ICT502 - final paper

Database Engineering (Universiti Teknologi MARA)

UNIVERSITI TEKNOLOGI MARA
FINAL EXAMINATION

COURSE	:	**DATABASE ENGINEERING**
COURSE CODE	:	**ICT502/ITS571**
EXAMINATION	:	**FEBRUARY 2023**
TIME	:	**3 HOURS**

INSTRUCTIONS TO CANDIDATES

1. This question paper consists of five (5) questions.
2. Answer ALL questions in the Answer Booklet. Start each answer on a new page.
3. Do not bring any material into the examination room unless permission is given by the invigilator.
4. Please check to make sure that this examination pack consists of:
   a) the Question Paper
   b) an Answer Booklet – provided by the Faculty
5. Answer ALL questions in English.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

This examination paper consists of 7 printed pages

QUESTION 1

a) Explain with an appropriate example of data dependency in a file-based approach.

(4 marks)

b) Discuss an end-user who will frequently use a data warehouse and give an example of the type of analysis that will be needed by this end-user.

(3 marks)

c) Table 1.0 shows an example of the first half of 2020 sales data from Famous Amore's data warehouse.

Table 1.0: Sales Data

PRODUCT	QUANTITY	MONTH	BRANCH
Macadamia	55	February	Jasin
Hazelnut	85	January	Alor Gajah
Peas	100	April	Jasin
Peas	95	March	Alor Gajah
Hazelnut	75	January	Alor Gajah
Macadamia	120	May	Alor Gajah
Peas	30	March	Jasin
Macadamia	150	January	Alor Gajah
Hazelnut	20	Jun	Jasin
Macadamia	70	May	Jasin
Hazelnut	69	February	Jasin
Peas	175	March	Jasin
Macadamia	60	Jun	Alor Gajah

Based on the data in Table 1.0, the main headquarters will analyse the sales of their products for the first six months of the year. Answer the following questions:

i) State the fact table and its dimension tables.

(3 marks)

ii) Draw a data cube for analysis of how many sales there were for each product in every month for the Jasin branch.

(6 marks)

iii) Dice the data for the product name 'Peas' based on the data cube in (ii).

(2 marks)

d) Explain the needs of data quality management in data warehouse implementation.

(2 marks)

QUESTION 2

a) The relational schema below shows the examination registration system for students in College Jati. Each student will be assigned a location (hall) for each subject that they have registered for.

STUDENT	(stid, stname, staddress, stcitycode, stemail, stphone, stfac)
EXAM	(examid, examdate, examtime, stid*, subcode*, hallid*)
SUBJECT	(subcode, subname, lecid*)
HALL	(hallid, hallname, halllocation. hallcapacity)
LECTURER	(lecid, lecname, lecemail, lecphone, lecfac)

For each subject, there is a lecturer-in-charge who should be contacted during the examination if there is any problem with the questions.

Answer the following questions by using **Structured Query Language (SQL)**.

i) Lock the rows for students from "Kuala Lumpur".

(2 marks)

ii) Change the data in column `stcitycode` for students from "Kuala Lumpur" to "WPKL".

(2 marks)

iii)Make the changes in (ii) permanent.

(1 mark)

b) Answer the following questions by using relational algebra and SQL.

i) Identify the lecturer's name and the number of their subjects for those lecturers who are in charge of more than two subjects.

(7 marks)

ii) List the code of subjects for examination taken by Siti Nurhaliza in January 2020, as in Table 2.0. Follow the format accordingly.

Table 2.0

STUDENT ID	STUDENT NAME	SUBJECT CODE	EXAM DATE
201922233	Siti Nurhaliza	ITS571	10th January 2020
201922233	Siti Nurhaliza	ITS570	13th January 2020
201922233	Siti Nurhaliza	ITS544	15th January 2020
201922233	Siti Nurhaliza	ITS520	17th January 2020

Hint: The default date format is "DD-MON-YYYY".

(8 marks)

QUESTION 3

a) List **FOUR (4)** recovery facilities in a database.

(4 marks)

b) Study the following transaction table.

Transaction 1.0

Transaction ID	Time	Action	Table	Row	Column	Old Value	New Value
T1	t1	Start					
T2	t2	Start					
T1	t3	Update	Staff	22	Name	Lesley	Hanabi
T1	t4	Commit					
T3	t5	Start					
T3	t6	Update	Staff	08	Name	Kadita	Lolita
	t7	CHECKPOINT					
T4	t8	Start					
T1	t9	Delete	Staff	19	Name	Layla	NULL
T3	t11	Commit					
T4	t12	Delete	Staff	88	Name	Esmeralda	NULL
T4	t13	Commit					
	t14	CRASH					

The transaction table shows the operation done from 10 a.m. until 11 a.m. on 15th March 2020. Answer the following questions.

i) Draw the transaction recovery timeline for transaction 1.0 above.

(6 marks)

ii) For each transaction, as illustrated in (i), state the recovery process to be done if the database administrator chooses the Immediate Update Recovery technique.

(4 marks)

iii) State the value of rows 22 and 88 after the recovery process in (ii) is finished.

(2 marks)

c) Read consistency in a database environment ensures that multiple users can use the same system at the same time. One day, Aini was trying to update Haslina's address in the "Employees" table. At the same time, the manager, Atiqah, is trying to view the employees' demographic data. The rule of read consistency states that readers do not wait for writers and vice versa. Explain how Atiqah can see consistent data about Haslina's address while Aini is updating the data.

(4 marks)

QUESTION 4

a) The query tree in Figure 1.0 shows the process of fetching data in the Human Resource (HR) schema.

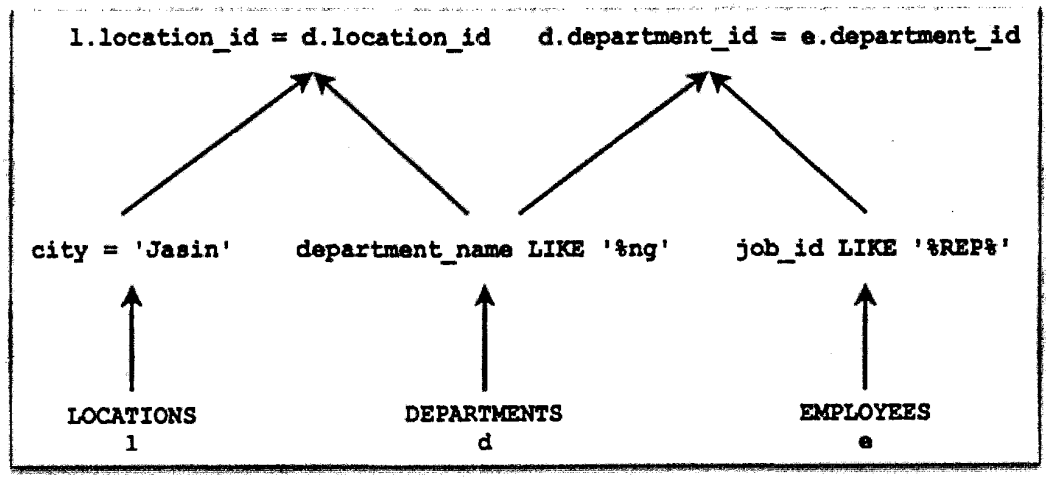

Figure 1.0

Based on the query tree in Figure 1.0, construct the SQL.

(4 marks)

b) In Database Management Systems (DBMS) approach, database is located at server and the processes are split between server and client. Illustrate the concept of a centralized database.

(4 marks)

c) Correctness rules are important to make sure that the fragmentation is correct. In the Distributed Database Management Systems (DDBMS) approach, explain **TWO (2)** correctness rules for fragmentation.

(4 marks)

d) The relational schema below shows the structure of the database of a movie rental company.

CUSTOMER	(custid, custname, custphone, custemail)
STAFF	(staffid, staffname, staffaddress, staffemail, staffphone, salary)
RENT	(rentid, rentstartdate, rentenddate, staffid*, custid*, movid*)
MOVIE	(movid, movname, releaseyear, rentprice, genreid*)
PRODUCER	(prodid, prodname, prodcountry)
MOV_PROD	(movid*, prodid*, quantity)
GENRE	(genreid, genrename, genredescription)

Each day, customers will come and rent movies for charity events in Kuala Lumpur. Because the company works closely with all movie producers, the top management decided to categorise movie and producer data by genre, which are as follows:

Genre ID	Genre Name
1	Romantic Comedy
2	Thriller
3	Crime
4	Action

Answer the following questions.

i) State the possibility of fragmentation type for each table if the company is trying to divide the movies and producers according to their genre.

(4 marks)

ii) Based on answer (i), show the possible table(s) that can be fragmented using relational algebra.

(4 marks)

QUESTION 5

a) Explain the importance of system definition in database development life cycle.

(2 marks)

b) As one of its benefits, the AirPro company provides quarters for its employees. Currently, the staff needs to apply for quarters through a paper-based system to the welfare department. Since the company has more than 200 staffs, the department has problems managing bulk applications at one time. Hence, the top management has decided to develop a database management system for quarters applications with these requirements:

- Staff details must be provided, such as their ID, full name, email, salary, and current branch.
- A branch has many staff that are eligible to apply for quarters.
- Quarters are divided into terrace or apartment types, which have different attributes.
- Many staff can apply for quarters that will be approved by the manager.
- Each application will have a status of "pending," "approved or "rejected."
- The staff can reapply for the quarters if the previous application is rejected.

As a database designer, you are required to design the entity relationship diagram (ERD) with cardinality and modality before the development stage starts. You can add any appropriate data to the ERD to complete the basic requirements.

(14 marks)

c) Describe **TWO (2)** criteria for creating an optimal data model.

(4 marks)

END OF QUESTION PAPER