1. (b) Consider the **ORDER_PRODUCT** relation below.

Order_ID	Order Date	Product_ID	Prod_Desc	Qty_ Ordered	Unit Price(RM)	Prod_ Location
1001	13/07/2013	P100	Sofa	10	20.00	L44
1002	13/07/2013	P101	Table	3	50.00	L22
1002	13/07/2013	P102	Table	2	125.00	L30
1003	14/07/2013	P100	Sofa	6	20.00	L31
1003	14/07/2013	P102	Table	4	125.00	L44

(i) Explain the meaning of insertion, modification and deletion anomalies that the above relation is susceptible to. (6 marks)

(ii) Identify each of the above anomalies with a specific example from the table. (6 marks)

(iii) Identify the primary key for the above ORDER_PRODUCT relation. (1 mark)

Q3. (a) State and discuss **TWO** (2) purposes of normalisation in database design. (8 marks)

(b) Briefly describe and give **ONE** (1) example for each of the following terms:

(i) Primary key (3 marks)

(ii) Foreign key (3 marks)

(iii) Concatenated key (3 marks)

Q1. (a) Sweet Sweet Sdn Bhd (SSSB) operates a dessert outlet that serves a variety of desserts such as bubble tea, frozen yogurt, mango pudding etc. There are two new outlets scheduled to be in operation in a few months' time with more outlets to be set up in their expansion plan.

The owner of SSSB, Mr Shito approached you and sought your advice on how to improve their existing business computer system which is still using **traditional file-based system (TFBS)** to maintain sales records.

Sales Table shown in **Figure 1** below is an example of data file stored in SSSB Sales System. After examining the data file, you noted that data redundancy exists in the file that may lead to **insertion, modification** and **deletion anomalies.**

Sales Table

Receipt No	Date	Outlet No	Location	Item No	Description	Price	Quantity
T150513-001	15/05/13	T13	TA Mall	B1	Bubble tea	5.90	2
T150513-001	15/05/13	T13	TA Mall	M3	Iced Mango	8.90	1
T150513-001	15/05/13	T13	TA Mall	Y1	Yogurt	9.50	1
G070513-002	07/05/13	G02	Gurney	M6	Mochi	7.50	1
P110413-007	11/04/13	P20	Paragon	B1	Bubble tea	5.90	1
T150513-002	15/05/13	T13	TA Mall	B1	Bubble tea	5.90	1
T150513-002	15/05/13	T13	TA Mall	S2	Soya Bean	5.50	1

Figure 1

[*Note: Receipt No is a code designed to indicate the outlet, eg: T(outlet)150513(date)-001*]

(i) Briefly explain to Mr Shito what is meant by **data redundancy.** (2 marks)

(ii) By referring to the table above, identify and explain to Mr Shito the problems that may occur with each of the **THREE (3)** data anomalies mentioned above. (6 marks)

Q3. (a) Examine the relational tables shown in **Figure 2** below.

Book Table

Book ID	**BookTitle**	**Publisher**	**Category Code**
T001	Management Way	Sun Publisher	Mgm
F123	Investment	High n Low	Fnc
F564	Bull and Bear	Prentice Hall	Fnc
C300	Computing Today	Prentice Hall	Com
M11	Top Management	Twin Tower	Mgm

Category Table

Category Code	**Description**
Mgm	Management
Fnc	Finance
Com	Computer Science

Figure 2

The two relational database tables shown in **Figure 2** above are said to display both entity integrity and referential integrity.

(i) Define "Primary Key" with **ONE (1)** example from the above tables. (2 marks)

(ii) Define "Foreign Key" with **ONE (1)** example from the above tables. (2 marks)

(iii) Entity integrity and referential integrity are based on primary key and foreign key. Briefly describe what is meant by **entity integrity** and **referential integrity** in the two tables above. (4 marks)

Q3. (b) Consider the following Co-curriculum Registration table for a high school. The table contains repeating groups, which can lead to data inconsistency. To resolve this problem, you are required to normalise the table to a set of **third normal form** relations (3NF). Your answer should show all the three (**1NF, 2NF** and **3NF**) steps of the normalisation process by using **Database Design Language** (**DBDL**).

[*Note: Underline the primary key or composite key and indicate the foreign keys with an *. Do not include any sample data.* .]

Co-curriculum Registration Table

CoCu Code	Desc	Advisor No	Advisor Name	StuID ID	Stu Name	Stu Contact	Day	Time
BA11	Basketball	A911	Alan Tan	P213	May	245578	Monday	5:00pm
				P234	June	656588	Monday	5:00pm
				P786	Wynn	623918	Friday	6:30pm
TA20	Taekwondo	Y012	Yumiko	P213	May	245578	Sunday	9:00am
				P669	Hatta	398897	Sunday	9:00am
KA07	Karate	N023	Naruto	P008	Wong	258789	Tuesday	7:00pm
NE11	Netball	S56	Susan Ong	P318	Sammy	389965	Monday	6:00pm
				P234	June	656588	Saturday	8:00am

Figure 5

(17 marks)

Q3 (c) Go Green Organics Sdn Bhd is in the business of selling organic products. The shop owner plans to expand his business to allow customers to make online purchase. Currently, the shop is using traditional file-based system to manage and maintain all records of their transactions. **Sales Table** shown in **Figure 1** below is an example of data file stored in their Sales System. This table contains multi-valued attributes (repeating groups) which include: *ItemNo, Description, SellingPrice and Quantity.*

Sales Table

Order No	Order Date	Cust ID	Customer Name	Address	Item No	Description	Selling Price	Quantity
A001	12-03-14	S116	Ivy Yeoh	3 Rose Av	M54	Milk powder	75.00	1
					S11	Sea salt	2.50	2
A002	12-03-14	M881	Megan	9 Watt Dr	F012	Floral tea	35.00	4
A003	14-03-14	S034	Salina	11 Bkt Mewah	M54	Milk powder	75.00	5
					O79	Oat	10.20	2
					S54	Soy beans	8.50	1
A004	14-03-14	M453	Mark Kay	1 Kenneth Hill	R23	Brown rice	25.00	1
					T354	Green tea	48.00	3
A005	10-04-14	S116	Ivy Yeoh	3 Rose Av	M54	Milk powder	75.00	2
					R23	Brown rice	25.00	1
					S14	Soy source	7.30	1

Figure 1

(i) The above design is susceptible to **insertion, modification** and **deletion anomalies**. Identify and explain the problems that may occur with each of the **THREE (3)** data anomalies mentioned above. (6 marks)

(ii) Normalise the table to a set of **third normal form** (3NF) relations. Your answer should show all the three **(1NF, 2NF** and **3NF)** steps of the normalisation process by using **Database Design Language (DBDL)**.
[*Note: Underline the primary key or composite key and indicate the foreign keys with an *. Do not include any sample data.*] (9 marks)

Q3. (b) Dream Itinerary Sdn Bhd is a tour agency is using traditional file-based system to manage and maintain all records of their customers' bookings. **TourPackages Table** shown in **Figure 1** below is an example of data file stored in their Tour Packages Booking System. This table contains multi-valued attributes (repeating groups) which include: *CustNo, CustomerName, CustPhone and DepartDate.*

TourPackages Table

Package Code	Package Desc	Price (RM)	Tour Guide	T_Guide Contact	Cust No	Cust Name	Cust Phone	Depart Date
C123	8 days Shanghai	3800	Andy	011124563	M54	Mary W	016112312	05-07-15
					S11	Su Si	012456567	05-07-15
					G05	Gary Lim	012456678	05-07-15
					Y02	Yumiko	011225436	05-07-15
T007	10 days Turkey	6200	Sally	012569563	B12	Braham	011235645	15-08-15
E236	10 days UK, France	12000	Brian	012870900	M54	Mary W	016112312	08-04-15
					S11	Su Si	012456567	08-04-15
					S54	Susan	017235646	08-04-15
					N37	Natalie	012456465	08-04-15
					B77	Kate S	016458965	08-04-15
J560	6 days Tokyo, Osaka	4300	Yuki	016258836	Y02	Yumiko	011225436	02-05-15
					A39	Andrew	013455667	02-05-15

Figure 1

(i) Based on the sample data shown in Figure 1, discuss each of the following data anomalies:

- insertion anomaly
- deletion anomaly
- modification anomaly

(6 marks)

(ii) Normalise TourPackages Table to a set of third normal form relations (3NF). Your answer should show all the necessary steps of the normalisation process from 1NF to 3NF.
[*Note: Underline the primary key and indicate the foreign keys with an *. DO NOT include any sample data.*]
(9 marks)

Question 1

(b) The PATIENT_DOCTOR relation shown below is susceptible to data anomalies.

(i) Explain what insertion, modification and deletion anomalies are. (6 marks)

(ii) Provide an example for each anomaly based on the relation given below. (6 marks)

PATIENT_DOCTOR

PatientID	Name	TelNo	DoctorCode	Specialization
P1001	Ali	09-1234557	D1	Surgery
P1002	Lim	04-4352345	D2	Emergency
P1003	John	06-7023815	D3	Consultant
P1004	Raju	05-6726817	D4	General
P1005	Mary	09-3691682	D2	Emergency

Question 2

(a) Explain the features of Primary Key and Candidate Key with an example. (7 marks)

Q2.	(a)	Primary Key explanation: • A primary key is a candidate key selected as the primary means of identifying rows in a relation. • There is only ONE primary key per relation. • The primary key may be a composite key. • The ideal primary key is short, numeric, and never changes. E.g. StudentID selected as the primary key **Choose the THREE correct explanation each is 1mark, therefore 3X1 = 3 marks and 1 mark for example.* Candidate Key explanation: • A candidate key is a key that determines all of the other columns in a relation. • There can be more than one candidate key • E.g. StudentID, IC_No, Driving_License_No **Each correct explanation is 1 mark, therefore 1X 2 = 2 marks and 1 mark for example.* ***Any other relevant answer*	4 marks 3 marks

Question 3

(c) Consider the following book orders based on different courses.

BOOK_ORDER

BookID	Book_Title	Book_ Category	PublisherID	Publisher __Name	FacultyID	Faculty_Name	Quantity
BN101	Oracle	Database	P11	Wrox	F001	Multimedia Technology	100
BN101	Oracle	Database	P11	Wrox	F002	Computer Science	70
BN102	Financial report	Finance	P12	Prentice	F101	Business & Finance	90
BN103	Rich dad	Finance	P13	Pearson	F101	Business & Finance	80

Repeating Groups

Normalize the table to a set of Third Normal Form (3NF). Your answer should show all three stages of normalization (1NF, 2NF and 3NF) of the normalization process by using the Database Design Language (DBDL) format. (12 marks)