UNIVERSITI SAINS MALAYSIA

First Semester Examination
2016/2017 Academic Session

December 2016 / January 2017

CMT221/CMM222 – Database Organisation & Design
[Organisasi & Reka Bentuk Pangkalan Data]

Duration : 2 hours
[Masa : 2 jam]

INSTRUCTIONS TO CANDIDATE:
[ARAHAN KEPADA CALON:]

- Please ensure that this examination paper contains **FOUR** questions in **TEN** printed pages before you begin the examination.

  *[Sila pastikan bahawa kertas peperiksaan ini mengandungi **EMPAT** soalan di dalam **SEPULUH** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

- Answer **ALL** questions.

  *[Jawab **SEMUA** soalan.]*

- You may answer the questions either in English or in Bahasa Malaysia.

  [Anda dibenarkan menjawab soalan sama ada dalam bahasa Inggeris atau bahasa Malaysia.]

- In the event of any discrepancies, the English version shall be used.

  [Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi bahasa Inggeris hendaklah diguna pakai.]

1. (a) The DBMS helps the data management more efficient compared to the file system data management. Describe f**ive** (**5**) advantages of DBMS.

*DBMS membantu pengurusan data yang lebih efisien berbanding pengurusan data secara fail. Senaraikan **lima** (**5**) kelebihan-kelebihan DBMS kepada pengguna.*

(10/100)

(b) What is a key and how is it important in a relational model?

Apakah itu kunci dan bagaimana kunci ini penting dalam model hubungan?

(5/100)

(c) What are the **two** (**2**) integrity rules? By using the example below, explain with examples how these rules are important for a good database design and implementation.

*Senaraikan **dua** (**2**) jenis peraturan-peraturan integriti. Dengan menggunakan contoh di bawah, terangkan bersama contoh-contoh bagaimana peraturan-peraturan ini penting untuk mereka bentuk pangkalan data yang baik.*

SINGER

Singer_ID	Name	Company	Telephone
212	Lizzy Tan	ABC Record	0125678910
232	Zam Slam	JSC Music	0176789123
435	David Arumugan	Alley&Cats Production	0132345890

ALBUM

Album_num	Singer_ID	Album_title	Year	Price
1	232	Crush	2016	25.90
2	435	Beautiful day	2010	18.50
3	212	Day & night	2014	20.00

(10/100)

2. (a) Create an ERD in Crow's Foot or UML notation that can be implemented in the relational model using the following description of operations.

Hot Water (HW) is a small start-up company that sells spas. HW does not carry any stock. A few spas are set up in a simple warehouse so customers can see some of the models available, but any products sold must be ordered at the time of the sale.

- HW can get spas from several different manufacturers.
- Each manufacturer produces one or more different brands of spas.
- Each and every brand is produced by only one manufacturer.
- Every brand has one or more models.
- Every model is produced as part of a brand.
- Every manufacturer is identified by a manufacturer code. The company name, address, area code, phone number, and account number are kept in the system for every manufacturer.
- For each brand, the brand name and brand level (premium, mid-level, or entry-level) are kept in the system.
- For each model, the model number, number of jets, number of motors, number of horsepower per motor, suggested retail price, HW retail price, dry weight, water capacity, and seating capacity must be kept in the system.

Note: Make sure that you include the attributes that able to show relevant entities with all connectivity and cardinality.

Ciptakan ERD dalam Crow's Foot atau notasi UML yang boleh dilaksanakan dalam model hubungan menggunakan penerangan operasi-operasi berikut.

Hot Water (HW) adalah sebuah syarikat kecil peringkat permulaan yang menjual spa. HW tidak mempunyai apa-apa stok. Beberapa spa dipasang di satu gudang sederhana supaya pelanggan boleh melihat beberapa model yang sediada, tetapi mana-mana produk yang dijual mesti dipesan pada masa jualan.

- *HW boleh mendapatkan spa dari beberapa pengeluar yang berbeza.*
- *Setiap pengeluar menghasilkan satu atau lebih banyak jenama spa yang berbeza.*
- *Setiap jenama yang dihasilkan oleh hanya satu pengilang.*
- *Setiap jenama mempunyai satu atau lebih model.*
- *Setiap model dihasilkan sebagai sebahagian daripada jenama.*
- *Setiap pengeluar dikenalpasti dengan kod pengilang. Nama syarikat, alamat, kod kawasan, nombor telefon, dan nombor akaun disimpan dalam sistem untuk setiap pengeluar.*
- *Bagi setiap jenama, nama jenama dan tahap jenama (premium, peringkat pertengahan atau peringkat kemasukan) disimpan di dalam sistem.*
- *Bagi setiap model, nombor model, bilangan jet, bilangan motor, bilangan kuasa kuda per motor, cadangan harga runcit, harga runcit HW, berat kering, kapasiti air, dan kapasiti tempat duduk mesti disimpan di dalam sistem.*

Nota: *Pastikan anda memasukkan atribut-atribut yang dapat menunjukkan entiti yang berkaitan dengan hubungan dan kardinaliti.*

(10/100)

(b) Given the two entities DOCTOR and PATIENT, where their relationships are 1:M (one to many).

Diberikan dua entiti DOCTOR *dan* PATIENT*, di mana hubungan mereka adalah 1:M (satu ke banyak).*

DOCTOR	
PK	DOC_ID
	DOC_LNAME
	DOC_FNAME
	DOC_CONTACT

PATIENT	
PK	PATIENT_ID
	PAT_LNAME
	PAT_FNAME
	PAT_CONTACT

Based on the entities given:

Berdasarkan entiti-entiti yang diberikan:

(i) Create an entity relationship diagram (ERD) based on the Crow's Foot or UML model to denote entities DOCTOR and PATIENT has a **strong** relationship.

Ciptakan gambar rajah hubungan entiti (ERD) berdasarkan Crow's Foot atau model UML untuk menunjukkan entiti-entiti DOCTOR dan PATIENT mempunyai perhubungan yang kuat.

(ii) Create an entity relationship diagram (ERD) based on the Crow's Foot or UML model to denote entities DOCTOR and PATIENT has a **weak** relationship.

Ciptakan gambar rajah hubungan entiti (ERD) berdasarkan Crow's Foot atau model UML untuk menunjukkan entiti-entiti DOCTOR dan PATIENT mempunyai perhubungan yang lemah.

(5/100)

(c) What is an entity **supertype**, and why is it used?

*Apakah itu entiti **supertype**, dan mengapa ia digunakan?*

(3/100)

(d) Given the following business scenario, create an ERD in Crow's Foot or UML notation using a specialization hierarchy where appropriate.

Two-Bit Drilling Company keeps information on employees and their insurance dependents. Each employee has an employee number, name, date of hire, and designation. If an employee is an inspector, then the date of certification and the renewal date for that certification should also be recorded in the system. For all employees, the identification card (IC) number and dependent names should be kept. All dependents must be associated with one and only one employee. Some employees may not have dependents, while others will have many dependents.

Diberikan senario perniagaan berikut, ciptakan satu ERD dalam Crow's Foot atau notasi UML menggunakan hierarki pengkhususan di mana sesuai.

Dua-Bit Drilling Company menyimpan maklumat bagi pekerja dan insurans tanggungan mereka. Setiap pekerja mempunyai nombor pekerja, nama, tarikh sewa, dan jawatan. Sekiranya seseorang pekerja itu adalah pemeriksa, maka tarikh pensijilan dan tarikh pembaharuan pensijilan perlu juga direkodkan dalam sistem. Untuk semua pekerja, nombor kad pengenalan (KP) dan nama tanggungan hendaklah disimpan. Semua tanggungan mesti dikaitkan dengan satu dan hanya satu pekerja. Sesetengah pekerja berkemungkinan tidak mempunyai tanggungan, manakala yang lain akan mempunyai banyak tanggungan.

(7/100)

3. Answer the questions based on the following tables. Provide the SQL statements for the following questions:

Jawab soalan-soalan berikut berdasarkan jadual-jadual di bawah. Berikan kenyataan-kenyataan SQL untuk soalan-soalan berikut:

Table: EMPLOYEE
Jadual: EMPLOYEE

EMP_ID	EMP_NAME	EMP_STREET	EMP_CITY
100	Raju Mundy	45 Beech Street	Georgetown
101	Lee Chin Seong	22 Main Street	Ipoh
102	Simon Teh	21 Garden Lane	Ipoh
103	Ghazi Salleh	67 Alley Drive	Shah Alam
104	Anis Soleha	32 Francis Street	Shah Alam
105	Kathy Lim	11 River Lane	Petaling Jaya
106	Anusya Sivaraju	10 Alor Street	Petaling Jaya

Table: COMPANY
Jadual: COMPANY

COM_ID	COM_NAME	COM_CITY
900	First Bank Corporation	Georgetown
901	Trendy Financial Services	Ipoh
902	Second Bank Corporation	Shah Alam
903	Power Investment Corporation	Petaling Jaya

Table: WORK
Jadual: WORK

EMP_ID	COM_ID	SALARY
100	900	51000.00
101	901	30000.00
102	901	27600.00
103	902	46500.00
104	902	18000.00
105	903	20000.00
106	903	26000.00

(a) (i) Add a new column MANAGER_ID to table EMPLOYEE. Set the data type for MANAGER_ID to integer. Define MANAGER_ID as a foreign key referencing EMP_ID.

Tambahkan satu lajur MANAGER_ID dalam jadual EMPLOYEE. Tetapkan jenis data integer bagi MANAGER_ID. Tetapkan MANAGER_ID sebagai kunci asing yang merujuk EMP_ID.

(ii) Update MANAGER_ID column in EMPLOYEE table following the conditions below.

Kemas kini lajur MANAGER_ID dalam jadual EMPLOYEE mengikut syarat-syarat berikut.

EMP_ID	MANAGER_ID
101 and 102	100
104, 105 and 106	103

(iii) Find the IDs and salary of all employees who do not work for company with the ID 900. Sort by employee salary in descending order.

Senaraikan ID dan gaji bagi semua pekerja yang tidak bekerja untuk syarikat dengan ID 900. Susun senarai tersebut mengikut gaji pekerja dalam turutan menurun.

(iv) Find the names, streets, and cities of residence for all employees who work for 'Second Bank Corporation' and earn more than $20,000.00.

Senaraikan nama-nama, jalan-jalan dan bandar-bandar bagi semua pekerja yang bekerja di 'Second Bank Corporation' dan mendapat gaji lebih daripada $20,000.00.

(v) List the company ID and the number of employees with total salary of employees above or equal to $50,000.00 for each company.

Senaraikan ID syarikat dan bilangan pekerja yang mempunyai jumlah gaji sekurang-kurangnya $50,000.

(18/100)

(b) (i) What is a trigger? Give an example when the use of a trigger would be appropriate.

Apakah maksud 'trigger'? Berikan satu contoh penggunaan yang sesuai bagi 'trigger'.

(ii) Create a stored procedure to add a new employee to the EMPLOYEE table. Use the following values in the new record:

107, 'Tan Joi San', '21 Bright Street', 'Shah Alam'

Name the stored procedure PRC_EMP_ADD. Run a query to see if the record has been added.

Tuliskan 'stored procedure' untuk menambah rekod pekerja baru dalam jadual EMPLOYEE. Gunakan nilai di bawah untuk menjana rekod baru.

107, 'Tan Joi San', '21 Bright Street', 'Shah Alam'

Namakan 'stored procedure' tersebut sebagai PRC_EMP_ADD. Tuliskan kenyataan SQL untuk memeriksa sama ada rekod tersebut telah ditambah.

(7/100)

4. (a) A school teacher creates a table to track her student attendance. Some rows of the table are shown as follows:

S_ID	Matric	Date	Time	Sub_ID	Sub_Name	Stu_Name	Gender	Status
S001	112231	1-Oct-16	9-11 am	ENG001	English	Ali	Male	Present
S002	112231	8-Oct-16	9-11 am	ENG001	English	Ali	Male	Absent
S003	112231	1-Oct-16	2-4 pm	COM001	Computer	Ali	Male	Present
S004	112231	8-Oct-16	2-4 pm	COM001	Computer	Ali	Male	Present
S001	112233	1-Oct-16	9-11 am	ENG001	English	Fatimah	Female	Absent
S002	112234	8-Oct-16	9-11 am	ENG001	English	Fatimah	Female	Absent
S003	112235	1-Oct-16	2-4 pm	COM001	Computer	Fatimah	Female	Present
S004	112236	8-Oct-16	2-4 pm	COM001	Computer	Fatimah	Female	Present

S_ID : Session ID
Date : Session date
Time : Session time
Sub_ID : Subject ID
Sub_Name : Subject name
Matric : Matric number
Stu_Name : Student's name
Gender : Student's gender (Female or Male)
Status : Attendance status (Present or Absent)

Seorang guru sekolah menjana satu jadual untuk mengesan kehadiran pelajarnya. Sebahagian baris jadual itu ditunjuk seperti berikut:

S_ID	*Matric*	*Date*	*Time*	*Sub_ID*	*Sub_Name*	*Stu_Name*	*Gender*	*Status*
S001	*112231*	*1-Oct-16*	*9-11 am*	*ENG001*	*English*	*Ali*	*Male*	*Present*
S002	*112231*	*8-Oct-16*	*9-11 am*	*ENG001*	*English*	*Ali*	*Male*	*Absent*
S003	*112231*	*1-Oct-16*	*2-4 pm*	*COM001*	*Computer*	*Ali*	*Male*	*Present*
S004	*112231*	*8-Oct-16*	*2-4 pm*	*COM001*	*Computer*	*Ali*	*Male*	*Present*
S001	*112233*	*1-Oct-16*	*9-11 am*	*ENG001*	*English*	*Fatimah*	*Female*	*Absent*
S002	*112234*	*8-Oct-16*	*9-11 am*	*ENG001*	*English*	*Fatimah*	*Female*	*Absent*
S003	*112235*	*1-Oct-16*	*2-4 pm*	*COM001*	*Computer*	*Fatimah*	*Female*	*Present*
S004	*112236*	*8-Oct-16*	*2-4 pm*	*COM001*	*Computer*	*Fatimah*	*Female*	*Present*

S_ID : ID sesi
Date : Tarikh sesi
Time : Waktu sesi
Sub_ID : ID subjek
Sub_Name : Nama subjek
Matric : Nombor matrik
Stu_Name : Nama pelajar
Gender : Jantina (Female atau Male)
Status : Status kehadiran (Present atau Absent)

(i) Based on the table above, draw a dependency diagram. Ensure that each of the dependency is correctly identified and labelled.

Berdasarkan jadual di atas, lukiskan satu gambar rajah bersandaran. Pastikan setiap kebersandaran itu dikenal pasti dan dilabel dengan betul.

(ii) Based on the dependency diagram which you created in 4(a)(i), describe and illustrate the process of normalizing the above table to 3NF. List down any assumptions you make about the data shown in the table.

Berdasarkan gambar rajah bersandaran yang dihasilkan dalam 4(a)(i), terangkan dan gambarkan proses penormalan jadual di atas kepada 3NF. Senaraikan sebarang andaian yang dibuat atas data yang ditunjuk dalam jadual.

(10/100)

(b) A toy manufacturer has four factories in Perlis, Kedah, Perak, and Sarawak. Its headquarter is located in Pulau Pinang. The employee relation of this toy manufacturer is fragmented horizontally by `factory_number`:

Satu pengilang alat permainan mempunyai empat kilang di Perlis, Kedah, Perak, dan Sarawak. Ibu pejabatnya terletak di Pulau Pinang. Jadual pekerja pengilang alat permainan ini difragmentasikan secara mendatar mengikut `factory_number`:

```
employee (name, address, salary, factory_number)
```

Assume that each fragment has two replicas: one stored at the headquarter located in Pulau Pinang, and the other one located locally at the factory site. Prescribe a processing strategy for the following queries entered at the Sarawak site.

Andaikan setiap serpihan itu ada dua replika: satu disimpan di ibu pejabat yang terletak di Pulau Pinang, dan satu lagi disimpan setempat di tapak kilang. Preskripsikan satu strategi untuk pertanyaan berikut yang dibuat di Sarawak.

(i) Find all employees at the Kedah and Perlis factories.

Cari semua pekerja yang berada di kilang yang terletak di Kedah dan Perlis.

(ii) Find the average salary of all employees.

Cari gaji purata semua pekerja.

(iii) Find the employee(s) with the highest salary at each of the following factory: Perlis, Kedah, and Perak.

Cari pekerja yang bergaji tertinggi di setiap kilang berikut: Perlis, Kedah, dan Perak.

(9/100)

(c) Company ABC operates in a region where typhoon is common. It generates a large amount of transactional data daily and the data is critical to the company operation. In order to protect the company database, the management is currently practising a database backup plan as follows:

"Multiple backups are made every six months. All the backups are located at the same site. The site to store the backups is humid and hot, and it is not fire-safe and quakeproof."

Highlight three problems of the current backup plan and propose a backup plan to address the identified problems.

Syarikat ABC beroperasi di satu kawasan yang sering dilanda taufan. Syarikat ini menjana data transaksi yang banyak setiap hari dan data tersebut adalah penting dalam operasi syarikat. Untuk melindungi pangkalan data syarikat, pihak pengurusan sedang mempraktikkan satu pelan sandaran pangkalan data seperti berikut:

"Pelbagai salinan sandar dibuat setiap enam bulan. Semua salinan sandar diletakkan di tempat yang sama. Tapak penyimpanan salinan sandar adalah lembap dan panas, dan tapak itu adalah tidak selamat daripada api dan gegaran gempa bumi."

Serlahkan tiga masalah pelan sandaran tersebut dan cadangkan satu pelan sandaran yang boleh mengatasi masalah-masalah itu.

(6/100)