UNIVERSITI SAINS MALAYSIA

Second Semester Examination
[Peperiksaan Semester Kedua]

Academic Session 2007/2008
[Sidang Akademik 2007/2008]

April 2008

CMT221/CMM222/CMT201 – Database Organisations & 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 **ELEVEN** printed pages before you begin the examination.

  *[Sila pastikan bahawa kertas peperiksaan ini mengandungi **EMPAT** soalan di dalam **SEBELAS** 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.]

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1. (a) There are several sections in USM Hamzah Sendut Library. Some of them are:

- Reader & Extension Services Division: Processes item borrowing and returns as well and handling patron problems and queries.
- Reference & Research Division: Manages reference items and inter-library loans; and
- Acquisition section: Manages item acquisition/purchases from licensed suppliers.

Suppose each section keeps and maintains its own data separately. Discuss briefly **three** (**3**) problems that may arise. Relate your discussion to the library above.

(6/100)

(b) For each of the entities in the following list (left side), identify whether each of the items on the right should be an attribute of that entity or a separate entity.

(i) SALE: Date, Item, Tax, Customer, Salesperson

(ii) PACKAGE: Size, Weight, Address, Customer, Delivery Truck, Employee

(iii) CAMERA: Customer, Megapixels, Battery, Lens, Price, Weight

(iv) CLUB: Name, School, Purpose, Member, Advisor, Activity

(12/100)

(c) What are **two** (**2**) of the components of a database management system (DBMS)? For each component you identified, explain the problems that would arise if the component were not there.

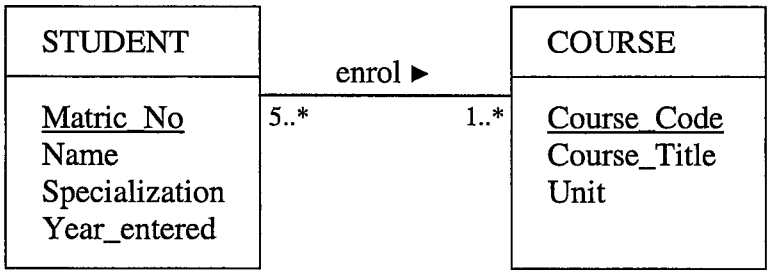
(7/100)

2. (a) As part of a reverse engineering activity, the USM Library provides you with the following relational schema in order to improve its book loan subsystem. Map the relational schema into an ER Diagram using UML notation. Complete the ER Diagram with proper relationship names and multiplicity constraints. State any assumptions you made, if necessary.

BOOK (**Book_ID**, Title, Publisher_name)
AUTHORS (**Book_ID**, Author_name)
PUBLISHER (**Name**, Address, Phone)
BOOK-COPIES (**Book_ID**, **Branch_ID**, No_of_copies)
BOOK-LOAN (**Book_ID**, **Branch_ID**, **Card_no**, Date_out, Due_date)
LIB-BRANCH (**Branch_ID**, Branch_name, Address)
BORROWER (**Card_no**, Name, Address, Phone)

(13/100)

(b) Is it possible to successfully map a binary M:N (many-to-many) relationship type without requiring a new relation? Why or why not? Map the following ER diagram to justify your answer.



(7/100)

(c) What does a null value represent? How do null values affect the two relational integrity rules of a database? Explain your answer using any simple example.

(5/100)

3. (a) Why is a client-server database more efficient than a database on a simple file server? Give **three (3)** reasons.

(5/100)

(b) Consider the following two forms: **Bill of Materials** and **Routing**.

BILL OF MATERIALS				
PRODUCT NUMBER: M128 **PRODUCT DESCRIPTION:** BOOKCASE				
PART NUMBER	**PART DESCRIPTION**	**QUANTITY USED**	**LOCATION**	**CODE**
139409	SIDE	2	A	1
328179	SHELF	3	A	1
421835	BACK	1	B	1
218367	PANEL	1	A	1
98210	SCREW	24	C	2

1. **PART NUMBER:** a number that uniquely identifies a part.
2. **PART DESCRIPTION:** a description of the given part number.
3. **QUANTITY USED:** the quantity of the given part used in this product.
4. **LOCATION:** the warehouse location of the specified part
5. **CODE:** a single-digit number that identifies the source of the part. The following code values are presently used:
   1 = manufactured component
   2 = purchased part

ROUTING				
PRODUCT NUMBER: M128 **PRODUCT DESCRIPTION:** BOOKCASE				
OPERATION NUMBER	**OPERATION DESCRIPTION**	**WORK CENTER**	**SETUP TIME**	**STD.OPER. TIME**
010	CUT SIDES (2)	RADIALS	0.20	0.10
020	CUT SHELVES (3)	RADIALS	0.20	0.10
030	CUT BACK	RADIALS	0.25	0.15
040	CUT PANEL	RADIALS	0.10	0.05
050	GROOVE SIDES (2)	ROUTERS	0.20	0.05
060	SAND PARTS	SANDERS	0.00	0.20
070	ASSEMBLE	ASSEMBLY	0.20	0.15
080	FINISH	FINISHING	0.20	0.50

Note: A **Routing** is a list of the operations (in the sequence they are performed) required to produce a product. Thus there is one Routing for each product. The above Routing form is listed for the M128 bookcase. The following are the descriptions of the Routing attributes:

1. **OPERATION NUMBER:** an arbitrary number indicating the sequence of the operation (the first operation is assigned the number 010, the second 020, and so on).
2. **OPERATION DESCRIPTION:** a brief description of the operation performed.
3. **WORK CENTER:** an alphanumeric field indicating the work centre where the operation is performed.
4. **SETUP TIME:** the setup time, in hours, for this operation.
5. **STD. OPER. TIME:** the standard time (in hours) for this operation, for each unit of the finished product. For example, the standard time to cut three shelves (operation 020) is 0.10 hours.

Based on the two forms above, provide the answers to the following questions:

(i) Normalize the **Bill of Materials** form to arrive at a suitable database design which satisfies the third normal form, clearly show the stages Un-Normalized Form (UNF), First Normal Form (1NF), Second Normal Form (2NF) and Third Normal Form (3NF).

(8/100)

(ii) Normalize the **Routing** form to arrive at a suitable database design which satisfies the third normal form, clearly show the stages Un-Normalized Form (UNF), First Normal Form (1NF), Second Normal Form (2NF) and Third Normal Form (3NF).

(7/100)

(iii) Combine the two normalized relations from Questions 3(b)(i) and (ii) above. Eliminate all redundancies and duplicate relations.

(5/100)

4. (a) Given the following tables:

EMPLOYEES (**EmployeeID,** Name, Salary, Age, HighestDegree, D*epartmentID*)
DEPARTMENT (**DepartmentID**, ManagerID, Location, DeptDescription)

Assume that managers are also employees, and therefore the domain of ManagerID is the same as EmployeeID. Every department has exactly one manager, and that every manager manages exactly one department.

Provide the **SQL statements** for questions (i) - (iv).

(i) Display the salaries of all employees who are not managers (ie. non-managers).

(5/100)

(ii) Display the names and salaries of all employees who work in department 'Audio Visual' and who earn between $10,000 and $25,000.

(5/100)

(iii) Display the names of all non-managers who earn more than at least one manager.

(5/100)

(iv) Add the salary of all managers by 25%.

(5/100)

(b) What is hot site and how is a hot site used to protect the business applications? Discuss also **one (1)** disadvantage of hot site.

(5/100)

1. (a) Terdapat beberapa bahagian di Perpustakaan Hamzah Sendut USM. Di antaranya adalah:

- Bahagian Khidmat Pembaca & Pengembangan: Memproses pinjaman dan pulangan bahan dah menangani masalah dan pertanyaan pengguna.
- Bahagian Rujukan dan Penyelidikan: Mengurus bahan-bahan rujukan dan pinjaman antara-pustaka; dan
- Bahagian Perolehan: Menguruskan dapatan/pembelian bahan dari pembekal-pembekal berlesen.

Andaikan setiap bahagian menyimpan dan mengelolakan data masing-masing secara berasingan. Bincang dengan ringkas **tiga** (**3**) masalah yang mungkin timbul. Kaitkan perbincangan anda dengan perpustakaan di atas.

(6/100)

(b) Bagi setiap entiti di senarai berikut (di sebelah kiri), kenal pasti sama ada setiap butiran di sebelah kanan sepatutnya suatu atribut entiti tersebut atau satu entiti berasingan.

(i) JUALAN: Tarikh, Bahan, Cukai, Pelanggan, Jurujual

(ii) BUNGKUSAN: Saiz, Berat, Alamat, Pelanggan, Lori Penghantaran, Pekerja

(iii) KAMERA: Pelanggan, Megapiksel, Bateri, Lensa, Harga, Berat

(iv) KELAB: Nama, Sekolah, Tujuan, Ahli, Penasihat, Aktiviti

(12/100)

(c) Apakah **dua** (**2**) daripada komponen-komponen sistem pengurusan pangkalan data (DBMS)? Bagi setiap komponen yang anda kenalpasti, terangkan masalah yang akan timbul sekiranya komponen tersebut tiada.

(7/100)

2. (a) Sebagai sebahagian dari aktiviti kejuruteraan semula, Perpustakaan USM menyediakan kepada anda dengan skima berhubungan berikut, untuk mempertingkatkan subsistem pinjaman bukunya. Petakan skima berhubungan tersebut menjadi Gambar rajah ER menggunakan notasi UML. Lengkapkan Gambar rajah ER tersebut dengan nama perhubungan dan kekangan multiplisiti yang sesuai. Nyatakan sebarang andaian yang anda buat, jika perlu.

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AUTHORS (**Book_ID**, Author_name)
PUBLISHER (**Name**, Address, Phone)
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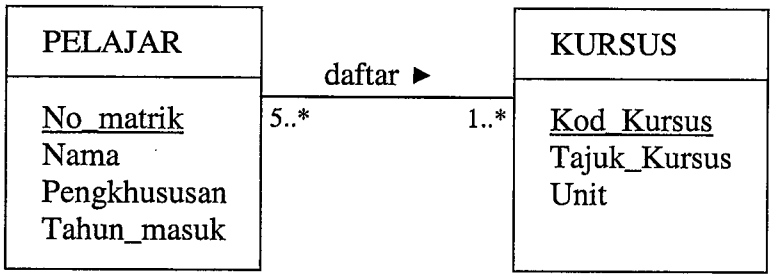
BORROWER (**Card_no**, Name, Address, Phone)

(13/100)

(b) Mungkinkan jenis perhubungan perduaan M:N dapat dipetakan dengan jayanya tanpa memerlukan hubungan baru? Kenapa ya atau kenapa tidak? Petakan gambar rajah ER berikut untuk menjustifikan jawapan anda.



(7/100)

(c) Apakah yang diwakili oleh nilai nul? Bagaimana nilai-nilai nul mempengaruhi dua peraturan integriti berhubungan bagi sesuatu pangkalan data? Terangkan jawapan anda dengan menggunakan contoh mudah.

(5/100)

3. (a) Kenapakah pangkalan data pengguna-pelayan lebih cekap daripada pelayan fail yang mudah? Berikan **tiga (3)** sebab.

(5/100)

(b) Perhatikan dua borang di bawah: **Bill of Materials** dan **Routing.**

BILL OF MATERIALS				
PRODUCT NUMBER: M128 **PRODUCT DESCRIPTION:** BOOKCASE				
PART NUMBER	**PART DESCRIPTION**	**QUANTITY USED**	**LOCATION**	**CODE**
139409	SIDE	2	A	1
328179	SHELF	3	A	1
421835	BACK	1	B	1
218367	PANEL	1	A	1
98210	SCREW	24	C	2

1. **PART NUMBER:** nombor unik yang mengecam sesuatu barangan.
2. **PART DESCRIPTION:** penerangan kepada *part number* yang diberikan.
3. **QUANTITY USED:** kuantiti kepada bahagian yang diberi yang digunakan dalam produk ini.
4. **LOCATION:** lokasi gudang barangan tertentu.
5. **CODE:** digit-tunggal yang mengenalpasti sumber barangan tersebut. Kod di bawah menunjukkan nilai yang digunakan sekarang:
   1 = komponen yang dibuat
   2 = barangan yang dibeli

ROUTING				
PRODUCT NUMBER: M128 **PRODUCT DESCRIPTION:** BOOKCASE				
OPERATION NUMBER	**OPERATION DESCRIPTION**	**WORK CENTER**	**SETUP TIME**	**STD.OPER. TIME**
010	CUT SIDES (2)	RADIALS	0.20	0.10
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070	ASSEMBLE	ASSEMBLY	0.20	0.15
080	FINISH	FINISHING	0.20	0.50

Nota: *Routing* ialah senarai operasi (dalam aturan bagaimana mereka dijalankan) yang diperlukan untuk menghasilkan sesuatu produk. Oleh itu, satu Routing adalah untuk satu produk. Borang Routing yang disenaraikan di atas adalah untuk M128 bookcase. Di bawah adalah penerangan untuk setiap atribut Routing:

1. **OPERATION NUMBER:** satu nombor yang menunjukkan aturan operasi (operasi pertama ialah diperuntukkan dengan nombor 010, kedua 020 dan seterusnya).
2. **OPERATION DESCRIPTION:** penerangan ringkas sesuatu operasi yang dijalankan.
3. **WORK CENTER:** bidang angka-abjad yang menunjukkan pusat kerja di mana sesuatu operasi itu dijalankan.
4. **SETUP TIME:** masa setup, dalam jam, untuk operasi ini.
5. **STD. OPER. TIME:** masa piawai (dalam jam) untuk operasi ini, untuk setiap unit sesuatu produk disiapkan. Contohnya, masa piawai untuk memotong tiga para (operasi 020) ialah 0.10 jam.

Berdasarkan kepada dua borang di atas, berikan jawapan kepada soalan berikut:

(i) Normalkan borang **Bill of Materials** untuk sampai kepada reka bentuk pangkalan data yang memenuhi Pernormalan Bentuk Ketiga dengan menunjukkan secara jelas peringkat Bentuk Tidak Normal (UNF), Pernormalan Bentuk Pertama (1NF), Kedua (2NF) dan Ketiga (3NF).

(8/100)

(ii) Normalkan borang **Routing** untuk sampai kepada reka bentuk pangkalan data yang sesuai yang memenuhi Pernormalan Bentuk Ketiga dengan menunjukkan secara jelas peringkat Bentuk Tidak Normal (UNF), Pernormalan Bentuk Pertama (1NF), Kedua (2NF) dan Ketiga (3NF).

(7/100)

(iii) Gabungkan dua perhubungan ternormal daripada Soalan 3(b)(i) dan (ii) di atas. Singkirkan semua hubungan yang berlebihan dan berulang.

(5/100)

4. (a) Diberikan jadual berikut:

EMPLOYEES (**EmployeeID,** Name, Salary, Age, HighestDegree, *DepartmentID*)
DEPARTMENT (**DepartmentID**, ManagerID, Location, DeptDescription)

Anggapkan bahawa para pengurus adalah juga pekerja, dan dengan itu, domain ManagerID adalah sama dengan EmployeeID. Setiap jabatan mempunyai hanya satu pengurus dan setiap pengurus menguruskan hanya satu jabatan.

Berikan **kenyataan SQL** untuk soalan (i) - (iv)

(i) Pamerkan gaji bagi semua pekerja yang bukan pengurus.

(5/100)

(ii) Pamerkan nama dan gaji bagi semua pekerja yang bekerja dalam jabatan 'Audio Visual' dan mendapat gaji antara $10,000 dengan $25,000.

(5/100)

(iii) Pamerkan nama semua bukan pengurus yang mendapat gaji lebih daripada sekurang-kurangnya seorang pengurus.

(5/100)

(iv) Tambahkan gaji semua pengurus sebanyak 25%.

(10/100)

(b) Apakah itu tapak panas dan bagaimanakah tapak panas digunakan untuk melindungi aplikasi perniagaan? Bincangkan juga **satu** (1) keburukan tapak panas.

(5/100)