Question 1 (ER/EER Diagram & Transformation) – 40 marks

Signum Libri (SL) is a Melbourne-based publishing company and you are hired to design its database. This publisher publishes large number of books. For each book, the book ID, title, number of pages and release date are required. In addition, the genre of the book is also stored, in which each book can belong to more than one genre.

For selected title, SL wants to have few excerpts stored in the database. Each excerpt of a book comes from different chapter of the book.

For some title, SL publishes the book in two formats, namely printed book and e-book, while for some other titles only printed book is available. If the book is printed, the information of the number of printed copies is required as well as printed copy price. For e-book, the information of the price is also maintained. In addition, for e-book, SL wants to keep track on the platforms in which the e-book can be viewed and downloaded. For each platform, information about platform name and description is required.

The publisher also wants to store information about the writer of the book. For each writer, a unique writer identifier as well as writer name, address and country of origin is stored. Each book can be written by a group of writer and each writer can write many books published by SL. At this stage, SL does not keep track information of writers who did not write a book for SL.

Each writer is represented by one agent and for this reason SL also needs information about the agents, which is identified by a unique identifier. The name, address and contact number of the agents is also required.

Each SL book has one editor. Each editor edits at least one book, but can edit many books. The information about editors is also required in the database. This includes the unique identifier of the editor, the name, contact detail and information whether she or he is available to edit in any foreign language. Each editor can mentor one or more other editors, but does not have to mentor any. Each mentor can have at most one mentor editor, but does not have to have any.

a) Develop an **EER model** for the above description. The EER should contain necessary information such as entities, attributes, primary keys, relationships, cardinalities, and participation. Note that you may need to make up some of the attributes for your model. **Any assumption should also be stated**.

[25 marks]

b) Perform the transformation of the EER model into the **Relational tables**.

[15 marks]

Question 2 (Normalisation) – 30 marks

a) Given a table below, answer the following questions:

EMPLOYEE-PROJECT					
EmployeeNo	**Project#**	**Hours**	**EmployeeName**	**ProjectName**	**ProjectLocation**
123456789	1	32.5	John Smith	Major Training	Hobart
123456789	2	7.5	John Smith	Automation	Adelaide
666884444	3	40.0	Ramesh Narayan	Installation	Melbourne
453453453	1	20.0	Joyce English	Major Training	Hobart
453453453	2	20.0	Joyce English	Automation	Adelaide
333445555	2	10.0	Franklin Wong	Automation	Adelaide
333445555	3	10.0	Franklin Wong	Installation	Melbourne
333445555	10	10.0	Franklin Wong	Computerization	Melbourne
333445555	20	10.0	Franklin Wong	Reorganization	Albury
999887777	30	30.0	Alicia Zelaya	Newbenefits	Perth

(i) What is the highest level of normal form for the table?

(ii) Describe the insertion, update and delete anomalies that can happen on the table.

[10 marks]

b) Nip and Tuck Construction Company maintains timesheet for their employees using a sample form shown below. Using normalization technique, identify the database tables for this form. All tables must be at least in BCNF.

Nip and Tuck Construction Company: Time Sheet

Employee No: 124298   **Name**: Smithers, Thomas   **Title (Mr, Mrs, Mss, Ms)**: Mr
Department: Electrics   **Telephone Extension**: 5890

Bank Account No: 12312-45683-58

Date	Job No	Operation	Time Start	Time Finish	Time (Hrs) Worked
01/08/12	3421	Cabling	8.00	12.00	4
02/08/12	3421	Cabling	8.00	12.00	4
02/08/12	3421	Cabling	12.30	16.30	4
03/08/12	2310	Faulty Wiring	8.00	10.00	2
03/08/12	3421	Insulation	10.30	12.30	2
03/08/12	4812	Faulty Wiring	13.00	16.30	3.5
				Total Hours Worked:	19.5
SICK LEAVE:		**FROM**: 04/08/12		**TO**: 05/08/12	
Comments: Medical certificate seen					

[20 marks]

Question 3 (Relational Algebra) – 20 marks

BUILDING

BuildingID	BNoofFloor	BManagerID
B1	5	M12
B2	6	M23
B3	4	M23
B4	4	M34
B5	3	M34

APARTMENT

BuildingID	AptNo	ANoOfBedrooms
B1	41	1
B1	21	1
B2	11	2
B2	31	2
B3	11	2
B4	11	2

INSPECTOR

InsID	InsName
I11	Jane
I22	Niko
I33	Mick
I44	Rudy

INSPECTING

InsID	BuildingID	DateLast	DateNext
I11	B1	15-MAY-2015	14-MAY-2016
I11	B2	17-FEB-2016	17-MAY-2016
I22	B2	17-FEB-2016	17-MAY-2016
I22	B3	11-JAN-2016	11-JAN-2017
I33	B3	12-JAN-2016	12-JAN-2017
I33	B4	11-JAN-2016	11-JAN-2017

MANAGER

ManagerID	MFName	MLName	MBDate	MSalary	MBonus
M12	Boris	Grant	30-JUN-1980	60000	
M23	Austin	Lee	30-OCT-1975	50000	5000
M34	George	Sherman	11-JAN-1976	52000	2000

Given the set of relations/tables, answer these following questions. (NOTE: (1) all PKs are underlined and all FKs are written in italics; (2) BManagerID is a foreign key pointing to MANAGER table)

a) Write the following query in relational algebra expression: *display building id of all buildings that have never been inspected.*

[6 marks]

b) Write the following query in relational algebra expression: *display apartment number and the manager name of the building where the apartments are located. The apartments listed are only those located in building with 4 level or more.*

[7 marks]

c) List the outcome of the relational algebra queries below:

$$\pi_{\text{BuildingID}} (\text{BUILDING}) \; \overline{\bowtie}_{\text{BuildingID=BuildingID}} (\text{INSPECTING})$$

$$\text{U}$$

$$\pi_{\text{BuildingID}} (\text{BUILDING}) \bowtie_{\text{BManagerID=ManagerID}} (\sigma_{\text{MSalary > 50000}}) (\text{MANAGER})$$

[7 marks]

Question 4 (SQL) – 45 marks

The following show the tables and sample data of **Bundoora Clinic**. *PATIENT, DOCTOR* and *NATUROPATH* tables store the list of patients, doctors and naturopaths respectively. *PATIENT_DOCTOR* table stores the information of the patients and their referring doctors. *VISIT* table stores information of patient's visit to the clinic including the medication prescribed to the patient during that visit. *CONDITION* table lists possible condition that patients can have. Finally, *PATIENT_CONDITION* table identifies what conditions that each patient has.

NOTE: Primary Key (PK) is underlined, Foreign Key (FK) is printed in italic, PK that is also FK is underlined and printed in italic.

PATIENT

PatientID	PatientName	Age	NaturoNo
P1	Jake Long	25	NP1
P2	Drew Green	35	NP2
P3	Amy Chan	10	
P4	Lisa Moon	60	NP1
P5	Henry Tran	55	NP3

NATUROPATH

NaturoNo	NaturoName	NaturoContact
NP1	Glenn Murphy	98562562
NP2	Helena Bond	98659620
NP3	Daniel Rowe	95369485
NP4	Adam Auburn	94793459
NP5	Hasan Sulistyo	95568840

DOCTOR

DoctorNo	DoctorName	Specialty	DoctorContact
D1	Ramon Dunn		98698544
D2	Jill Ilic	Oncologist	98695214
D3	Dean Hanson	Cardiologist	90248965
D4	Kunal Reddy	Pediatrician	88963562
D5	Hans Bolte	Perinatologist	98012563

PATIENT_DOCTOR

PatientNo	DoctorNo
P1	D1
P1	D2
P2	D3
P2	D4
P3	D3

VISIT

VisitNo	VisitDate	AmountPaid	Medication	PatientID
V1	15-Apr-2016	95	Chinese Herbs	P4
V2	16-Apr-2016	75	Anti-Depressant	P1
V3	30-Apr-2016	120	Supplements	P2
V4	13-May-2016	125		P2
V5	15-May-2016	265	Antihistamine	P4

CONDITION

ConditionCode	ConditionName
C1	Allergy
C2	Artificial Implants
C3	Hospitalized
C4	Under Medical Care

PATIENT_CONDITION

PatientID	ConditionCode	Notes
P1	C1	Antihistamine
P2	C1	Chinese Herbs
P3	C3	5 Years Ago
P4	C4	Since Birth

Provide the **SQL statements** for questions (a) to (e)

(a)   Create a view that can be used to list the doctor name and the number of patients referred by the doctor in the database.

[5 marks]

(b)   Display the details of all naturopath in the database along with his/her patient(s) (if any). Patient name and age should be displayed. The display should be ordered by naturopath name in ascending order and then the patients should be ordered from the older patients to the younger ones.

[10 marks]

(c)   Display the detail of the doctors who have the greatest number of patients in the database.

[10 marks]

(d)   Display the names and contact numbers of doctors and naturopaths who have at least one patient in the database.

[10 marks]

(e)   Display the top 5 most expensive patient's visits made in 2016.

[10 marks]

Question 5 (Stored Procedures/Functions &Triggers) - 45 marks

The following show the tables and sample data of **Bundoora Clinic**. *PATIENT, DOCTOR* and *NATUROPATH* tables store the list of patients, doctors and naturopaths respectively. *PATIENT_DOCTOR* table stores the information of the patients and their referring doctors. *VISIT* table stores information of patient's visit to the clinic including the medication prescribed to the patient during that visit. *CONDITION* table lists possible condition that patients can have. Finally *PATIENT_CONDITION* table identifies what conditions that each patient has.

NOTE: Primary Key (PK) is underlined, Foreign Key (FK) is printed in italic, PK that is also FK is underlined and printed in italic.

PATIENT

PatientID	PatientName	Age	NaturoNo
P1	Jake Long	25	NP1
P2	Drew Green	35	NP2
P3	Amy Chan	10	
P4	Lisa Moon	60	NP1
P5	Henry Tran	55	NP3

NATUROPATH

NaturoNo	NaturoName	NaturoContact
NP1	Glenn Murphy	98562562
NP2	Helena Bond	98659620
NP3	Daniel Rowe	95369485
NP4	Adam Auburn	94793459
NP5	Hasan Sulistyo	95568840

DOCTOR

DoctorNo	DoctorName	Specialty	DoctorContact
D1	Ramon Dunn		98698544
D2	Jill Ilic	Oncologist	98695214
D3	Dean Hanson	Cardiologist	90248965
D4	Kunal Reddy	Pediatrician	88963562
D5	Hans Bolte	Perinatologist	98012563

PATIENT_DOCTOR

PatientNo	DoctorNo
P1	D1
P1	D2
P2	D3
P2	D4
P3	D3

VISIT

VisitNo	VisitDate	AmountPaid	Medication	PatientID
V1	15-Apr-2016	95	Chinese Herbs	P4
V2	16-Apr-2016	75	Anti-Depressant	P1
V3	30-Apr-2016	120	Supplements	P2
V4	13-May-2016	125		P2
V5	15-May-2016	265	Antihistamine	P4

CONDITION

ConditionCode	ConditionName
C1	Allergy
C2	Artificial Implants
C3	Hospitalized
C4	Under Medical Care

PATIENTCONDITION

PatientID	ConditionCode	Notes
P1	C1	Antihistamine
P2	C1	Chinese Herbs
P3	C3	5 Years Ago
P4	C4	Since Birth

a.   Write a *stored procedure* that receives a date as input and displays as the output the list of patient names who visited the clinic on that day.

[15 marks]

b.   Write a *stored function* that uses a patient's id as input and calculates the total amount paid to date by that patient. In addition, also need to show an SQL statement to display the total amount paid by <u>all of the patients in the database</u>.

[15 marks]

c.   A *trigger* that is activated whenever a new medication given to a patient matches any one of the patient's allergy list.

[15 marks]