Monash University

FIT2094

SAMPLE EXAM PAPER
SAMPLE Solutions

PART A. Multiple Choice Questions. (10 x 1 mark = 10 marks).

Mark your selection by placing a √ or a X through your selected answer
for example ✓ or ✗
If you change your selection during the review of your paper, prior to the end of the Examination, make sure that the alteration is clear.

Note: There is only ONE correct answer for each question. There is no penalty for incorrect answer.

1. Assume you are using the MINUS operator to combine the results from two tables with identical structure, CUSTOMER and CUSTOMER_2. The CUSTOMER table contains 10 rows, while the CUSTOMER_2 table contains 7 rows. Customers Dunne and Olowski are included in the CUSTOMER table as well as in the CUSTOMER_2 table (and no other customers are in both tables). How many records are returned when using the MINUS operator - i.e., in analyzing CUSTOMER MINUS CUSTOMER_2?
    a. 0
    b. 2
    c. 8
    d. 10

2. A ____ relationship exists when an association is maintained within a single entity.

    a. unary
    b. ternary
    c. binary
    d. weak

3. Which statement is correct in relation to RELATIONAL MODEL properties?

    a. **The order of the attribute is immaterial.**
    b. Duplicate rows are possible.
    c. Attribute may have multiple values.
    d. Tuples should be addressed by their position in the relation.

4. Which statement is correct in relation to VIEW?

    a. The data in a view can always be updated.
    b. **The data in a view is generated only when the view is used.**
    c. The data in view can always be inserted using INSERT statement.
    d. Derived column is not allowed in view.

5. A table that is in 2NF and contains no transitive dependencies is said to be in ____.

    a. 1NF
    b. 2NF
    c. **3NF**
    d. 4NF

6. The following SQL is executed in ORACLE and produces an error message. What is the most likely cause of the error message?

```
SELECT student_id, student_name
FROM student
WHERE course='MAIT'
UNION
SELECT student_id, student_name, student_dob
FROM student
WHERE course='MIT'
```

   a. The union operation is not supported for two tables.
   b. The attribute student_name does not have the correct data type.
   c. The union operation should not be used for retrieving data from a single table.
   d. **The two select statements are not union compatible.**

7. ANSI SPARC recommends view integration into database design. The recommendation suggests three levels of design. What are the levels?

   a. External, conceptual, database
   b. Conceptual, logical, physical
   c. External, conceptual, logical
   d. **External, conceptual, internal.**

8. An ER diagram needs to be developed to represent the fact that an employee may supervise another employee. Both the supervisor and the supervisee are employees. What would be the best way for you to model this fact?

   a. Supervisor is a strong entity and the supervisee is a weak entity.
   b. **A recursive relationship called supervises on an entity called employee.**
   c. A multi-varied attribute called supervisor in an entity called employee.
   d. A many to many relationship between an entity called supervisor and an entity called supervisee.

9. _____ requires that all operations of a transaction be completed.

   a. Specificity
   b. **Atomicity**
   c. Durability
   d. Time stamping

10. Which of the following is an example of a soft crash in database?

   a. Disk crash.
   b. **Power Failure**.
   c. Software bugs.
   d. Concurrency.

END OF PART A

PART B. Answer all questions on the space provided. Total: 90 marks

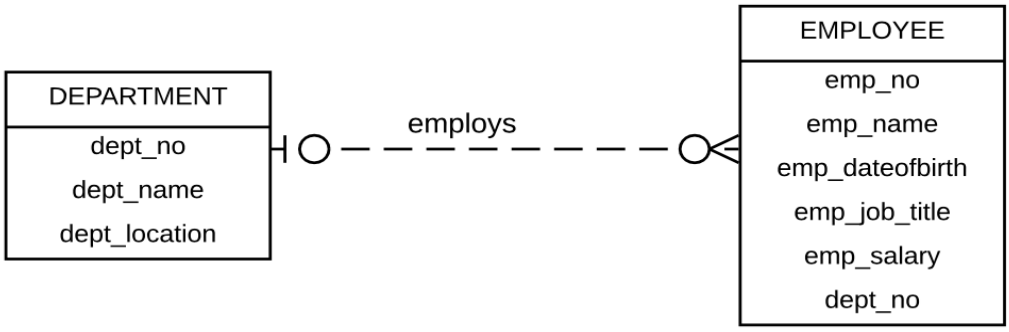
1. The Relational Model (20 marks)

A company wishes to record the following attributes about their employees: employees ID, department number, name, home address, education qualifications and skills which the employee has. A small sample of data is show below:

Employee ID	Department Number	Employee Name	Home Address	Qualification	Skill
101	21	Given name: Joe Family name: Bloggs	Street: 12 Wide Rd Town: Mytown Postcode: 1234	Bachelor of Commerce MBA	Project Management Hadoop R
102	13	Given name: Wendy Family name: Xiu	Street: 55 Narrow St Town: Mytown Postcode: 1234	Bachelor of Computer Science Master of IT Doctor of Philosophy	SQL PL/SQL
103	13	Given name: Sarah Family name: Green	Street: 25 High St Rd Town: Mytown Postcode: 1234	Certificate IV in Business Administration	SQL Java Phyton

(a) Use this data to explain the difference between a multivalued attribute and a composite attribute.

[10 marks]



(b) Assume that there are two tables as suggested by the above ER diagram. Generate the Relational Algebra for the following statements. If the Relational Algebra is not exactly the same implementation as SQL, **explain** which part of the SQL that is not implemented.

Statement A:

```
SELECT DISTINCT emp_job_title
FROM EMPLOYEE;
```

Statement B:

```
SELECT emp_name
FROM EMPLOYEE
WHERE emp_salary > 50000
ORDER BY emp_name;
```

[(2 + 3) x 2 = 10 marks]

Answer Q1

a) A Multivalued attribute is an attribute which has several possible values f**or a given instance** – Skills. For example, employee 102 has skills in PL/SQL and SQL

A Composite attribute is an attribute which has a single value for a given instance which may be subdivided into other values - Employee name or Home Address. For example, employee 101's name can be subdivided into given and family

b)

Answer A = $\pi_{emp\_job\_title}$ (EMPLOYEE)
OR
Answer A = Proj [emp_job_title] (EMPLOYEE)

Explanation: The relation algebra is exactly the same as the SQL, because projection in the relation algebra is always distinct.

Answer B = π_{emp_name} ($\sigma_{emp\_salary>50000)}$ EMPLOYEE)
OR
Answer B = Proj [emp_name] (Sel [emp_salary > 50000] (EMPLOYEE))

Explanation: The relation algebra is not exactly the same as the SQL, because in relational algebra the result is never ordered, and there is no relational algebra to order the results.

Therefore, ORDER BY will not be implemented in relational algebra.

2. Database Design (20 marks)

The Monash Computing Students Society (MCSS) is one of the student clubs at Monash University.

Students are welcome to join as a member. When a student joins MCSS, a member id, and the full name, date of birth, email and phone number will be recorded. This club has an annual membership fee. When a member has paid the membership fee for the current year, the current year is recorded against the year of membership as part of their membership details.

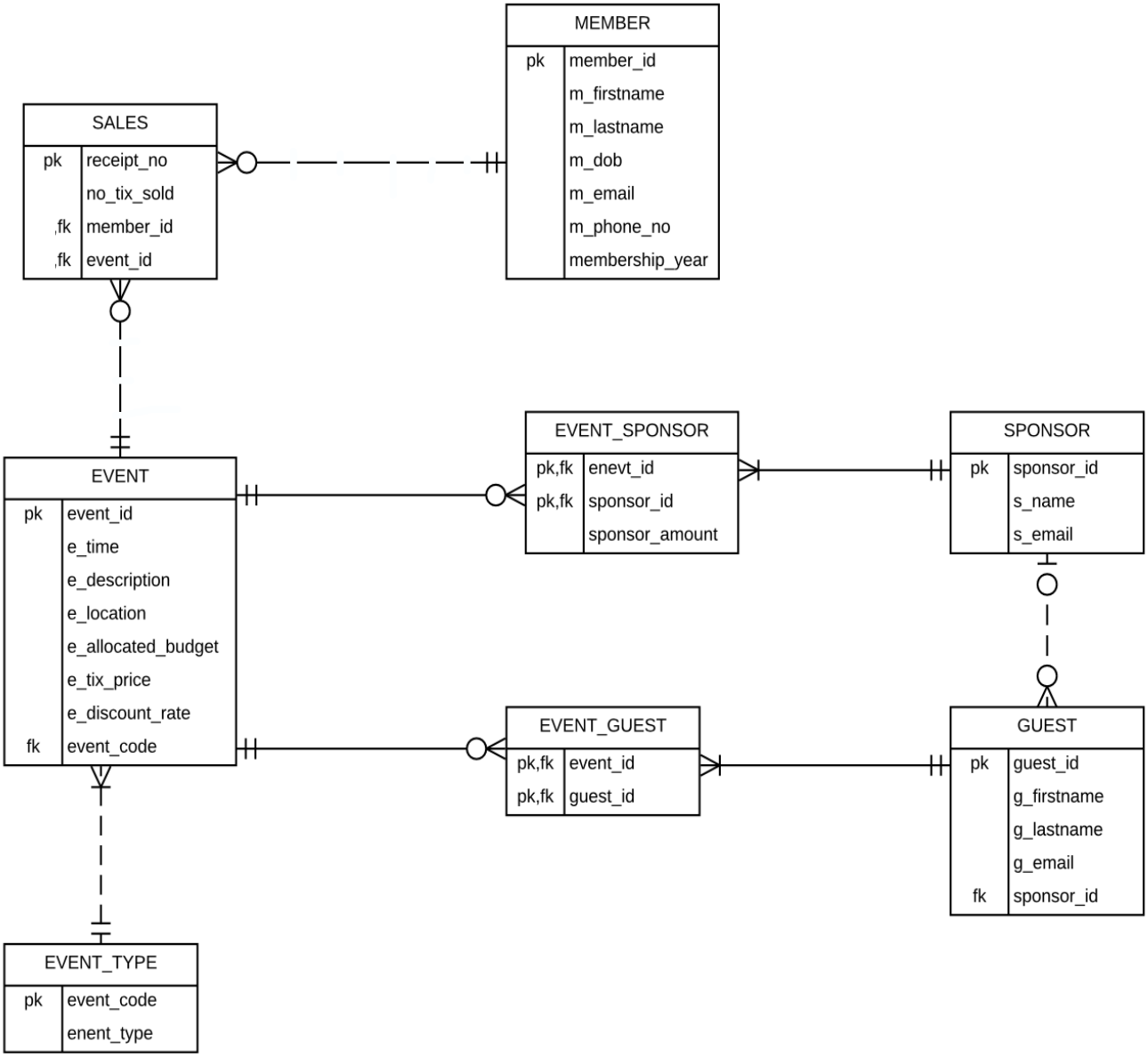
MCSS hosts several events throughout the year. The events are categorised into *Professional Events*, *General Events*, and *Social Events*. When an event is scheduled, MCSS assigns an event id to the event. The event time, description, location, allocated budget, the ticket price and the discount rate (eg 5%) for members. Some events are organised as free events for members. In this situation, the discount rate is recorded as 100% for members. For all events, only members can purchase the tickets. However, members can buy additional tickets for their friends or family at full price. For each of the sales, the receipt number, number of tickets sold and member id are recorded.

Some events attract some sponsorships. The sponsor may be an organisation or an individual. The sponsors provide financial support to the event. Some events may have several sponsors. The amount of financial support provided by each sponsor is recorded for the event. Each sponsor is identified by a sponsor id. The name and contact email are also recorded. A sponsor may support several events throughout the year.

For some events such as career night, MCSS may also invite some guest speakers to share their experience. The database records all guests' information including the full name, email and phone number. If a guest comes from an organisation or an individual that provides a sponsorship to any of the MCSS event (does not have to be on the event where the guest speaks), this fact will also be recorded. A guest may be invited to several events.

Create ***a logical level diagram using Crow's foot notations*** to represent the "Monash Computing Students Society" data requirements described above. Clearly state any assumptions you make when creating the model. Be sure to include all attributes. Identify clearly the Primary Keys and Foreign Keys, as part of your design. You do not need to include the data type of the attributes.

Answer Q2


MEMBER
pk member_id
m_firstname
m_lastname
m_dob
m_email
m_phone_no
membership_year
SALES
pk receipt_no
no_tix_sold
fk member_id
fk event_id
EVENT_SPONSOR
pk,fk enevt_id
pk,fk sponsor_id
sponsor_amount
SPONSOR
pk sponsor_id
s_name
s_email
EVENT
pk event_id
e_time
e_description
e_location
e_allocated_budget
e_tix_price
e_discount_rate
fk event_code
EVENT_GUEST
pk,fk event_id
pk,fk guest_id
GUEST
pk guest_id
g_firstname
g_lastname
g_email
fk sponsor_id
EVENT_TYPE
pk event_code
enent_type

3. Normalisation (20 marks)

Monash University owns several performance halls that are used by organizations within and outside Monash University. The following table shows the booking information for several performances across different venues in Monash University. Multiple performances or shows can be organized at the same time across multiple venues. The following situations are observed during the operation of the performance halls:

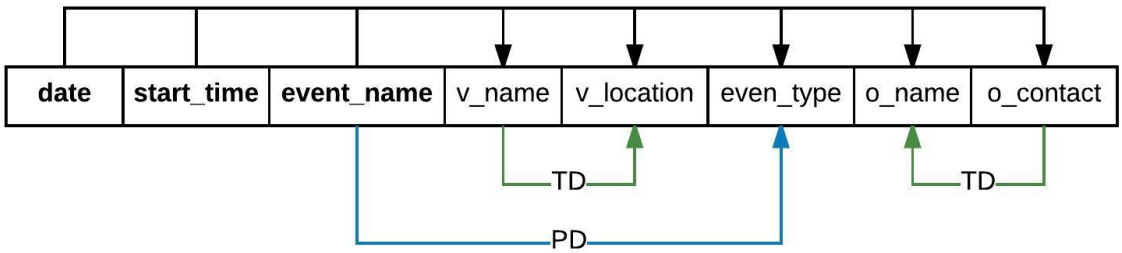
- Each show is organised by an organisation.
- A single contact number is kept for an organiser.
- A show can be scheduled on multiple days, for example Melbourne Symphony-Summer Classic has two performances on the 12-Jan-2015 and 17-Jan-2015.
- A show can be scheduled twice a day (matinee and night).

Start Time	Date	Venue	Venue Location	Show Type	Show	Organiser	Organiser's contact
8 PM	12-Jan-2015	Robert Blackwood Hall	Clayton	Music concert	Melbourne Symphony – Summer Classic	MSO	(03) 99021212
8 PM	12-Jan-2015	K3.24	Caulfield	Comedy	Adam Hill	Melbourne Comedy Festival	(03) 99031456
2 PM	14-Jan-2015	Robert Blackwood Hall	Clayton	Musical	Cats	Monash Student Association	(03) 99012233
8 PM	14-Jan-2015	Alexander Theatre	Clayton	Comedy	Dave Hughes	Melbourne Comedy Festival	(03) 99031456
8 PM	16-Jan-2015	Robert Blackwood Hall	Clayton	Music concert	Hoodoo Guru	Mushroom Promoter	(02) 90021002
8 PM	17-Jan-2015	Robert Blackwood Hall	Clayton	Music concert	Melbourne Symphony – Summer Classic	MSO	(03) 99021212

a) Draw a dependency diagram for this table. **(10 marks)**
b) Convert the table shown above to Third Normal Form (3NF), showing each stage of the process. Clearly state any assumptions that you make. **(10 marks)**

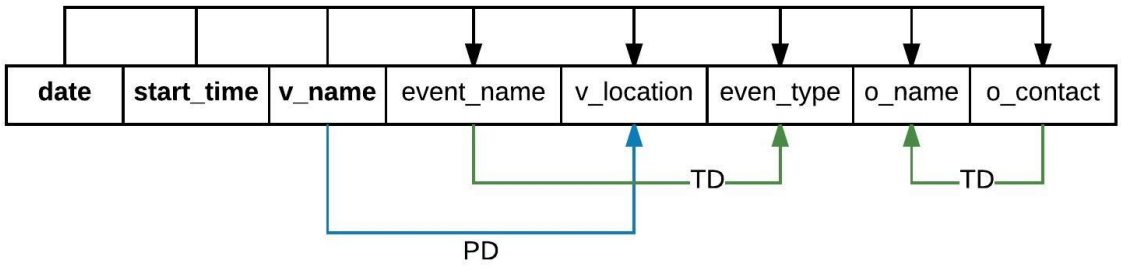
Answer Q3

a) Draw a dependency diagram for this table.
date, start_time, event_name, v_name, v_location, event_type, o_name, o_contact



========== ALTERNATIVE ==========

date, start_time, v_name, event_name, v_location, event_type, o_name, o_contact



b) Convert the table shown above to Third Normal Form (3NF), showing each stage of the process. Clearly state any assumptions that you make. You should not add new attribute.

1NF
PERFORMANCE (date, start_time, event_name, v_name, v_location, event_type, o_name, o_contact)

2NF

PERFORMANCE (date, start_time, event_name, v_name, v_location, o_name, o_contact)

EVENT (event_name, event_type)

3NF

PERFORMANCE (date, start_time, event_name, v_name, o_contact)

VENUE (v_name, v_location)

EVENT (event_name, event_type)

ORGANISER (o_contact, o_name)

========== ALTERNATIVE ==========

1NF

BOOKING (date, start_time, v_name, event_name, v_location, event_type, o_name, o_contact)

2NF

BOOKING (date, start_time, v_name, event_name, event_type, o_name, o_contact)

VENUE (v_name, v_location)

3NF

BOOKING (date, start_time, v_name, event_name, o_contact)

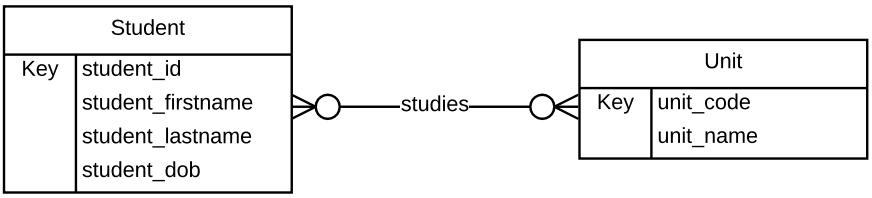
VENUE (v_name, v_location)

EVENT (event_name, event_type)

ORGANISER (o_contact, o_name)

4. DDL (10 marks)

An entity relationship diagram to depict a relationship between STUDENT and UNIT is given below

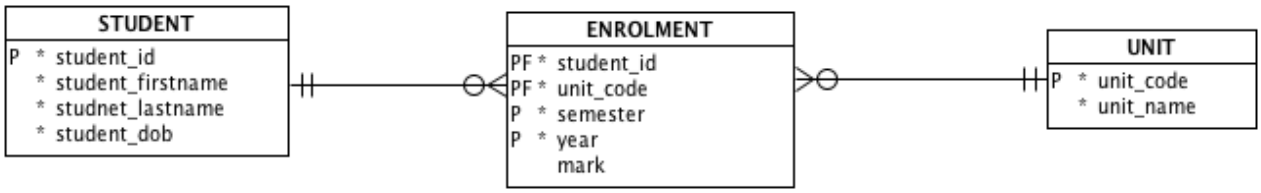


(i) Map the above conceptual model to a logical level diagram of relational model using Crow's foot notation. Include in this model the attributes ***semester, year*** and ***mark***. The mark is allocated for a student for a given unit in a given semester and year. **(5 marks)**

(ii) Write the create table statement for **the table that contains the semester, year and mark attributes**. Include in the create table statement a constraint that ensures that the mark is limited to the range of 0 to 100 inclusive. You DO NOT need to write create table statements for the STUDENT and the UNIT tables. In writing the create table statement, you can assume that create table statements for the STUDENT and the UNIT table have been included in the schema and will be executed prior to the execution of the create table statement that you have to write. **(5 marks)**

Q4 ANSWER

(i)



(ii)

```
CREATE TABLE ENROLMENT (
     student_id NUMBER (8) NOT NULL,
     unit_code VARCHAR2 (8) NOT NULL,
     semester VARCHAR2 (1) NOT NULL,
     year DATE NOT NULL,
     mark NUMBER (3) CHECK (mark BETWEEN 0 and 100)
     CONSTRAINT ENROLMENT_PK PRIMARY KEY
          (student_id, unit_code, semester, year);


ALTER TABLE ENROLMENT
    ADD CONSTRAINT student_enrolment_fk FOREIGN KEY
    (student_id)
    REFERENCES STUDENT
    (student_id);


ALTER TABLE ENROLMENT
    ADD CONSTRAINT unit_enrolment_fk FOREIGN KEY
    (unit_code )
    REFERENCES UNIT
    (unit_code);
```

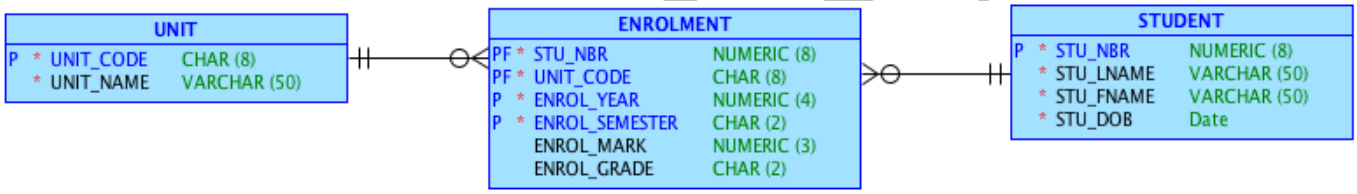
As an alternative the PK and CHECK constraints can also be created using the ALTER command or all constraints created within the create table

5. Transaction Management (20 marks)

(i) The script shown below is used to add 2 students and their enrolments into two tables STUDENT and ENROLMENT. The new students are "James Bond" and "Bruce Lee". James Bond wants to enrol into FIT1004 and FIT1001, whereas Bruce Lee wants to enrol into FIT1004.

```
-- Start of INSERT script
INSERT INTO student VALUES (sno_seq.nextval,'Bond','James',to_date('01-Jan-
1994','yyyy-mon-dd'));
INSERT INTO student VALUES (sno_seq.nextval,'Lee','Bruce',to_date('01-Feb-
1994','yyyy-mon-dd'));
INSERT INTO enrolment VALUES (sno_seq.currval,1,2012,'FIT1004',0,'NA');
INSERT INTO enrolment VALUES (sno_seq.currval,1,2012,'FIT1001',0,'NA');
INSERT INTO enrolment VALUES (sno_seq.currval,1,2012,'FIT1004',0,'NA');
COMMIT;
-- Finish of INSERT script
```

The database implementation of the two tables is based on the following ER diagram.



An ORACLE's sequence called sno_seq has been created for auto-generating of the student number in the database. The units listed in the script (e.g., FIT1004, FIT1001) exist in the UNIT table.

a) What problems will be associated with the execution of the above script? **(5 marks)**

b) Fix the script so the problems identified in (a) are eliminated. **(5 marks)**

(ii) Using an example, illustrate and explain what the lost update problem is where two concurrent transactions are updating the same data element. **(10 marks)**

Q5 ANSWER

(i)

a)

- An error message will be generated when the fifth INSERT statement is executed by the DBMS. The error will state there is a duplicate PK identified. Bruce Lee will be enrolled into FIT1004 twice for S1, 2015 offering.
- James Bond will not be enrolled in FIT1004.
- Bruce Lee will be enrolled in both FIT1004 and FIT1001.

b) The order of the statements in the script needs to be changed. The order should be:

- insert James Bond details into STUDENT table.
- Insert James Bond's enrolment details into ENROLMENT table.
- Insert Bruce Lee's details into STUDENT table
- Inert Bruce Lee's enrolment details into ENROLMENT table.

(ii)

Explanation based around

TABLE 10.3 Lost Updates

TIME	TRANSACTION	STEP	STORED VALUE
1	T1	Read PROD_QOH	35
2	T2	Read PROD_QOH	35
3	T1	PROD_QOH = 35 + 100	
4	T2	PROD_QOH = 35 − 30	
5	T1	Write PROD_QOH **(Lost update)**	135
6	T2	Write PROD_QOH	5