

THE UNIVERSITY OF FIJI

SCHOOL OF SCIENCE AND TECHNOLOGY

Department of IT & Computer Science

The University of Fiji
Library
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ITC206

DATABASE DESIGN AND IMPLEMENTATION

Semester II, 2011

FINAL EXAMINATION PAPER

Time Allowed: 3 Hours [10 Minutes Extra Allowed For Reading The Paper]

Paper Total: 100 Marks

Total Percentage: 50%

Instructions

- There are 3 main sections in this examination.

Sections	Marks
A: 25 Multiple Choice Questions	25
B: 5 Open Ended Questions	55
C: 1 Case Study	20
TOTAL	100

- ALL QUESTIONS are COMPLUSORY.
- You may ask for extra sheets from the supervisors if the need arises.
- Write your ID number on all pages used in the answer booklet and also on any extra sheet(s) attached.
- Hand in your Answer Booklet to the supervisor before you leave the Examination hall.
- This booklet contains 10 pages.

Good Luck!

Circle the letter which best represents the most appropriate answer on the grid provided with the answer booklet.

- 1) The components of a data warehouse are _____.
 - a. integrated
 - b. volatile
 - c. object-oriented
 - d. decentralized
- 2) Which of the following questions would NOT be asked by a designer viewing the database?
 - a. How must the data be structured?
 - b. How will the data be accessed?
 - c. How is the data transformed into information?
 - d. What information is needed to implement the solutions?
- 3) The _____ command is used to modify the table by deleting a row.
 - a. ERASE
 - b. DELETE
 - c. ALTER
 - d. DROP
- 4) A table is in the 4NF if _____.
 - a. all attributes must be dependent on the primary key, and must be dependent on each other
 - b. all attributes are unrelated
 - c. no row can contain two or more multivalued facts about an entity.
 - d. no column contains the same values
- 5) Which of the following is a valid name for a table?
 - a. TBL_1
 - b. 2_TBL
 - c. TBL 3
 - d. 4 tbl
- 6) _____ is defined as an advanced data analysis environment that supports decision making, business modeling, and an operation's researching activities.
 - a. VLAD
 - b. ROLAP
 - c. OLAP
 - d. DSS
- 7) "Should the existing system be replaced?" is a question that is asked during the _____ stage of the SDLC.
 - a. planning
 - b. analysis
 - c. implementation
 - d. maintenance
- 8) Before the COMMIT command is used, you can retrieve deleted records by using the _____ command.
 - a. UNDELETE
 - b. UNSAVE
 - c. BACK
 - d. ROLLBACK
- 9) _____ yields better performance.
 - a. Atomization
 - b. Normalization
 - c. Denormalization
 - d. Compression
- 10) The key's role is based on a concept known as _____.
 - a. consistency
 - b. determination
 - c. uniqueness
 - d. availability
- 11) You form compound conditions by connecting two or more simple conditions using the _____ operator.
 - a. AND
 - b. OR
 - c. NOT
 - d. All of the above

- 12) Many of the OLAP interface features are "borrowed" from previous generations of data ____ tools.
- a. module
 - b. analysis
 - c. filtering
 - d. processing
- 13) Which of the following is NOT a periodic maintenance activity performed by a database administrator?
- a. Daily system-usage summary
 - b. Preventive maintenance (backup)
 - c. Corrective maintenance (recovery)
 - d. Periodic security audits based on the system-generated statistics
- 14) When designing a database, you should ____.
- a. consider more important issues such as performance before normalizing
 - b. create table structures then normalize the database
 - c. only normalize the database when performance problems occur
 - d. make sure entities are in normal form before table structures are created
- 15) Which of the following is not a valid normal form?
- a. 1NF
 - b. BCNF
 - c. 3NF
 - d. MVNF
- 16) The referential integrity rule requires that ____.
- a. every null foreign key value must reference an existing primary key value
 - b. an attribute have a corresponding value
 - c. every non-null foreign key value reference an existing primary key value
 - d. you delete a row in one table whose primary key does not have a matching foreign key value in another table
- 17) There is a commonly accepted shorthand representation to show the structure of a relational database: After the name of the table, all the columns in the table are listed within a set of ____.
- a. square brackets
 - b. parentheses
 - c. back slashes
 - d. curly braces
- 18) A complete data warehouse ____ includes support for a DSS data store, a data extraction and integration filter, and a specialized presentation interface.
- a. database
 - b. cycle
 - c. file
 - d. architecture
- 19) The first step in developing the conceptual model using ER diagrams is ____.
- a. normalize the entities
 - b. complete the initial ER diagram
 - c. identify, analyze, and refine the business rules
 - d. define the attributes, primary keys, and foreign keys for each of the entities
- 20) The correct data type for the BALANCE column in the CUSTOMER table is ____.
- a. CHAR
 - b. INT
 - c. SMALLINT
 - d. DECIMAL

```
UPDATE tablename
*****
[WHERE conditionlist];
```

- 21) What command replaces the ***** in the above statement?
- a. SET columnname = expression
 - b. columnname = expression
 - c. expression = columnname
 - d. LET columnname = expression
- 22) A table that displays data redundancies yields ____.
- a. inconsistencies
 - b. anomalies
 - c. fewer attributes
 - d. more entities
- 23) Improving ____ leads to more flexible queries.
- a. normalization
 - b. denormalization
 - c. atomicity
 - d. derived attributes
- 24) The ____ data type is used to store integers.
- a. INTEGER
 - b. NUMERAL
 - c. NUMBER
 - d. INT
- 25) A table that has all key attributes defined, has no repeating groups, and all its attributes are dependent on the primary key, is said to be in ____.
- a. 1NF
 - b. 2NF
 - c. 3NF
 - d. 4NF

SECTION B

OPEN-ENDED

55 MARKS

Read each question carefully and write the solutions as best as you can in the answer booklet.

Question One [15 marks]

- 1) Identify and discuss the serious data redundancy problems exhibited by the file structure shown below. (The file is meant to be used as a teacher class assignment schedule). [2 marks]

BUILDING_CODE	ROOM_CODE	TEACHER_LNAME	TEACHER_FNAME	TEACHER_INITIAL	DAYS_TIME
KOM	204E	Williston	Horace	G	MWF 8:00-8:50
KOM	123	Cordoza	Maria	L	MWF 8:00-8:50
LDB	504	Patroski	Donald	J	TTh 1:00-2:15
KOM	34	Hawkins	Anne	W	MWF 10:00-10:50
JKP	225B	Risell	James		TTh 9:00-10:15
LDB	301	Robertson	Jeanette	P	TTh 9:00-10:15
KOM	204E	Cordoza	Maria	I	MWF 9:00-9:50
LDB	504	Williston	Horace	G	TTh 1:00-2:15
KOM	34	Cordoza	Maria	L	MWF 11:00-11:50
LDB	504	Patroski	Donald	J	MWF 2:00-2:50

- 2) Discuss the type of integrity that is enforced when a primary key is declared? [1 mark]
- 3) Explain the requirements that two relations must satisfy in order to be considered union-compatible? [3 marks]

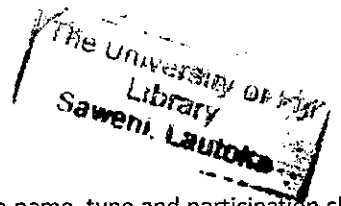
Table name: BOOTH			Table name: MACHINE		
BOOTH_PRODUCT	BOOTH_PRICE		MACHINE_PRODUCT	MACHINE_PRICE	
Chips	1.5		Chips	1.25	
Cola	1.25		Chocolate Bar	1	
Energy Drink	2		Energy Drink	2	

- 4) Use the Booth and machine tables given above to :-
- a) Perform the operation BOOTH INTERSECT MACHINE. Explain and show the result. [2 1/2 marks]
- b) Create the table that results from MACHINE DIFFERENCE BOOTH. [2 1/2 marks]

Left Outer Join			Right Outer Join		
STU_CODE	PROF_CODE	DEPT_CODE	STU_CODE	PROF_CODE	DEPT_CODE
553427	1	2	100278		
128569	2	6	531268		
531235	2	6	553427	1	2
	3	6	128569	2	6
512272	4	4	531235	2	6
			512272	4	4

- 5) Create the basic ERD for the database shown above. Include both Chens and Crows Foot solutions. [4 marks]

Question 2 [13 marks]



- 1) Given the 3NF schema below, draw the crows foot ERD. Include the relation name, type and participation clearly in your diagram. Also show PK and FK. [7 marks]

CLIENT (CLIENT_NUM, CLIENT_NAME, REGION_CODE)

CLASS (CLASS_CODE, CLASS_DESCRIPTION)

CONTRACT (CONTR_NUM, CLIENT_CODE, CONTR_DATE, REGION_CODE)

CONSULTANT (CONS_NUM, CONS_NAME, REGION_CODE)

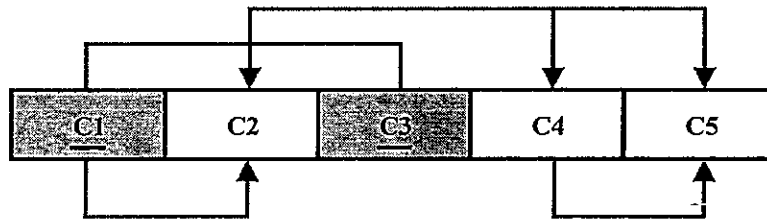
REGION (REGION_CODE, REGION_NAME)

- 2) Create an ERD based on the Crow's Foot model, using the following requirements: [6 marks]

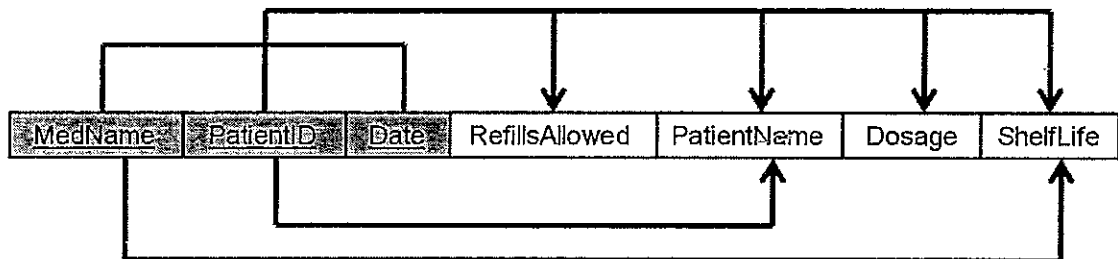
- An INVOICE is written by a SALESREP. Each sales representative can write many invoices, but each invoice is written by a single sales representative.
- The INVOICE is written for a single CUSTOMER. However, each customer can have many invoices.
- An INVOICE can include many detail lines (LINE), each of which describes one product bought by the customer.
- The product information is stored in a PRODUCT entity.
- The product's vendor information is found in a VENDOR entity.

Question 3 [13 marks]

- 1) What are business rules? Why are they important to a database designer? [2 marks]
- 2) In a SELECT query, what is the difference between a WHERE clause and a HAVING clause? [2 mark]
- 3) Given the dependency diagram shown below identify and discuss each of the indicated dependencies together with its relational schema: [3 marks]



- 4) The dependency diagram shown below indicates that a patient can receive many prescriptions for one or more medicines over time. Based on the dependency diagram, create a database whose tables are in at least 2NF, showing the dependency diagram for each table. [3 marks]



- 5) Decision support system (DSS) refers to an arrangement of computerized tools used to assist managerial decision making within a business. From a DSS point of view, summarize the major differences between operational and DSS data. [3 marks]

Question 4 [14 marks]

- 1) The Techno Car Service & Repair Centers are owned by the NEEL car dealer and it services and repairs only NEEL cars. It has three centers that provide service and repair for the entire state. Each center is independently managed and operated by a shop manager, a receptionist, and at least eight mechanics.

Each center maintains a fully stocked parts inventory. Each center also maintains a manual file system in which each car's maintenance history is kept: repairs made, parts used, costs, service dates, owner, and so on. Files are also kept to track inventory, purchasing, billing, employees' hours, and payroll. You have been contacted by the manager of one of the centers to design and implement a computerized system.

Given the preceding information, Indicate the most appropriate sequence of activities by labeling each of the following steps in the correct order. (For example, if you think that "Load the database." is the appropriate first step, label it "1.") [5 marks]

- _____ Normalize the conceptual model.
- _____ Obtain a general description of company operations.
- _____ Load the database.
- _____ Create a description of each system process.
- _____ Test the system.
- _____ Draw a data flow diagram and system flowcharts.
- _____ Create a conceptual model, using ER diagrams.
- _____ Create the application programs.
- _____ Interview the mechanics.
- _____ Create the file (table) structures.
- _____ Interview the shop manager.

- 2) What does the acronym DBLC mean and what does it portray? Thoroughly discuss its six phases. [6 marks]

- 3) Joel is a database designer for Exotic rentals, a large rental cars company located in Namaka, Lautoka and Suva. He is always busy performing maintenance activities within the database. Explain three system maintenance activities that Joel routinely carries out on the company distributed database. [3 marks]

Answer ALL the questions form this section in the answer booklet provided.

1. During a database lab class, lecturer Ms Priyanka, who specializes in SQL commands, asked her students to work in groups of two to create a dummy database for ConstructCo Company and run some queries on it. This activity was part of their two hour practical assessment. The students were provided with the following details to help make the database. She outlined a set of nine tasks to be done by each group.

ConstructCo stores data for a consulting company that tracks all charges to projects. The charges are based on the hours each employee works on each project. The structure and contents are shown in Figure 1 below.

Special Note: the ASSIGNMENT table in Figure 1 stores the JOB_CHG_HOUR values as an attribute (ASSIGN_CHG_HR) to maintain historical accuracy of the data. The JOB_CHG_HOUR values are likely to change over time. In fact, a JOB_CHG_HOUR change will be reflected in the ASSIGNMENT table. And, naturally, the employee primary job assignment might change, so the ASSIGN_JOB is also stored. Because those attributes are required to maintain the historical accuracy of the data, they are not redundant.

A handful of students could not carry out some of the tasks and kept praying for a guardian angel to help them. Now you have been assignment to help these students to use figure 1 to answer questions a – i.

Figure 1 : ConstructCo database relationship and tables

Table name: EMPLOYEE

EMP_NUM	EMP_LNAME	EMP_FNAME	EMP_INITIAL	EMP_HIREDATE	JOB_CODE	EMP_YEARS
101	News	John	G	08-Nov-00	502	8
102	Senior	David	H	12-Jul-89	501	19
103	Arbough	June	E	01-Dec-96	503	12
104	Ramoras	Anne	K	15-Nov-87	501	21
105	Johnson	Alice	K	01-Feb-93	502	16
106	Smithfield	William		22-Jun-01	500	4
107	Aloezzo	Maria	D	10-Oct-83	500	15
108	Washington	Ralph	B	22-Aug-81	501	17
109	Smith	Larry	W	18-Jul-87	501	11
110	Olenko	Gerald	A	11-Dec-95	505	13
111	Wabash	Geoff	B	04-Apr-81	506	17
112	Smithson	Darlene	M	23-Oct-91	507	14
113	Joenbrood	Delbert	K	15-Nov-95	508	12
114	Jones	Annelise		20-Aug-93	508	15
115	Bawangi	Travis	B	25-Jan-82	501	17
116	Pratt	Gerald	L	05-Mar-97	510	12
117	Williamson	Angie	H	19-Jun-96	509	12
118	Frommer	James	J	04-Jan-05	510	4

Table name: JOB

JOB_CODE	JOB_DESCRIPTION	JOB_CHG_HOUR	JOB_LAST_UPDATE
500	Programmer	35.75	20-Nov-09
501	Systems Analyst	96.75	20-Nov-09
502	Database Designer	125.00	24-Mar-10
503	Electrical Engineer	84.50	20-Nov-09
504	Mechanical Engineer	67.90	20-Nov-09
505	Civil Engineer	55.78	20-Nov-09
506	Clerical Support	26.87	20-Nov-09
507	DSS Analyst	45.95	20-Nov-09
508	Applications Designer	48.10	24-Mar-10
509	Bio Technician	34.55	20-Nov-09
510	General Support	18.36	20-Nov-09

Table name: PROJECT

PROJ_NUM	PROJ_NAME	PROJ_VALUE	PROJ_BALANCE	EMP_NUM
15	Evergreen	1453500.00	1002350.00	103
18	Amber Waves	3500500.00	2110346.00	108
22	Rolling Tide	805000.00	500345.20	103
25	Starflight	2650500.00	2308890.00	107

Table name: ASSIGNMENT

ASSIGN_NUM	ASSIGN DATE	PROJ_NUM	EMP_NUM	ASSIGN_JOB	ASSIGN_CHG_HR	ASSIGN_HOURS	ASSIGN_CHARGE
1001	22-Mar-10	18	103	503	84.50	3.5	295.75
1002	22-Mar-10	22	117	509	34.55	4.2	145.11
1003	22-Mar-10	18	117	509	34.55	2.0	69.10
1004	22-Mar-10	18	103	503	84.50	5.9	498.55
1005	22-Mar-10	25	106	501	96.75	2.2	212.85
1006	22-Mar-10	22	104	501	96.75	4.2	406.35
1007	22-Mar-10	25	113	508	50.75	3.0	192.85
1008	22-Mar-10	18	103	503	84.50	0.9	76.05
1009	23-Mar-10	15	115	501	96.74	5.6	541.80
1010	23-Mar-10	15	117	509	34.55	2.4	82.92
1011	23-Mar-10	25	105	502	105.00	4.3	451.50
1012	23-Mar-10	18	106	501	96.75	3.4	378.95
1013	23-Mar-10	25	115	501	96.75	2.0	193.50
1014	23-Mar-10	22	104	501	96.75	2.0	270.90
1015	23-Mar-10	15	103	503	84.50	6.1	515.45
1016	23-Mar-10	22	105	502	105.00	4.7	493.50
1017	23-Mar-10	18	117	509	34.55	3.6	131.28
1018	23-Mar-10	25	117	509	34.55	2.2	76.01
1019	24-Mar-10	25	104	501	110.50	4.9	541.45
1020	24-Mar-10	15	101	502	125.00	3.1	367.50
1021	24-Mar-10	22	106	501	110.50	2.7	296.35
1022	24-Mar-10	22	115	501	110.50	4.9	541.45
1023	24-Mar-10	22	105	502	125.00	3.9	437.50
1024	24-Mar-10	15	103	503	84.50	3.3	278.85
1025	24-Mar-10	18	117	509	34.55	4.2	145.11

- a) Prashneel and Arjun know the basic EMP_1 table structure and have summarized it in the table below but they don't know how to write the SQL code that will create the table structure for this table named EMP_1, which is a subset of the EMPLOYEE table, where the JOB_CODE is the FK to JOB. You write the code for them [2 marks]

ATTRIBUTE (FIELD) NAME	DATA DECLARATION
EMP_NUM	CHAR(3)
EMP_LNAME	VARCHAR(15)
EMP_FNAME	VARCHAR(15)
EMP_INITIAL	CHAR(1)
EMP_HIREDATE	DATE
JOB_CODE	CHAR(3)

- b) Having successfully created the table structure for EMP_1, Farnaaz and Temesi are now confused how to write the SQL code to enter values into the table. Show them how to write the insert command for the first two rows from the table shown below. [2 marks]

EMP_NUM	EMP_LNAME	EMP_FNAME	EMP_INITIAL	EMP_HIREDATE	JOB_CODE
101	News	John	G	08-Nov-00	502
102	Senior	David	H	12-Jul-89	501
103	Arbough	June	E	01-Dec-96	500
104	Ramoras	Anne	K	15-Nov-87	501
105	Johnson	Alice	K	01-Feb-93	502
106	Smithfield	William		22-Jun-04	500
107	Alonzo	Maria	D	10-Oct-93	500
108	Washington	Ralph	B	22-Aug-91	501

- c) Rajneel and Karthik were the first group to create EMP_1 and insert all data shown above in their table. However they got stuck trying to write the SQL code that will list all attributes for a job code of 502. They need your help. [1 1/2 marks]
- d) Reshma told Yoshneel to use select statement with a condition to list all employees whose last names start with *Smith*. Execution causes an error. Help them write the correct code. (Hint: both Smith and Smithfield should be included in the listing. Assume case sensitivity). [2 marks]
- e) Help Kolonio and Jotame write the SQL code to delete the row for the person named William Smithfield, who was hired on June 22, 2004, and whose job code classification is 500. (Hint: Use logical operators to include all of the information given in this problem.) [3 marks]
- f) Assist Timoci and Sisa in using a single command sequence to write the SQL code that will change the project number (PROJ_NUM) to 18 for all employees whose job classification (JOB_CODE) is 500. [1 1/2 marks]
- g) Instead of helping, Abisheik confused Arshad and now he can't write the correct code to calculate the ASSIGN_CHARGE values in the ASSIGNMENT table. You have to write the correct code now. Note that ASSIGN_CHARGE is a derived attribute -- calculated by multiplying ASSIGN_CHG_HR by ASSIGN_HOURS. [3 marks]
- h) Melaia and Lanieta found difficulty in creating the SQL code that will produce the results shown in table given below. You use EMPLOYEE, JOB, and PROJECT tables and write the code to help them. [3 marks]

PROJ_NAME	PROJ_VALUE	PROJ_BALANCE	EMP_LNAME	EMP_FNAME	EMP_INITIAL	JOB_CODE	JOB_DESCRIPTION	JOB_CHG_HOUR
Rolling Tide	805000.00	500345.20	Senior	David	H	501	Systems Analyst	96.75
Evergreen	1453500.00	1002350.00	Arbough	June	E	500	Programmer	35.75
Starflight	2650500.00	2309880.00	Alonzo	Maria	D	500	Programmer	35.75
Amber Wave	3500500.00	2110346.00	Washington	Ralph	B	501	Systems Analyst	96.75

- i) Fazil is the only person who doesn't have a project partner and is working on this assessment all alone. He needs your undivided help and guidance at this point in time. All you have to do this time is to write a query to count the number of employees. [2 marks]