

CS219

## Database Systems

Wednesday, July 1, 2020

### Course Instructor

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### Remote Final Exam

Attempt Time: 3 Hours  
Submission (on LMS and  
through email) Time: 15  
minutes

**Total Marks: 100**

#### Instructions:

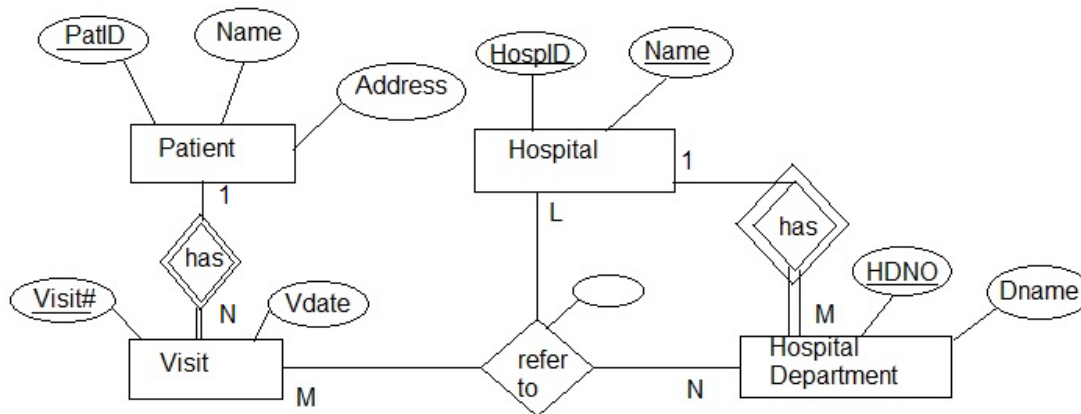
1. The final exam will be attempted offline in the student's own handwriting (in readable way).
2. The students will use A4 size blank white sheets to attempt the exam (portrait format unless a diagram or table requires landscape). Each sheet of the A4 size paper **MUST** have the Roll Number, Name, the course code, name of the course and Signature of the student at the top of **EACH** sheet.
3. Students will use cam-scanner, MS lens, or an equivalent application to scan and convert their hand-written answer sheets into a **SINGLE** pdf file (keeping the correct order of pages and question numbers), which they will submit on LMS and **MUST also** email to the email address (of the concerned course/lab instructor) which will be provided. They will be given 15 minutes (after the 3 hours attempt time) for this purpose. All students must use the standard file name format (Full course code - Roll number e.g. CS-219-18i-0123). Submissions after 30 minutes may not be accepted. **Try to submit soon after 3 hours of attempt time and do not wait for 15 minutes to be elapsed.**
4. For proven cheating/ plagiarism, student will get an F grade even if the student had opted for S/U grade, and the case will be referred to DDC (Department's Disciplinary Committee). Instructors will conduct vivas of randomly selected students or in case of doubt (significantly different attempt as compared to past performance in the course or matching attempt with other students). Plagiarism includes sharing an attempt to other students (copy providing). Students who are not able to satisfactorily answer instructor's questions (based on the exam as well as slightly lateral but related concepts) during viva will also be considered as plagiarism cases.
5. Students should carry a clean scanning that is free from any marks/stains etc.
6. Order of answering the questions must be followed as per exam paper. Negligence will carry the deduction of 2% marks.

	Q-1	Q-2	Q-3	Q-4	Q-5	Total
Marks Obtained						
Total Marks	20	20	20	20	20	100

## Question 1:

Marks 2, 18

Following is a portion of an ER Diagram and answer the following questions



- (1) Describe the real life scenario of this ER Diagram in few 3 to 4 lines.
- (2) Sometime, correspondences of entities can be managed by postal mail and electronic means. Draw each entity without relation using ER-symbols of necessary columns of entities/ relationships with the characteristics such as composite, complex attributes etc.
- (3) Produce the mapping (table design) with standard key constraints of an ER Diagram including part (a2).
- (4) Write down DDL SQL script with all possible standard and additional constraints of your mapping of part (a3)

## Question 2:

Marks 20

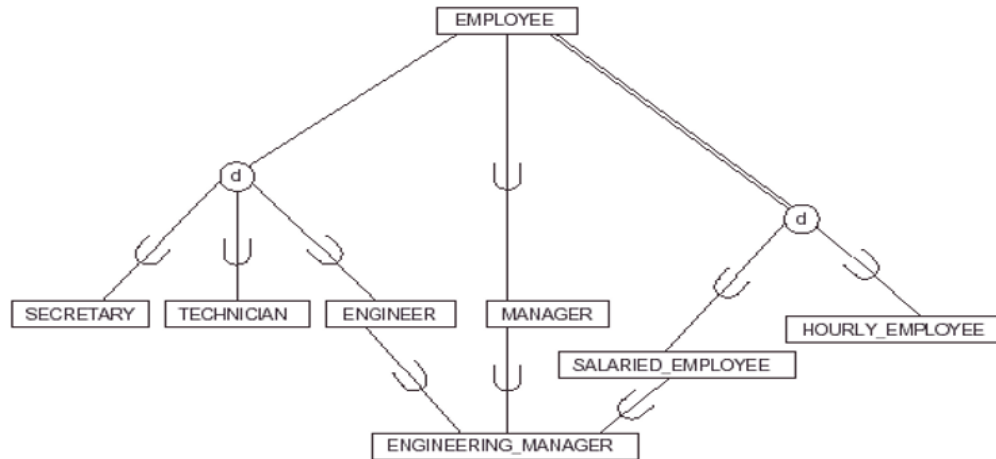
Given a following Scenario:

1. FAST NU has five Campuses; each campus has mailing address and known by abbreviation title such as KHI, PWR etc. You can analyze FAST NU structure through its web site: [www.nu.edu.pk](http://www.nu.edu.pk)
  2. There are different Schools of various disciplines such as School of Computing, School of Engineering etc., each school has its head with job title Dean and mailing address. Each school has its subordinates departments and programs of campuses.
  3. There are various departments (for example, Electrical Engineering KHI) exist in each campus, each has mailing address, managed under Schools with HOD. Although, departments are administratively managed under their Campuses.
  4. There are many programs (e.g., Computer Science BS, Computer Science MS, Computer Science PhD etc.), supervised by the Schools and execute in departments. Any department may offer multiple programs such as abbreviated with CS, SE, AI etc. in specific campus for each of levels BS, MS, PhD. Some departments of campus may not offer all programs and some are restricted to levels.
  5. Every campus has its own Semester schedule for all its departments and programs.
- a) Draw an ER diagram for FAST NU (to **manage centralized system for all campuses**) with all possible valid attributes of this scenario. Do not forget to underline the keys and to mention the cardinalities.
- b) Transform your ER Diagram into dataset in the form of tables with possible valid data and standard constraints.

**Question 3:**

**Marks 20**

- a) Re-draw given lattice EER diagram by showing attributes with entities with the following details: Full time Salaried employee will be only entitled for the job title Manager if his/ her nationality is Pakistani from job category Engineer.



- b) A customers are paying Insurance for different types such as house, car and life. Customer table is given. Write down two more tables with valid possible columns and all constraints.

Customer(CustID, Name, Address, City, Telno, Email)

- c) An Enterprise Stock & Exchange is keeping all business companies' data in a spread sheet. Following is a selected data for the design.

	A	B	C	D	E	F
1	Company List					
2	CompanyID	RegTitle	ShortTitle	Address	OwnerName	
3	PUN40021	Aramix Inc.	Aramix	35 Main Rd, Lahore	Azhar Hussain	
4	SND50010	Star Textile Mill	Star	225 Link Road, North Karachi	M. Mobeen	
5	SND22331	Nestle	Nestle	45 Canal Road, Jamshoro	Omer Ali	
6	KPK14215	Fort Stones	Fstones	Peshawar main city Sadar Peshawar	Jamal Khan	
7						
8						
9						
10	Company Branch Contacts					
11	SerialNo	BranchCode	BranchName	Address	Manager	CompanyID
12	1	2302	City	254 Star Mall, Sakar	Jamil	SND50010
13	2	2303	Chilman	20 Cant Road, Peshawar	Hasan	KPK14215
14	3		Blue Area	Hafeez Plaza North Islamabad	Qadeer	PUN40021
15	4	1020	Mint Chowk	Central Road, DHA-I, Haiderabad		SND50010
16	5	2303	F-11	Bhal street, Gujrat	Ali	PUN40021
17						

You are working as a designer and Enterprise manager is asking you to design ER Diagram with mapping (table design) of given data including standard constraints for the programming team.

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- d) Draw an optimized Query Tree of the following SQL by “moving projection & selection down” to the table nodes.

```
Select C.CustName, S.Qty, P.ProdName
from Customer C, Invoice I, SoldItems S, Product P
where I.Inv#='66481'
and C.CustID=I.CustID
and I.Inv#=S.Inv#
and S.ProdID=P.ProdID
```

## Question 4:

Marks 5, 15

Consider a course registration scenario, where the maximum number of seats (S) in Data Mining course is 100. The system also keeps track of the students who registered but later on dropped the course (represented as variable D). Initially, 3 students dropped the course after registering it. Moreover, a waiting queue is maintained so that if a student drops the course, next one in queue is automatically enrolled in the course. Here in this schedule, initial count of queue (Q) is 2.

	T1	T2	T3	T4
0	Start			
1	Read S			
2		Start		
3		Read S		
4		Read Q		
5		Read D		
6		$D = D + 1$		
7		$Q = Q - 1$		
8		$S = S$		
9		Write S		
10		Write Q		
11		Write D		
12	Read D			
13	$D = D + 2$			
14	Write D			
15			Start	
16				Start
17			Read Q	
18			$Q = 0$	
19				Read D
20				$D = D + 1$
21				Write D
22			Write Q	
23	Commit			
24				Commit
25			Commit	
26		Commit		

- a) Using the schedule given above, create an undo/redo log.
- b) Assume that the system is crashed after statement 4, and all the changes at this point were already made permanent on the disk
1. State which of the transactions will be undone? And why?

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2. State which transactions will be redone? And why?
- c) Again, assume that the system is crashed after statement 15, and all the changes at this point were already made permanent on the disk
  1. State which of the transactions will be undone? And why?
  2. State which transactions will be redone? And why?
- d) Assume that the system is crashed after statement 24, and all the changes at this point were already made permanent on the disk
  1. State which of the transactions will be undone? And why?
  2. State which transactions will be redone? And why?
- e) Draw the precedence graph for this schedule and describe the serializability of a schedule.
- f) Based on the graph, find the equivalent serial schedule of this graph.

## Question 5:

Marks 20

METRO Islamabad is a retail company that sells its products to customers at cheap rates. The structure of each table along with populated data is shown in Appendix-A. Read Appendix-A carefully and write down the **single SQL** statements for each of the following scenarios:

- a) Write a dynamic query to compute the total number of customers staying in a specific Area Code entered by the user. Only include those customers who have done some purchases.
- b) Write a query to list all customers (last name, first name, and phone) whose first name starts with 'O'. Sort the results alphabetically by last name
- c) Create a query to find the customer balance characteristics (which includes the total sum of the outstanding balances, minimum, maximum, and average balance for all customers) with headings Total Balance, Minimum Balance, Maximum Balance, and Average Balance respectively.
- d) Write a query to list all products and their vendors. If there is no vendor for a product the vendor details should show null as shown below.

P_DESCRIPTION	V_NAME	V_CONTACT
1 1.25-in. metal screw, 25	Brvson, Inc.	Smithson
2 Claw hammer	Brvson, Inc.	Smithson
3 Rat-tail file, 1/8-in. fine	Gomez Bros.	Ortega
4 9.00-in. pwr. saw blade	Gomez Bros.	Ortega
5 7.25-in. pwr. saw blade	Gomez Bros.	Ortega
6 Hrd. cloth, 1/2-in., 3x50	Randsets Ltd.	Anderson
7 Hrd. cloth, 1/4-in., 2x50	Randsets Ltd.	Anderson
8 Hicut chain saw, 16 in.	ORDVA, Inc.	Hakford
9 BnD jigsaw, 8-in. blade	ORDVA, Inc.	Hakford
10 BnD jigsaw, 12-in. blade	ORDVA, Inc.	Hakford
11 Steel matting, 4'x8'x1/6", .5" mesh	Rubicon Systems	Orton
12 BnD cordless drill, 1/2-in.	Rubicon Systems	Orton
13 Power painter, 15 psi., 3-nozzle	Rubicon Systems	Orton
14 2.5-in. wd. screw, 50	D and E Supply	Singh
15 PVC pipe, 3.5-in., 8-ft	(null)	(null)
16 Sledge hammer, 12 lb.	(null)	(null)

- e) Create a query to produce the total purchase amount per invoice and invoice date as shown in the table below. The output should include only invoices where the total invoice value is greater than 100. The output should be similar to shown in the table below.

INVOICE	INDATE	\$Total Value
1003	16/01/04	153.85
1006	17/01/04	397.83
1008	17/01/04	399.15

## Tables structures for METRO Islamabad database

### CUSTOMER

Name	Null?	Type
CUS_CODE		NUMBER
CUS_LNAME		VARCHAR2 (15)
CUS_FNAME		VARCHAR2 (15)
CUS_INITIAL		VARCHAR2 (1)
CUS_AREACODE		VARCHAR2 (3)
CUS_PHONE		VARCHAR2 (8)
CUS_BALANCE		NUMBER

SQL> select \* from customer;

CUS_CODE	CUS_LNAME	CUS_FNAME	C	CUS	CUS_PHON	CUS_BALANCE
10010	Ramas	Alfred	A	615	844-2573	0
10011	Dunne	Leona	K	713	894-1238	0
10012	Smith	Kathy	W	615	894-2285	345.86
10013	Olowski	Paul	F	615	894-2180	536.75
10014	Orlando	Myron		615	222-1672	0
10015	O'Brian	Amy	B	713	442-3381	0
10016	Brown	James	G	615	297-1228	221.19
10017	Williams	George		615	290-2556	768.93
10018	Farriss	Anne	G	713	382-7185	216.55
10019	Smith	Olette	K	615	297-3809	0

10 rows selected

### INVOICE

Name	Null?	Type
INV_NUMBER		NUMBER
CUS_CODE		NUMBER
INV_DATE		DATE

SQL> select \* from invoice;

INV_NUMBER	CUS_CODE	INV_DATE
1001	10014	16/01/04
1002	10011	16/01/04
1003	10012	16/01/04
1004	10011	17/01/04
1005	10018	17/01/04
1006	10014	17/01/04
1007	10015	17/01/04
1008	10011	17/01/04

8 rows selected

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## LINE

Name	Null?	Type
INV_NUMBER		NUMBER
LINE_NUMBER		NUMBER
P_CODE		VARCHAR2 (10)
LINE_UNITS		NUMBER
LINE_PRICE		NUMBER

```
SQL> select * from line;
```

INV_NUMBER	LINE_NUMBER	P_CODE	LINE_UNITS	LINE_PRICE
1001	1	13-Q2/P2	1	14.99
1001	2	23109-HB	1	9.95
1002	1	54778-2T	2	4.99
1003	1	2238/QPD	1	38.95
1003	2	1546-QQ2	1	39.95
1003	3	13-Q2/P2	5	14.99
1004	1	54778-2T	3	4.99
1004	2	23109-HB	2	9.95
1005	1	PVC23DRT	12	5.87
1006	1	SM-18277	3	6.99
1006	2	2232/QTY	1	109.92
1006	3	23109-HB	1	9.95
1006	4	89-WRE-Q	1	256.99
1007	1	13-Q2/P2	2	14.99
1007	2	54778-2T	1	4.99
1008	1	PVC23DRT	5	5.87
1008	2	WR3/TT3	3	119.95
1008	3	23109-HB	1	9.95

18 rows selected.

## PRODUCT

Name	Type
P_CODE	VARCHAR2 (10)
P_DESCRIPT	VARCHAR2 (35)
P_INDATE	DATE
P_ONHAND	NUMBER
P_MIN	NUMBER
P_PRICE	NUMBER
P_DISCOUNT	NUMBER
V_CODE	NUMBER

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SQL> select \* from product;

P_CODE	P_DESCRIPTION	P_INDATE	P_ONHAND	P_MIN	P_PRICE	P_DISCOUNT	V_CODE
11QER/31	Power painter, 15 psi., 3-nozzle	03/11/03	8	5	109.99	0	25595
13-Q2/P2	7.25-in. pwr. saw blade	13/12/03	32	15	14.99	.05	21344
14-Q1/L3	9.00-in. pwr. saw blade	13/11/03	18	12	17.49	0	21344
1546-QQ2	Hrd. cloth, 1/4-in., 2x50	15/01/04	15	8	39.95	0	23119
1558-QW1	Hrd. cloth, 1/2-in., 3x50	15/01/04	23	5	43.99	0	23119
2232-QTY	B&D jigsaw, 12-in. blade	30/12/03	8	5	109.92	.05	24288
2232/QWE	B&D jigsaw, 8-in. blade	24/12/03	6	5	99.87	.05	24288
2238/QPD	B&D cordless drill, 1/2-in.	20/01/04	12	5	38.95	.05	25595
23109-HB	Claw hammer	20/01/04	23	10	9.95	.1	21225
23114-AA	Sledge hammer, 12 lb.	02/01/04	8	5	14.4	.05	
54778-2T	Rat-tail file, 1/8-in. fine	15/12/03	43	20	4.99	0	21344
89-WRE-Q	Hicut chain saw, 16 in.	07/02/04	11	5	256.99	.05	24288
PVC23DRT	PVC pipe, 3.5-in., 8-ft	20/02/04	188	75	5.87	0	
SM-18277	1.25-in. metal screw, 25	01/03/04	172	75	6.99	0	21225
SW-23116	2.5-in. wd. screw, 50	24/02/04	237	100	8.45	0	21231
WR3/TT3	Steel matting, 4'x8'x1/6", .5" mesh	17/01/04	18	5	119.95	.1	25595

16 rows selected.

## VENDOR

Name	Type
V_CODE	NUMBER
V_NAME	VARCHAR2 (15)
V_CONTACT	VARCHAR2 (50)
V_AREACODE	VARCHAR2 (3)
V_PHONE	VARCHAR2 (8)
V_STATE	VARCHAR2 (2)
V_ORDER	VARCHAR2 (1)

SQL> select \* from vendor;

V_CODE	V_NAME	V_CONTACT	V_A	V_PHONE	V_STATE	V_ORDER
21225	Bryson, Inc.	Smithson	615	223-3234	TN	Y
21226	SuperLoo, Inc.	Flushing	904	215-8995	FL	N
21231	D&E Supply	Singh	615	228-3245	TN	Y
21344	Gomez Bros.	Ortega	615	889-2546	KY	N
22567	Dome Supply	Smith	901	678-1419	GA	N
23119	Randsets Ltd.	Anderson	901	678-3998	GA	Y
24004	Brackman Bros.	Browning	615	228-1410	TN	N
24288	ORDVA, Inc.	Hakford	615	898-1234	TN	Y
25443	B&K, Inc.	Smith	904	227-0093	FL	N
25501	Damal Supplies	Smythe	615	890-3529	TN	N
25595	Rubicon Systems	Orton	904	456-0092	FL	Y

11 rows selected.