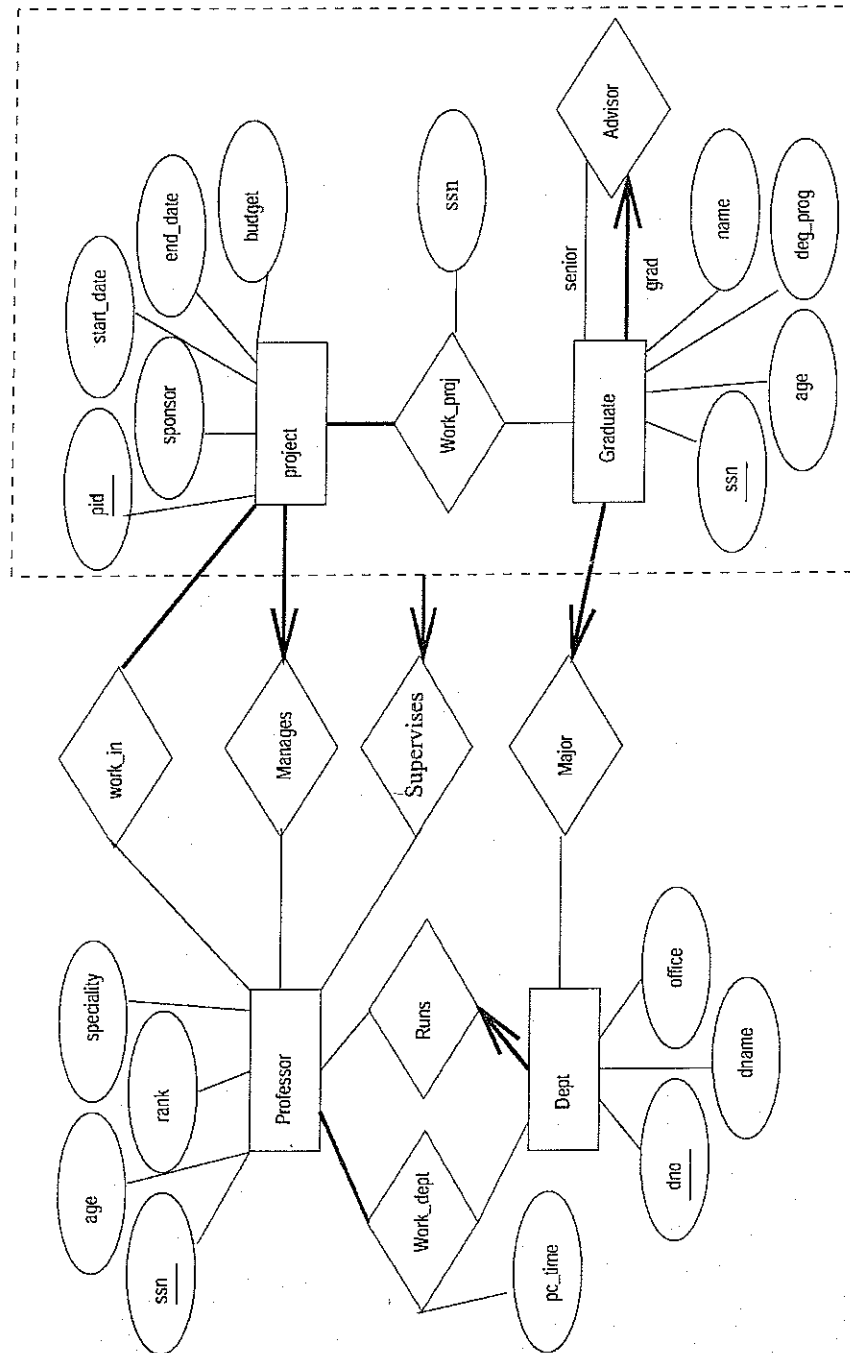
⑥ match (applicantno, jobno, match status)

not in 2NF hence normalize

Application no	Job Description	Name	Address	Age	Job Title	Salary	Date
----------------	-----------------	------	---------	-----	-----------	--------	------

↑ ↑ ↑ ↑ ↑ ↑ ↑

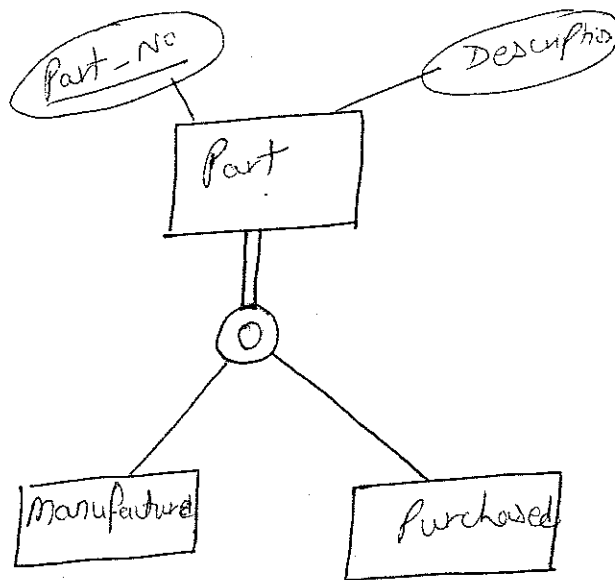
2.a.



4M

Figure 2.7 ER Diagram for Exercise 2.3

b. E-R to Relational Mapping 4M



3.a. i) Select T1.ProfID
 From Teaching T1, Teaching T2
 where T1.ProfID = T2.ProfID
 AND T1.CrsCode < > T2.CrsCode

RA $\pi_{ProfID} (\sigma_{T1.CrsCode \neq T2.CrsCode} (Teaching \bowtie Teaching))$

b. Select P.ProfID
 From Professor P
 where not exists

RA use \neg

(C Select D.DeptID
 From Department D)
 except

(Select C.DeptID
 from Teaching T, Course C
 where T.ProfID = P.ID
 AND T.CrsCode = C.CrsCode))

(3)

iii) Select C. CrsName

From Cource. C

Where C. Crscode not in

(Select T. Crscode

from teaching T

where T.sem = 'S2000')

RA

List all courses

—
List all course
taught in S2000

iv Select P. Name

From Professor P, Teaching T

where P.ID = T.ProfID AND

Crscode like 'CS %'

Union

RA

Using union.

(Select P.Name

from Professor P

where P.DeptID = 'CS')

b. Create table Items

(code char (5) Primary Key,

desc varchar (25),

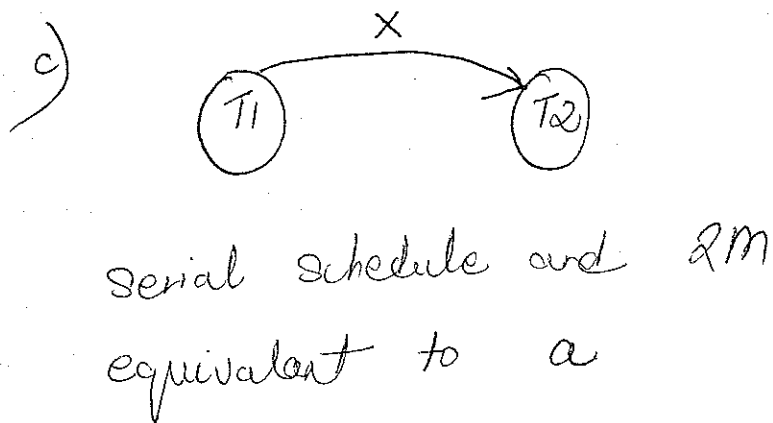
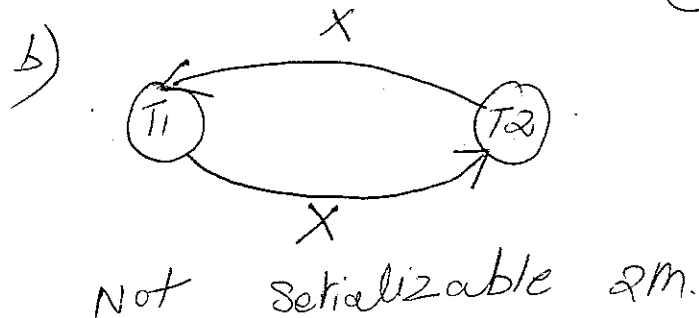
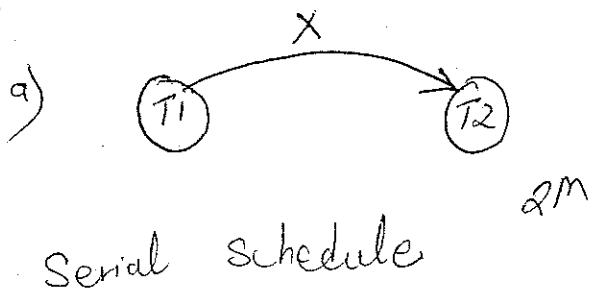
ROL integer,

QOH integer,

check (ROL < QOH));

A.

(4)



5.

T1	T2	A	B
$W_1(A); R_1(A)$			
$A = A + 100$			
$W_1(A); L_1(B); U_1(A)$		<u>125</u>	
	$U_2(A); R_2(A)$		
	$A = A * 2$	<u>250</u>	
	$W_2(A)$		
	$U_2(B)$ <u>Denied</u>		
$R_1(B); B = B + 100$			<u>125</u>
$W_1(B); W_1(B)$			
	$U_2(B); U_2(A); R_2(B)$		
	$B = B * 2$		<u>250</u>
	$W_2(B); U_2(B)$		

3m

Significance of waits for graph - 2m.

2.a.

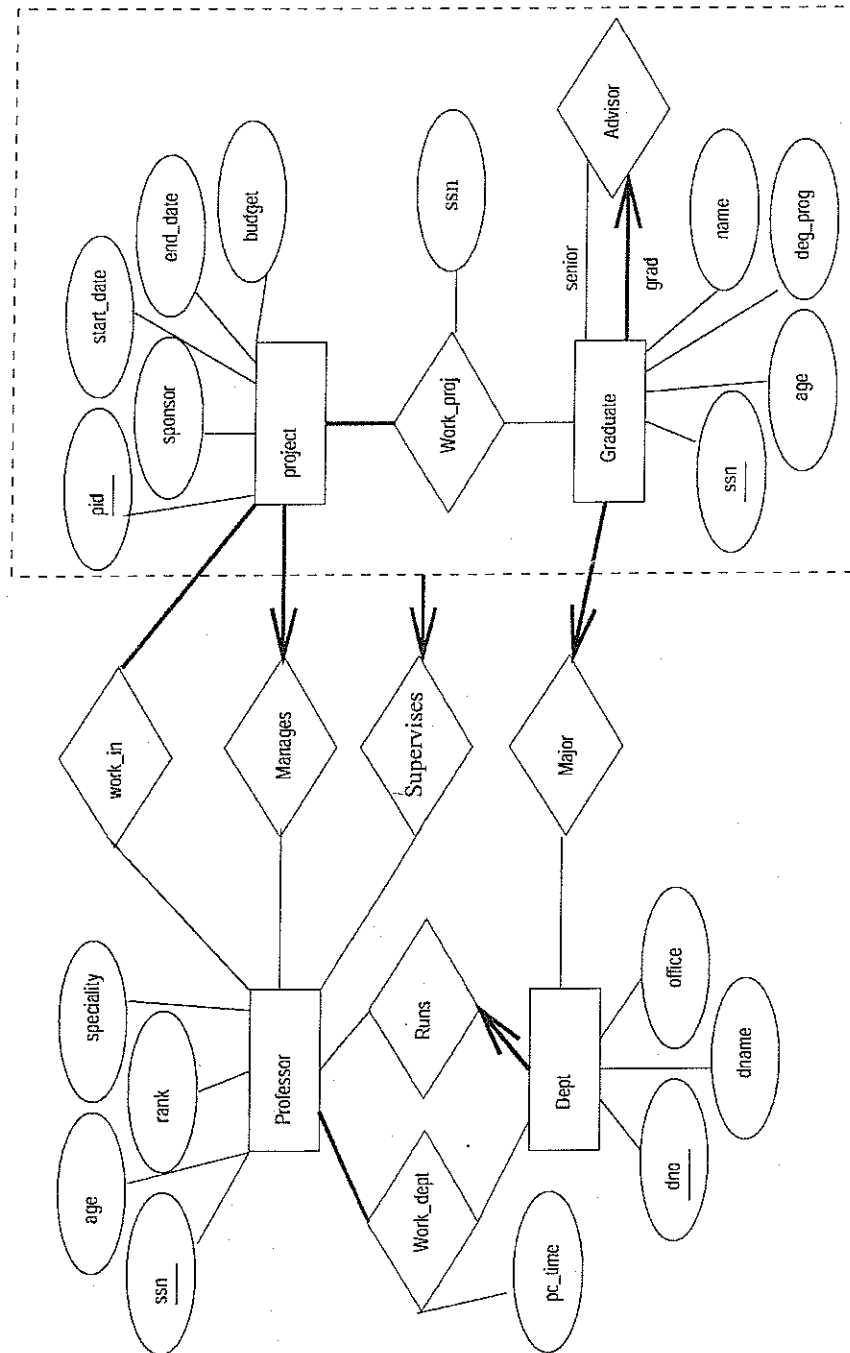
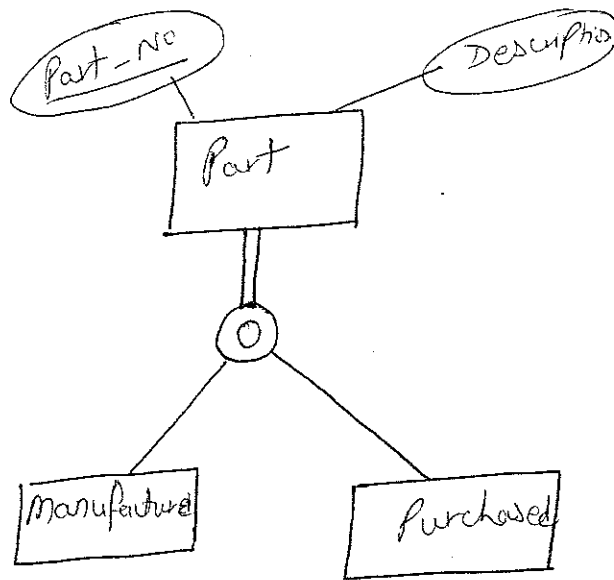


Figure 2.7 ER Diagram for Exercise 2.3

b. E-R to Relational Mapping 4M



(2)

3. a. i) Select T1.ProfID
 From Teaching T1, Teaching T2
 where T1.ProfID = T2.ProfID
 AND T1.CrsCode <> T2.CrsCode

RA $\pi_{ProfID} (\sigma_{T1.CrsCode \neq T2.CrsCode} (Teaching \bowtie Teaching))$

b. Select P.ProfID
 From Professor P
 where not exists

RA use \div

(C Select D.DeptID
 From Department D)
 except

(Select C.DeptID
 from Teaching T, Course C
 where T.ProfID = P.ID
 AND T.CrsCode = C.CrsCode))

iii) Select C. CrsName

From Course C

Where C. Crscode not in

(Select T. Crscode

from teaching T

where T.sem = 'S2000')

RA

List all courses

—
List all course
taught in S2000

iv Select P. Name

From Professor P, Teaching T

Where P.ID = T.ProfID AND

Crscode like 'CS %'

Union

RA

Using union.

(Select P. Name

from Professor P

where P.DeptID = 'CS')

b. Create table Items

(code char (5) Primary Key,

desc varchar (25),

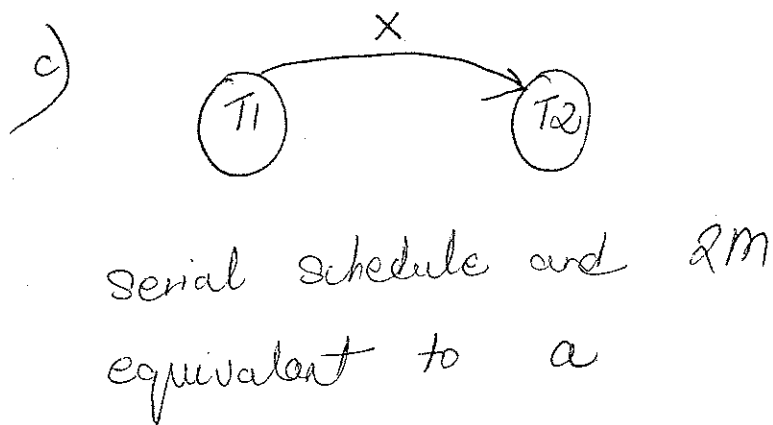
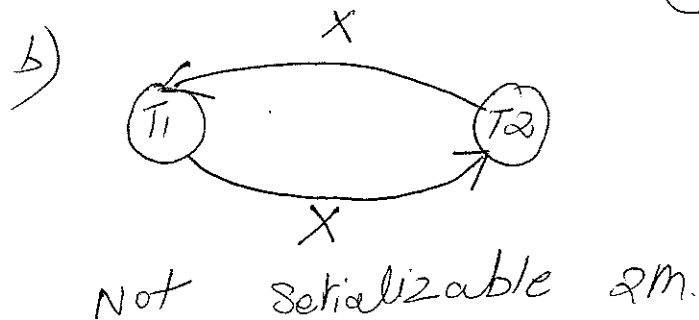
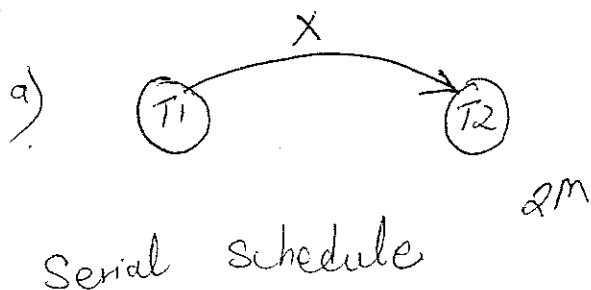
ROL integer,

QOH integer,

check (ROL < QOH))

A.

(4)



5.

T1	T2	A	B
$W_1(A); R_1(A)$ $A = A + 100;$ $W_1(A); L_1(B); U(A);$	$U_2(A); R_2(A);$ $A = A * 2$ $W_2(A)$ $U_2(B)$ <u>Denied</u>	<u>125</u> <u>250</u>	 <u>125</u> <u>250</u>
$R_1(B); B = B + 100$ $W_1(B); W_1(B)$	$U_2(B); U_2(A); R_2(B)$ $B = B * 2$ $W_2(B); U_2(B)$		

3M

Significance of waits for graph - 2M.

111 ~ 7m

TEST II Question Paper

BITS Pilani, Dubai Campus, Academic City, Dubai.

II/III Year SECOND SEMESTER 2012-2013

Degree: B.E. (Hons.) Branch: C.S.

Course No : CS C352 / CS F212 Course Title: Database Systems

Date: 02, May, 2013 Thursday Time: 50 min. Total marks: 40 Weight-age: 20%

Data provided are complete. **OPEN Book.**

Text / Reference Book and class notes permitted.

This question paper has 3 pages.

Answer all Questions.

1. A **student record** has the following fields in this order:

IDNO: INTEGER (2 bytes)

STUDENT NAME: String (30 bytes)

DATE_OF_BIRTH: Date (10 bytes)

TIME_OF_BIRTH: Time (8 bytes)

PLACE_OF_BIRTH: String (30 bytes).

How many bytes does the student record take **for each** of the following situations, given below?

- a) Fields can start at any byte.
- b) Fields must start at a byte that is a multiple of 4.
- c) Fields must start at a byte that is a multiple of 8.

[4 M]

2. Writing of **SQL Queries** and **OUTPUT** for Warehouse database shown in Page 3.

Write the following queries in SQL and also write the output for each query.

- a. List order numbers that have an individual item order quantity of at least 2 but no more than 5.
- b. List the order numbers ordered on 27th August 2008 in descending order.
- c. List all itemcodes with description that have an itemcode starting with "TF".
- d. List all details of items that have a description starting with "TFX" or "KB" in order of description.
- e. Write a SQL TRIGGER to be activated, when **qoh** is less than **reord_pnt** during insert or update operation. You can perform **any one** of these actions:

Alert the Warehouse Manager with this message "*Quantity on Hand has gone below the Reorder Point, for some item; Take necessary action from your side*".

[OR]

Write this particular record into a different file.

- f. How many items are listed in each **ordernum**? [2+3+3+3+3+2]

Warehouse Database (for question 2)

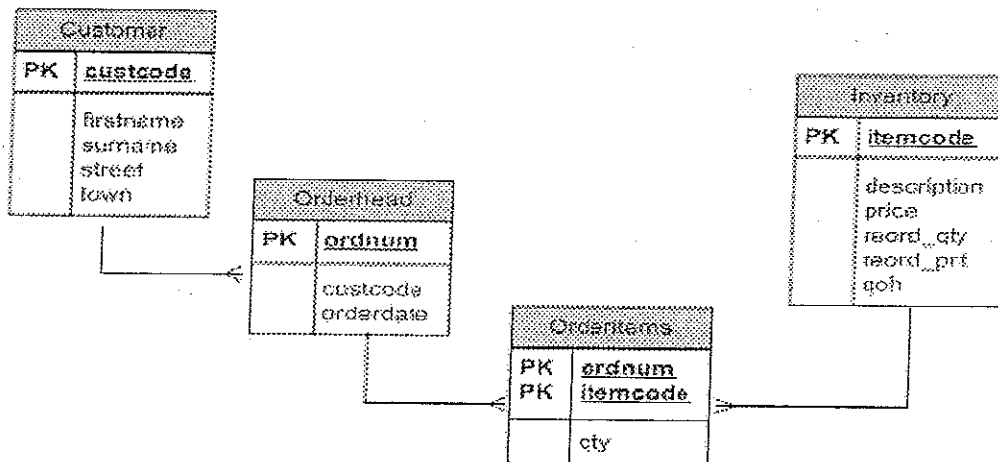


Table 1: CUSTOMER

CUSTCODE	FIRSTNAME	SURNAME	STREET	TOWN
REE1	JIM	REED	13 GREGORY'S LANE	SYDNEY
DIF1	DARREN	DIFILLIPO	34 SAINTY DRIVE	MELBOURNE
REE2	STEVE	REED	23 POMEGRANATE ST	BRISBANE
SPL1	RACHELLE	SPLATT	23 DRAGWAYS AV	MELBOURNE
KIR1	ROBIN	KIRBY	67 PENNZOIL CLOSE	MAIDEN GULLY

Table 2: INVENTORY

ITEMCODE	DESCRIPTION	PRICE	REORD_QTY	REORD_PNT	QOH
TFX1	TFX ENGINE BLOCK	4950.00	3	1	2
TFROD1	ALUMINIUM CONROD#1	330.00	32	8	5
TFPST2	FORGED PISTON#2	150.00	32	8	12
KBCR3	KB CRANKSHAFT#3	2750.00	3	2	1
BAE5	BAE CYLINDER HEAD	2750.00	6	2	4

Table 3: ORDERHEAD

ORDNUM	CUSTCODE	ORDERDATE
1	SPL1	26/08/2008
2	KIR1	27/08/2008
3	REE2	29/08/2008

Table 4: ORDERITEMS

ORDNUM	ITEMCODE	QTY
1	TFX1	1
1	BAE5	2
1	KBCR3	1
2	TFPST2	16
2	TFROD1	16
2	BAE5	2
2	TFX1	1
3	TFPST2	8
3	TFROD1	8
3	KBCR3	1
3	BAE5	2
2	KBCR3	2

TEST II Answering / Marking Scheme

BITS Pilani, Dubai CAMPUS, Academic City, Dubai.

II/III Year SECOND SEMESTER 2012-2013

Degree: B.E. (Hons.) Branch: C.S.

Course No : CS C352 / CS F212 Course Title: Database Systems

Date: 02/05/13 Thursday Time: 50 min. Total marks: 40 Weightage: 20%

Data provided are complete. OPEN *Book*.

Text/ Reference Book and class notes permitted.

Answer all Questions.

1. A **student record** has the following fields in this order:

IDNO: INTEGER (2 bytes)

STUDENT NAME: String (30 bytes)

DATE_OF_BIRTH: Date (10 bytes)

TIME_OF_BIRTH: Time (8 bytes)

PLACE_OF_BIRTH: String (30 bytes).

How many bytes does the student record take **for each** of the following situations, given below?

a) Fields can start at any byte. $2+30+10+8+30=80$

b) Fields must start at a byte that is a multiple of 4. $4+32+12+8+32=88$

c) Fields must start at a byte that is a multiple of 8. $8+32+12+8+32=92$
[1+1.5+1.5M]

2. Writing of SQL Queries and OUTPUT

[Queries 10 M;
output 6*1=6 M]

- a. List order numbers that have an individual item order quantity of at least 2 but no more than 5.

Select ordernum from orderitems where qty <=2 and qty <= 5;

Correct output

- b. List the order numbers ordered on 27th August 2008 in descending order.

**Select ordernum from orderitems, orderhead where
orderitems.ordernum=orderhead.ordernum and
orderhead.orderdate='27/08/2008';**

Correct output

TEST II Answering / Marking Scheme CSC 352/CS F212 DBS

- c. List all itemcodes with description that have an itemcode starting with "TF".

Select itemcode,description from inventory where description like 'TF%';

Correct output

- d. List all details of items that have a description starting with "TFX" or "KB" in order of description.

Select * from inventory where description like 'TFX%' OR description like 'KB%' Order by description;

Correct output

- e. Write a SQL TRIGGER to be activated, when **qoh** is less than **reord_pnt** during insert or update operation. You can perform **any one** of these actions:

Alert the Warehouse Manager with this message "Quantity on Hand has gone below the Reorder Point, for some item; Take necessary action from your side".

[OR]

Write this particular record into a different file.

CREATE TRIGGER ALERT_DBA

BEFORE/AFTER INSERT OR UPDATE OF

Qoh ON INVENTORY FOR EACH ROW

WHEN

(NEW.qoh < reord_pnt))

ALERT_DBA (NEW.qoh); This procedure will do display message.

Alternate: CREATE TRIGGER ALERT AFTER INSERT OR UPDATE ON
INVENTORY
REFERENCING NEW TABLE AS CHECKED TABLE

TEST II Answering / Marking Scheme CSC 352/CS F212 DBS

FOR EACH STATEMENT

INSERT INTO MODIFIED TABLE (SPECIFY FIELDS)
FROM CHECKED TABLE C
WHERE C.QOH < C.RECORD_PNT

- f. How many items are listed in each **ordernum**? [2+3+3+3+3+2]

**Select orderitems.ordernum, orderitems.itemcode,
count(orderitems.itemcode) as numitems from orderitems, orderhead where
orderitems.ordernum=orderhead.ordernum group by
orderitems.ordernum,orderitems.itemcode;**

Correct output

Q.3. a. Track capacity = $50 \times 512 = \underline{\underline{25K}}$ ⑦

b. Capacity of each surface = $25K \times 2000 = 50,000K$

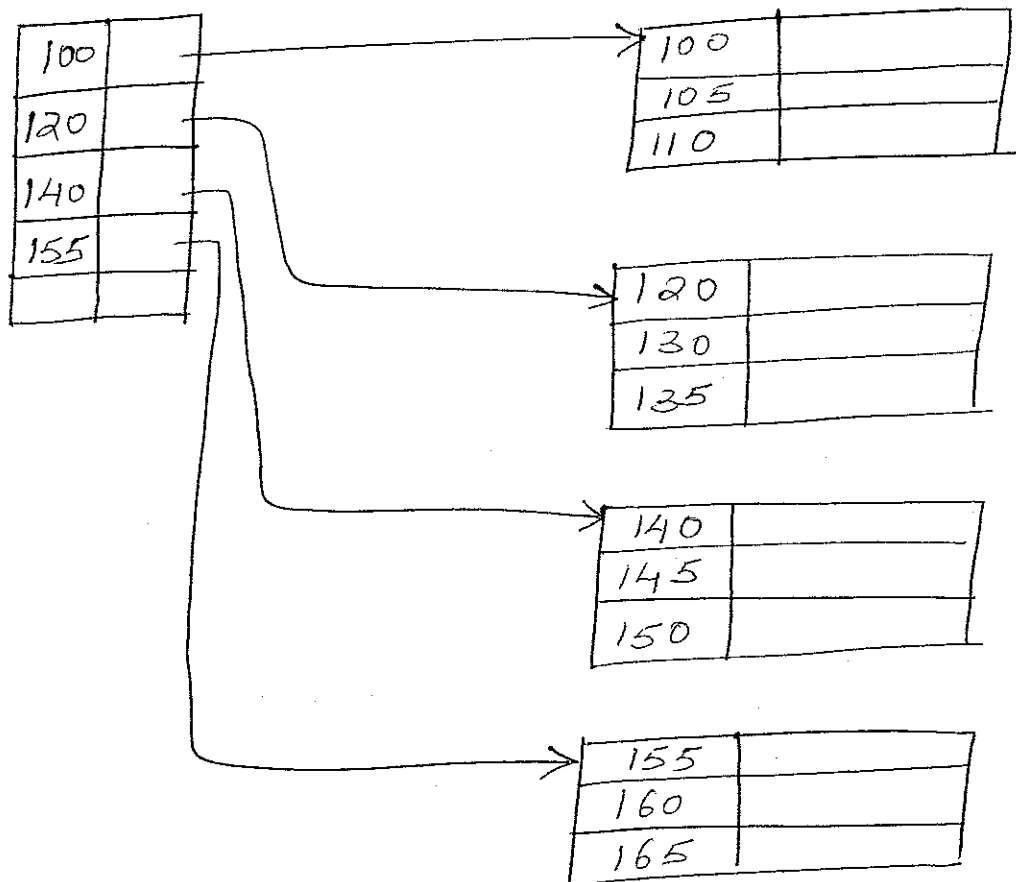
c. Disk Capacity $5 \times 2 \times 50,000 = \underline{\underline{500,000K}}$

d. No of cylinders = No of tracks on each platter

$$= \underline{\underline{2000 \text{ cylinders}}}$$

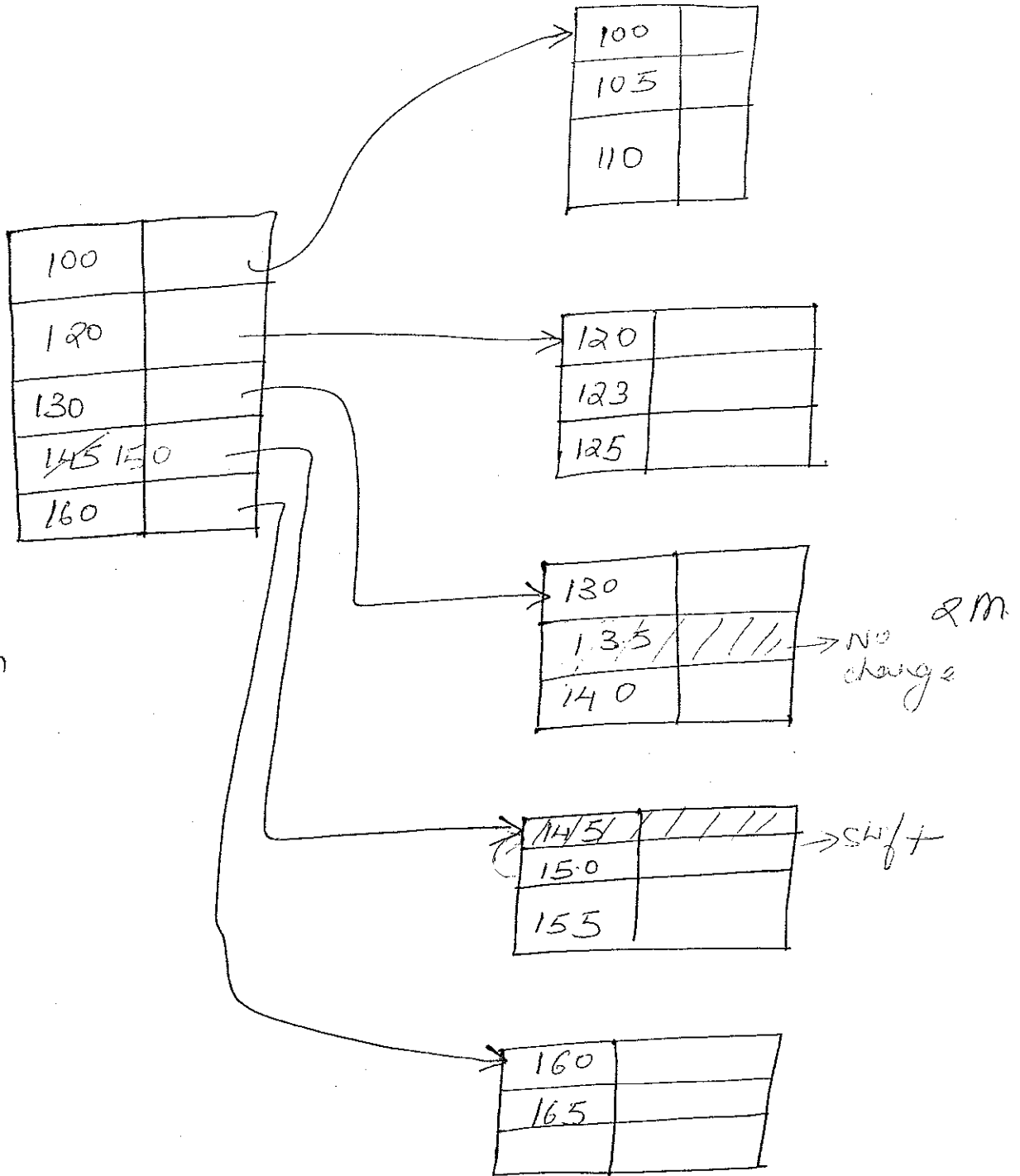
$\underline{1 \times 4 = 4m}$

Q.4.



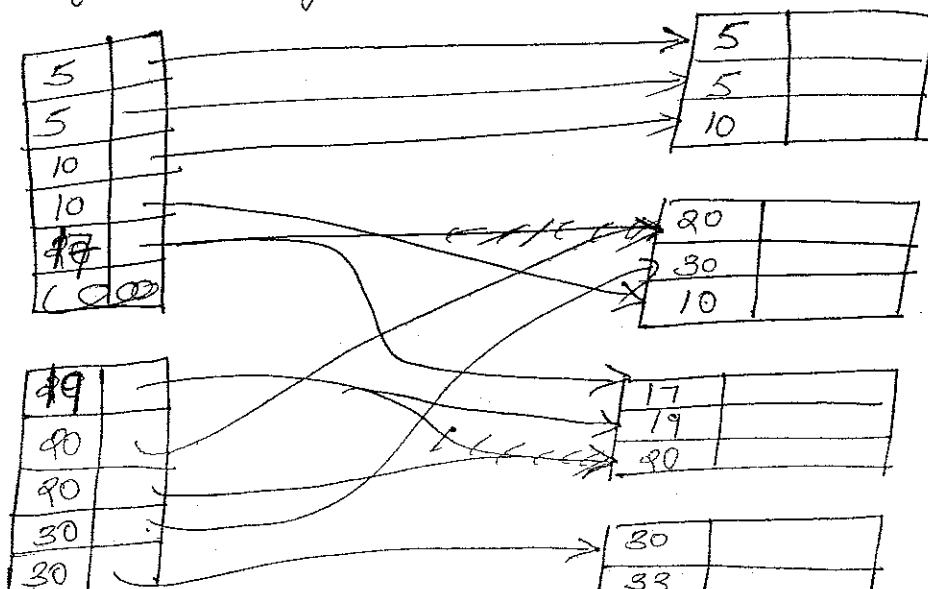
2m

b.



a. Use of Secondary Index - 1m

b.



6. 6 - 0110 12 - 1100 ⑥
 15 - 1111 5 - 0101
 7 - 0111 3 - 0011
 4 - 0100
 11 - 1011
 8 - 1000

$j=1$
$n=2$
$r=3$

0	0110
1	1111
	0111

Now when 4th element is added.
 $r/n > 1.5$ (75% of 2)
 hence $j=2$

$j=2$
$n=3$
$r=4, 5$

00	1100
01	1111
10	0111
	0110

Now when adding 0101 $r/n > 1.5$ hence extend.
 Now add 3

$j=2$
$n=4$
$r=5$

00	1100
01	0101
10	0110
11	1111
	0111

Now $r/n = 1.5$ hence increase j , $n=5$

$j=3$
$n=5$
$r=$

000	
001	0101
010	0110
011	1111
100	0111
	1100

Add 4

BITS Pilani, Dubai Campus, Academic City, Dubai.

SECOND SEMESTER 2012-2013

Degree: B.E. (Hons.) Branch: C.S.

TEST I Question Paper

Course No : CS C352/CS F212 Course Title: Database Systems

Date: 21, March, 2013 Thursday Time: 50 min. Total marks: 40 Weightage: 20%

Data provided are complete. **Closed Book.**

This question paper has 2 pages.

Answer all Questions.

I. State formally the following Armstrong Axioms (Inference Rules):

- Reflexive
- Augmentation
- Transitive
- Decomposition

[4 M]

II. Write the expressions in **relational algebra** for each of the queries given below w.r.t. the given schema:

Student(ssn, name, address, major)

Course(code, title)

Registered(ssn, code)

[8*2=16 M]

- a. List the titles of registered courses.
- b. List the codes of courses for which no student is registered.
- c. List the titles of courses for which no student is registered.
- d. List the names of students and the titles of courses they have registered for.
- e. List the ssns of students who are registered for 'Database Systems' or 'Analysis of Algorithms'.
- f. List the ssns of students who are registered for both 'Database Systems' and 'Analysis of Algorithms'.
- g. Display the list of courses in which all students are registered.
- h. Display the list of courses in which all 'CS' major students are registered.

III. Explain the term functional dependency with a clear example. [2 M]

P.T.O.

page 1 of 2

IV. Given a relation $R(A,B,C,D)$, find the candidate keys of the relation and explain whether or not R is in 3NF or BCNF with proper justification with respect to the following FD's (note that each roman numeral question is separate) Explain each of your answers.

- i) $B \rightarrow C, C \rightarrow A, C \rightarrow D$
- ii) $ABC \rightarrow D$
- iii) $A \rightarrow C, B \rightarrow D$

(2 X 3 = 6M)

V. Consider a relation R (Roll_number, Name, Date_of_birth, Age) with the following functional dependencies.

- 1. Date_of_Birth \rightarrow Age
- 2. Name \rightarrow Roll_number
- 3. Course_number \rightarrow Course_name
- 4. (Roll_number, Course_number) \rightarrow Grade
- 5. Age \rightarrow Eligibility
- 6. Roll_number \rightarrow Name
- 7. Course_number \rightarrow Instructor

- i) What is the key of the relation ?
- ii) Identify the normal form in which this relation R is in, Justify your answer.
- iii) Normalize R up to the 3NF.

5M

VI. Consider the following table, what could be the drawback of this table? Indicate the meaning of the first record of this table. And how could this table be split to be in the 5NF ?

Dealers	Product	Companies
JM Associate	Sweets	Cadbury
Shiv Networks	Shoes	Nike
Star Sellers	Magazine	Times
Hari Publishers	Books	KM Publications

(1 + 1 + 2 = 4M)

VII. Give one word answers for the following questions.

(1 X 3 = 3M)

- i) A relation is in this form if it is in BCNF and has no multi-valued dependencies.
- ii) When the values in one or more attributes being used as a foreign key must exist in another set of one or more attributes in another table, this kind of constraint is referred to as.
- iii) A table has fields F_1, F_2, F_3, F_4 , and F_5 , with the following functional dependencies:
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 In terms of normalization, this table is in which normal form?

BITS Pilani, Dubai Campus, Academic City, Dubai.

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Degree: B.E. (Hons.) Branch: C.S.

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(Augmentation) If $X \rightarrow Y$, then $XZ \rightarrow YZ$

(Transitive) If $X \rightarrow Y$ and $Y \rightarrow Z$, then $X \rightarrow Z$

(Decomposition) If $X \rightarrow YZ$, then $X \rightarrow Y$ and $X \rightarrow Z$

[4 *1=4 M]

2.R.A. Queries:

[8*2=16 M]

Consider the following relations:

Student(ssn, name, address, major)

Course(code, title)

Registered(ssn,code)

a. List the titles of registered courses.

PROJECT code (Course JOIN Registered)

b. List the codes of courses for which no student is registered

PROJECT code (Course) - PROJECT code (Registered)

c. The titles of courses for which no student is registered.

PROJECT name ((PROJECT code (Course) - PROJECT code (Registered)) JOIN Course)

d. Names of students and the titles of courses they registered to.

PROJECT name,title (Student JOIN Registered JOIN Course)

e. SSNs of students who are registered for 'Database Systems' or 'Analysis of Algorithms'.

Scheme: DBS CSC352/CS F212 Contd....

PROJECT ssn (Student JOIN Registered JOIN (SELECT title='Database Systems'
Course)) U
PROJECT ssn (Student JOIN Registered JOIN (SELECT title='Analysis of Algorithms'
Course))

f. SSNs of students who are registered for both 'Database Systems' and 'Analysis of Algorithms'.

PROJECT ssn (Student JOIN Registered JOIN (SELECT title='Database Systems'
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PROJECT ssn (Student JOIN Registered JOIN (SELECT title='Analysis of Algorithms'
Course))

g. List of courses in which all students are registered.

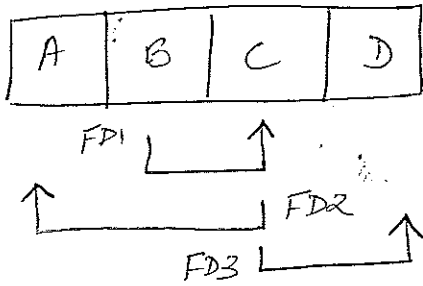
PROJECT code, ssn (Registered) / PROJECT ssn (Student)

h. List of courses in which all 'CS' major students are registered.

PROJECT code, ssn (Registered) / PROJECT ssn (SELECT major='CS' Student)

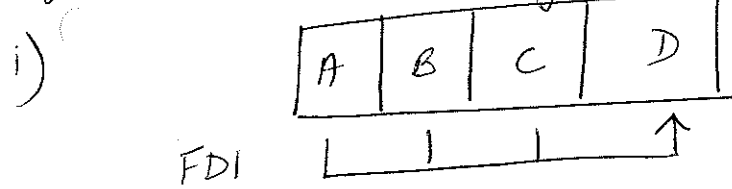
III Functional Dependency explanation with e.g. (3) (1+1m)

IV i)



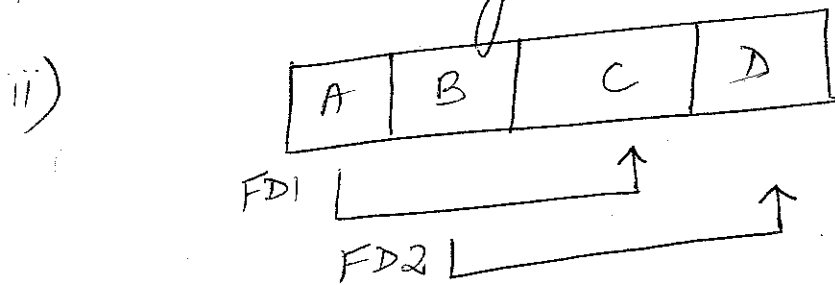
2m

B is the candidate key and R is not in 3NF because of transitive dependency



2m

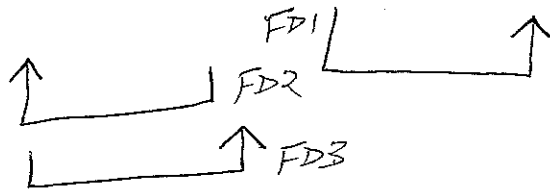
candidate key (A, B, C), relation is in 3NF and BCNF because no transitive dependency (3NF) and the determinant is the candidate key



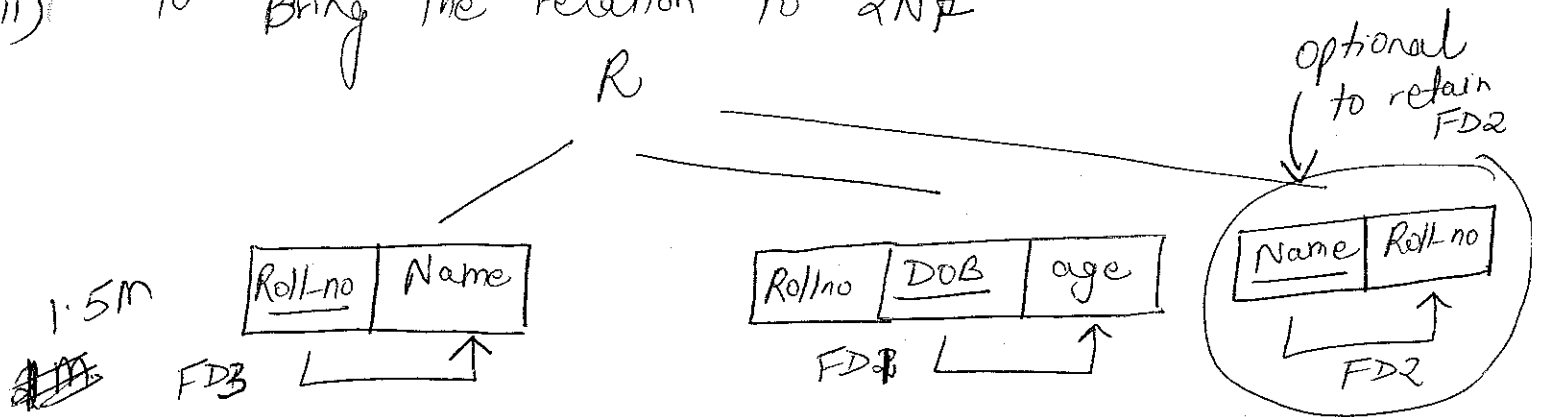
candidate key (A, B) relation is not in 3NF because prime attribute must be fully FD on the prime attribute

Roll-no	Name	DOB	age
---------	------	-----	-----

only some FD's hold in this relation. (4)



- i) Candidate Keys $\{ \text{Roll-no}, \text{DOB} \}$, $\{ \text{Name} \}$, DOB
 we select primary key to be $\{ \text{Roll-no}, \text{DOB} \}$ — 1m
- ii) The relation is in 1NF Justify — 2m.
- iii) To Bring the relation to 2NF



The table is now in 3NF because there is no transitive dependency and it is in 2NF — 0.5m

Drawback of table — Too much information combined together in one table 1m

Meaning of first record —
 JM Associates is a dealer for Cadbury
 Sweets must be manufactured by Cadbury

splitting the tables

Dealers	Product
---------	---------

Product	Company
---------	---------

Dealers	Company
---------	---------

iii) 1NF

i) 4NF ii) Referential Integrity constraint

BITS Pilani, Dubai Campus, Academic City, Dubai.

SECOND SEMESTER 2012-2013

Degree: B.E. (Hons.) Branch: C.S.

TEST I Question Paper

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[8*2=16 M]

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[2 M]

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(2 X 3 = 6M)

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(1 + 1 + 2 = 4M)

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PROJECT ssn (Student JOIN Registered JOIN (SELECT title='Database Systems'

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^^

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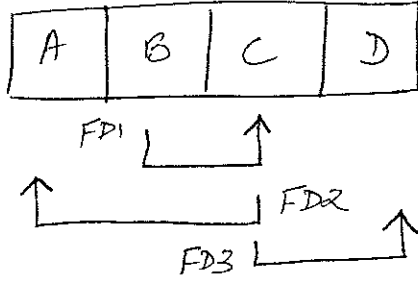
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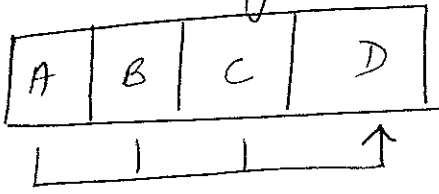
IV i)



2m

B is the candidate key and R is not in 3NF because of transitive dependency

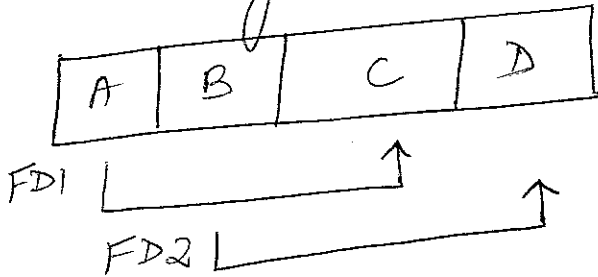
ii)



2m

candidate key (A, B, C), relation is in 3NF and BCNF because no transitive dependency (3NF) and the determinant is the candidate key

i)

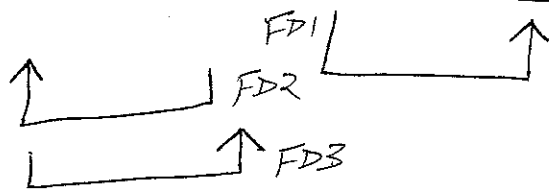


candidate key (AB) relation is not in 3NF because prime attribute must be fully FD on the prime attribute

✓

Roll-no	Name	DOB	age
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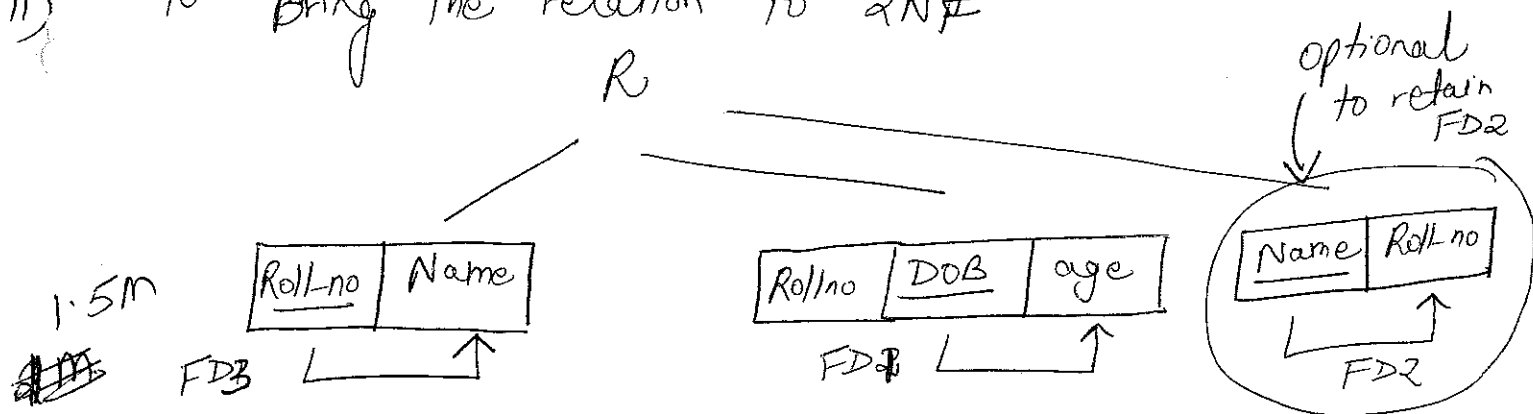


i) Candidate Keys {Roll-no, ^{DOB}Name}, {Name, DOB}

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splitting the tables

Dealers	Product
---------	---------

Product	Company
---------	---------

Dealers	Company
---------	---------

II i) 4NF ii) Referential Integrity Constraint iii) 1NF

QUIZ I

Course No : CS C352 / CS F212 Course Title: Data Base Systems
Date: 27, Feb, 2013 Wednesday Time: 20 min. Total marks: = 10
Weightage: 5% Venue : 334/336 **Closed Book.**

This question paper has 2 pages [use **back page** for **rough work** only]

IDNO:

Name:

SET A

Write answers in the space provided in question paper. Answer all questions.

1. Fill in the blanks with the appropriate answers.
 - a. Concurrency in database systems is ensured by the maintenance of _____ 0.5 M
 - b. Setting of different access rights for different users in a database is the role of a _____. 0.5 M
 - c. Three levels of abstraction of the database system are _____ and _____ 1.5 M
2. A record on movies contains some information (movie name, year of release etc) about a particular movie. Using a Network Model representation, **show diagrammatically** how information about 3 actors of the movie is stored. 1 M
3. Draw an EER diagram corresponding to the following statement
" **Schools and Colleges are both Educational institutions** ". 1M
4. List any three major components of a Database System. 1.5 M

QUIZ I

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IDNO:

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SET A

5. Represent each of the following statements using **separate ER diagrams**:

a. "Existence of seeds depends on the fruit". Use weak entity representation for seeds and show all participation and key constraints clearly. 1M

b. Every papaya can either be seedless or have multiple seeds.

1M

6. How can you express queries and other operations over a database? 1 M

7. An university has one or more colleges affiliated to it. A college has one or more departments under it. A department has the following:

- One or more faculty members
- One or more administrative personnel.

Represent this problem diagrammatically using Hierarchical Model.

1 M.

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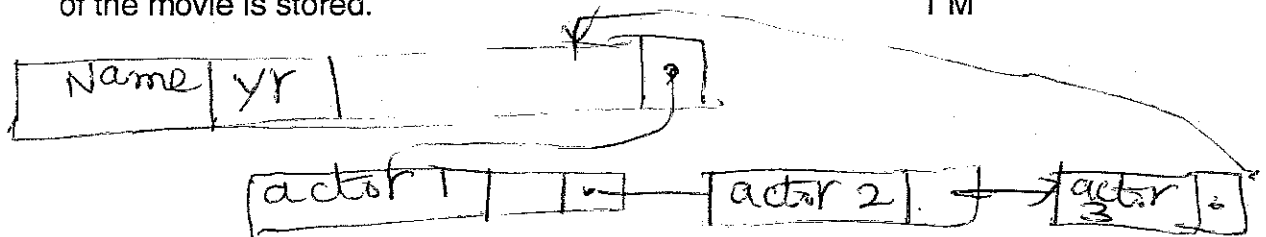
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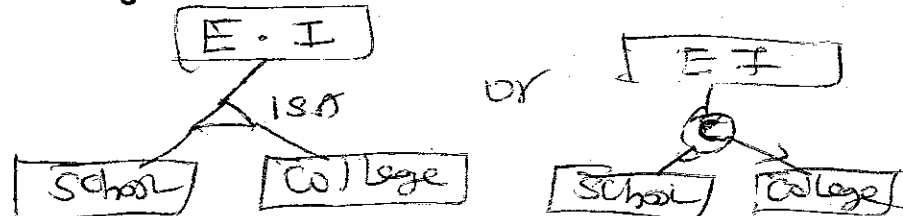
SET A

Write answers in the space provided in question paper. Answer all questions.

1. Fill in the blanks with the appropriate answers.
 - a. Concurrency in database systems is ensured by the maintenance of Locks. 0.5 M
 - b. Setting of different access rights for different users in a database is the role of a DBA. 0.5 M
 - c. Three levels of abstraction of the database system are Physical, Conceptual/Logical and external/view. 1.5 M
2. A record on movies contains some information (movie name, year of release etc) about a particular movie. Using a Network Model representation, **show diagrammatically** how information about 3 actors of the movie is stored. 1 M



3. Draw an EER diagram corresponding to the following statement "Schools and Colleges are both Educational institutions". 1M



4. What are the major components of a Database System? 1.5 M

Query Processor, Concurrency Mgr,
Control
HLI, Query Optimizer
Transaction Mgr,
DDL Compiler

M/A before

BITS, Pilani – Dubai Campus, Academic City, Dubai.
II/III Year Second Semester 2012-2013
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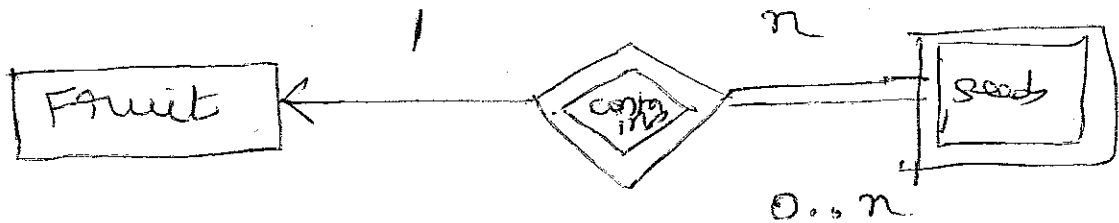
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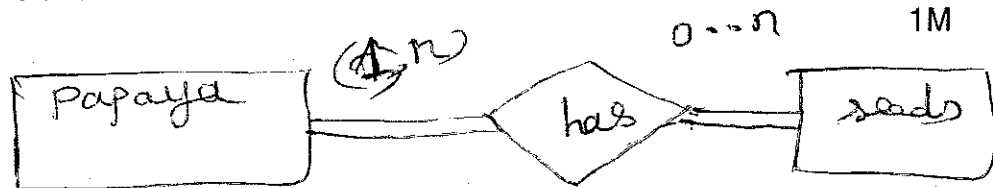
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- b. Every papaya can either be seedless or have multiple seeds. 1M



6. How can you express queries and other operations over a database? 1 M
using SQL, HLL, C/C++/Java

7. An university has one or more colleges affiliated to it. A college has one or more departments under it. A department has the following:

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