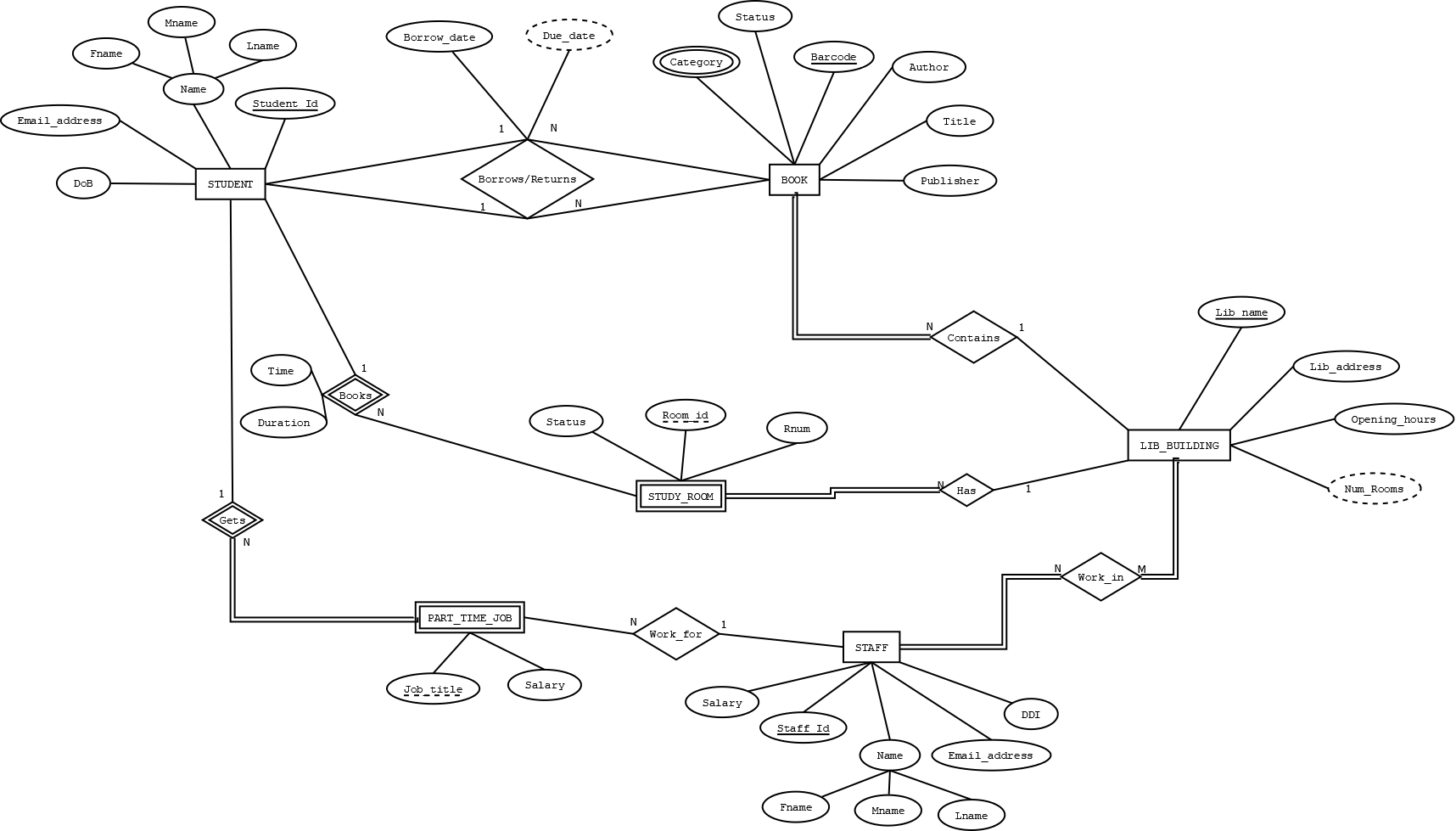
**COSC344 Assignment 2**

Group: 3

Group Leader: Elsie Sun

Members: Andy Randell, Ben Taylor, Elsie Sun, Nikki Meadows

**1. Revised ER Diagram**

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**1.a) Changes from previous ER diagram:**

**Changes to attributes:**

* The first change that was made from the previous ER diagram was to change DoB under the student entity from a derived attribute to an attribute. As we will store the exact DoB of a student, there is no need to derive this attribute.
* Another attribute that has changed is the Due\_date in the Borrows/Returns relationship between the Student and Book entities. Due\_date is now a derived attribute, as this can be calculated from the Borrow\_date attribute.
* The Return\_date attribute has been removed from the Borrows/Returns relationship in order to remove duplication as we are already storing the Due\_date for this relationship.
* Under the BOOK entity, the IBSN attribute has been removed and replaced with Barcode. IBSN has been removed from the diagram as this number is unable to be used as a key attribute as multiple copies of the same book are able use the same IBSN. As a Barcode is most often used in libraries to identify individual books, this is now the key attribute in the BOOKS entity.
* Under the BOOK entity, the Book\_status attribute has been changed to a single valued attribute named Status.
* Under the STUDY\_ROOM entity, the Room\_status attribute has also been changed to a single valued attribute named Status.
* The Department attribute has been removed from the PART\_TIME\_JOB entity as for simplicity purposes each employed student would work in the same department.
* Under the BOOK entity, the Location attribute has been removed as the location of a book is represented by the CONTAINS relationship between BOOKS and LIB\_BUILDING.
* The Lib\_name attribute has been removed from the STUDY\_ROOM entity as this is represented by the HAS relationship between the STUDY\_ROOM and LIB\_BUILDING entities.
* The final attribute that has been modified in the revised diagram is Num\_rooms under the LIB\_BUILDING entity is now represented as a derived attribute for each library.

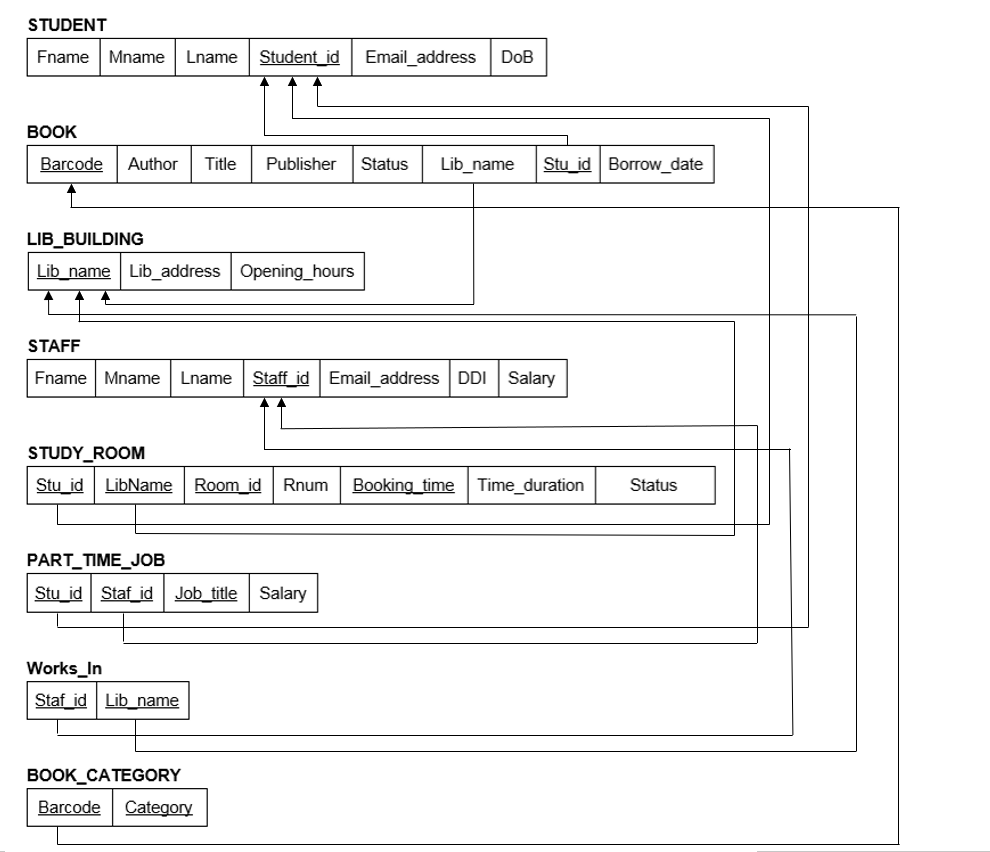
**Changes to entities:**

* The STUDY\_ROOM entity has been modelled in the revised ER diagram as a weak entity type due to the fact that rooms in each different library are able to have the same Room\_id. Room\_id has therefore been updated to a weak key attribute to reflect this change.

**Changes to relationships:**

* The name of the relationship between the STUDY\_ROOM and LIB\_BUILDING entities has been changed from Contains to Has, to ensure that we do not have two relationships with the same name in our diagram.
* The two relationships from the previous diagram between the STUDENT and BOOK entities have been combined into one Borrows/Returns relationship.

**2. Relational Schema**

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**3. Normalization**

**Step 1: 1NF**

All relations are in 1NF. In the above relationship model,the multivalued attribute ‘CATEGORY’ in ‘BOOK’ and the composite attributes ‘Name’ in entities ‘STUDENT’ and ‘STAFF’ are removed, and new relations have been created. So, each domain of each attribute has atomic values only, and each value of each attribute in a tuple has a single value from the domain of the attribute.

**Step 2: 2NF**

BOOK is not in 2NF, because the ‘Title’, ‘Author’, ‘Publisher’, and ‘Lib\_name’ depend on ‘Barcode’, and the ‘Borrow\_date’ is dependent on ‘Stu\_id’ and ‘Barcode’. To get it into 2NF we divide it into the following relations:

BOOK( Barcode, Title, Author, Publisher, Lib\_name, Stu\_id, Borrow\_date, Status)

→ BookInfo(Barcode, Title, Author, Publisher, Status, Lib\_name)

→ StudentBook(Stu\_id, Barcode, Borrow\_date)

**Step 3: 3NF**

3NF has no non-prime attribute that is transitively dependent on the primary key. PART\_TIME\_JOB and STUDY\_ROOM are not in 3NF, because when ‘Job\_title’ has changed, ‘Salary’ should be changed as well in ‘PART\_TIME\_JOB’. Also, when ‘Room\_id ’has changed, ‘Lib\_name’ should be changed as well in ‘STUDY\_ROOM’. In addition, in ‘STUDY\_ROOM’, choosing ‘Booking\_time’ as a primary key, because ‘Stu\_id’, ’room\_id’ and ‘Booking\_time’ are highly correlated, and using ‘Booking\_time’ to distinguish multiple bookings come from one student. To get it into 3NF we divide them into the following relations:

PART\_TIME\_JOB(Stu\_id, Sta\_id, Job\_title, Salary)

→ StudentJob(Stu\_id, Staf\_id, Job\_title)

→ JobInfo(Job\_title, Salary)

STUDY\_ROOM(Stu\_id, Lib\_name, Room\_id, Booking\_time, Rnum, Time\_duration, Status)

→ StudentRoom(Stu\_id, Room\_id, Booking\_time, Time\_duration)

→ RoomInfo(Room\_id, Rnum, Lib\_name, Status)

**Step 4: BCNF**

All relations are in BCNF.

**4. Load.sql**

DROP TABLE book\_category;

DROP TABLE student\_book;

DROP TABLE student\_room;

DROP TABLE room\_info;

DROP TABLE works\_in;

DROP TABLE student\_job;

DROP TABLE staff;

DROP TABLE bookinfo;

DROP TABLE job\_info;

DROP TABLE student;

DROP TABLE lib\_building;

CREATE TABLE student(

fname VARCHAR2(15) NOT NULL,

mname CHAR,

lname VARCHAR2(15) NOT NULL,

student\_id CHAR(10) PRIMARY KEY,

email\_address VARCHAR2 (28),

dob DATE

);

INSERT INTO student VALUES

('Timothea','J','Warner','1234567','warti100@student.otago.ac.nz',TO\_DATE('01-05-1997', 'DD-MM-YYYY'));

INSERT INTO student VALUES

('Gina','A','Alvarez','7895623','alvgi101@student.otago.ac.nz',TO\_DATE('21-12-1998','DD-MM-YYYY'));

INSERT INTO student VALUES

('Theo','T','Stevens','4562359','steth102@student.otago.ac.nz',TO\_DATE('15-01-1997','DD-MM-YYYY'));

INSERT INTO student VALUES

('Estelle','A','Garner','4513150','gares103@student.otago.ac.nz',TO\_DATE('22-12-2000','DD-MM-YYYY'));

INSERT INTO student VALUES

('Ramona','R','Sims','5147967','simra104@student.otago.ac.nz',TO\_DATE('31-12-2002','DD-MM-YYYY'));

INSERT INTO student VALUES

('Eugenia','E','Townsend','7894520','toweu105@student.otago.ac.nz',TO\_DATE('06-11-1995','DD-MM-YYYY'));

INSERT INTO student VALUES

('Sally','S','Hum','4468206','humsa106@student.otago.ac.nz',TO\_DATE('28-11-1998','DD-MM-YYYY'));

INSERT INTO student VALUES

('Alicia','J','Smith','8888222','smial107@student.otago.ac.nz',TO\_DATE('30-03-1999','DD-MM-YYYY'));

INSERT INTO student VALUES

('Jennifer','X','Wallace','9658201','walje108@student.otago.ac.nz',TO\_DATE('20-02-2002','DD-MM-YYYY'));

INSERT INTO student VALUES

('Vicky','v','He','8546073','hevic109@student.otago.ac.nz',TO\_DATE('11-11-2000','DD-MM-YYYY'));

CREATE TABLE lib\_building(

lib\_name VARCHAR2(20) PRIMARY KEY,

lib\_address VARCHAR2(50),

opening\_hours VARCHAR2(30)

);

INSERT INTO lib\_building VALUES('Central', '65 Albany Street', '7am-11pm');

INSERT INTO lib\_building VALUES('Robertson', '135 Union Street East', '7am-11pm');

INSERT INTO lib\_building VALUES('Science', '100 Castle Street North', '7am-11pm');

INSERT INTO lib\_building VALUES('Law', '85 Albany Street', '7am-11pm');

CREATE TABLE bookinfo(

barcode CHAR(12) PRIMARY KEY,

title VARCHAR2(50) NOT NULL,

author VARCHAR2(30) NOT NULL,

publisher VARCHAR2(30) NOT NULL,

status VARCHAR2(15) NOT NULL,

lib\_name VARCHAR2(20) NOT NULL CONSTRAINT libbuilding\_fk REFERENCES lib\_building(lib\_name) DISABLE

);

ALTER TABLE bookinfo ENABLE CONSTRAINT libbuilding\_fk;

INSERT INTO bookinfo VALUES('278462740182', 'To Kill a Mockingbird', 'Harper Lee', 'J. B. Lippincott and Co.', 'Unavailable', 'Central');

INSERT INTO bookinfo VALUES('123649071295', 'War and Peace', 'Leo Tolstoy', 'The Russian Messenger.','Unavailable', 'Robertson');

INSERT INTO bookinfo VALUES('874021833362', 'The Handmaid’s Tale', 'Margaret Atwood', 'McClelland and Stewart','Unavailable', 'Law');

INSERT INTO bookinfo VALUES('938566720192', 'The Hobbit', 'J.R.R Tolkien', 'Allen and Unwin', 'Unavailable','Science');

INSERT INTO bookinfo VALUES('876543645110', '1984', 'George Orwell', 'Secker and Warburg', 'Unavailable','Central');

INSERT INTO bookinfo VALUES('198567651657', 'Pride and Prejudice', 'Jane Austen','T.Egertin, Whitehall', 'Available', 'Central');

CREATE TABLE staff(

fname VARCHAR2(15) NOT NULL,

mname CHAR,

lname VARCHAR2(15) NOT NULL,

staff\_id CHAR(8) PRIMARY KEY,

email\_address VARCHAR2(28),

ddi VARCHAR2(11),

salary NUMBER(6)

);

INSERT INTO staff VALUES

('Pearl','A','Robbins','12345678','robpe12a@otago.ac.nz','+6434798910',30000);

INSERT INTO staff VALUES

('Harmony','B','Cook','12345679','cooha52p@otago.ac.nz','+6434798910',35000);

INSERT INTO staff VALUES

('Tamara','C','Marsh','12496583','marta14s@otago.ac.nz','+6434798914',50000);

INSERT INTO staff VALUES

('Juliet','D','Mills','45612134','milju95o@otago.ac.nz','+6434795116',56320);

INSERT INTO staff VALUES

('Faye','E','Harper','88888884','harfa89q@otago.ac.nz','+6434798803',40000);

CREATE TABLE job\_info (

job\_title VARCHAR(20) PRIMARY KEY,

salary NUMBER(6) NOT NULL

);

INSERT INTO job\_info VALUES

('returns', 3200);

INSERT INTO job\_info VALUES

('data entry', 3100);

INSERT INTO job\_info VALUES

('help desk', 4000);

CREATE TABLE student\_job (

student\_id CHAR(10) NOT NULL

CONSTRAINT stu\_id\_cnst REFERENCES student(student\_id) DISABLE,

staff\_id CHAR(8) PRIMARY KEY,

job\_title VARCHAR(20) NOT NULL

CONSTRAINT job\_title\_cnst REFERENCES job\_info(job\_title) DISABLE

);

ALTER TABLE student\_job ENABLE CONSTRAINT stu\_id\_cnst;

ALTER TABLE student\_job ENABLE CONSTRAINT job\_title\_cnst;

INSERT INTO student\_job VALUES

('1234567', '12345678', 'returns');

INSERT INTO student\_job VALUES

('7895623', '12345679', 'data entry');

INSERT INTO student\_job VALUES

('4562359', '12496583', 'returns');

INSERT INTO student\_job VALUES

('8888222', '45612134', 'help desk');

CREATE TABLE works\_in (

staff\_id CHAR(8) NOT NULL

CONSTRAINT staff\_id\_cnst REFERENCES staff(staff\_id) DISABLE,

lib\_name VARCHAR2(20) NOT NULL

CONSTRAINT lib\_name\_cnst REFERENCES lib\_building(lib\_name) DISABLE

);

ALTER TABLE works\_in ENABLE CONSTRAINT staff\_id\_cnst;

ALTER TABLE works\_in ENABLE CONSTRAINT lib\_name\_cnst;

INSERT INTO works\_in VALUES

('12345678', 'Science');

INSERT INTO works\_in VALUES

('12345679', 'Robertson');

INSERT INTO works\_in VALUES

('12496583', 'Law');

INSERT INTO works\_in VALUES

('45612134', 'Central');

CREATE TABLE room\_info (

room\_id VARCHAR2(10) PRIMARY KEY,

r\_num NUMBER NOT NULL CHECK (r\_num >1 and r\_num <11),

status VARCHAR2(15) NOT NULL,

lib\_name VARCHAR2(20) NOT NULL

CONSTRAINT lib\_name\_cnst1 REFERENCES lib\_building(lib\_name) DISABLE

);

ALTER TABLE room\_info ENABLE CONSTRAINT lib\_name\_cnst1;

INSERT INTO room\_info VALUES('CentGS1', 8, 'Available','Central');

INSERT INTO room\_info VALUES('CentGS2', 10,'Unavailable', 'Central');

INSERT INTO room\_info VALUES('CentGS3', 4, 'Unavailable','Central');

INSERT INTO room\_info VALUES('LawGS 6.1', 4,'Available', 'Law');

INSERT INTO room\_info VALUES('LawGS 9.1', 6, 'Unavailable','Law');

INSERT INTO room\_info VALUES('RobGS1', 10, 'Available','Robertson');

INSERT INTO room\_info VALUES('RobGS2', 6,'Unavailable', 'Robertson');

INSERT INTO room\_info VALUES('RobGS3', 8, 'Available','Robertson');

INSERT INTO room\_info VALUES('SciGS G01' , 8, 'Unavailable','Science');

INSERT INTO room\_info VALUES('SciGS 103' ,8, 'Available','Science');

INSERT INTO room\_info VALUES('SciGS 106' ,8,'Unavailable', 'Science');

CREATE TABLE student\_room(

student\_id CHAR(10) PRIMARY KEY

CONSTRAINT stu\_id\_cnst2 REFERENCES student(student\_id) DISABLE,

room\_id VARCHAR2(10) NOT NULL

CONSTRAINT room\_id\_cnst REFERENCES room\_info(room\_id) DISABLE,

booking\_time DATE NOT NULL,

time\_duration NUMBER CHECK (time\_duration >0 and time\_duration <4)

);

ALTER TABLE student\_room ENABLE CONSTRAINT stu\_id\_cnst2;

ALTER TABLE student\_room ENABLE CONSTRAINT room\_id\_cnst;

INSERT INTO student\_room VALUES

('1234567', 'CentGS2', TO\_DATE('22-08-2020 11:00:00', 'dd-mm-yyyy hh24:mi:ss'), 2);

INSERT INTO student\_room VALUES

('5147967', 'LawGS 9.1', TO\_DATE('23-08-2020 17:00:00', 'dd-mm-yyyy hh24:mi:ss'), 3);

INSERT INTO student\_room VALUES

('8888222', 'CentGS3', TO\_DATE('24-08-2020 16:00:00', 'dd-mm-yyyy hh24:mi:ss'), 2);

INSERT INTO student\_room VALUES

('4562359', 'RobGS2', TO\_DATE('22-08-2020 09:00:00', 'dd-mm-yyyy hh24:mi:ss'), 1);

INSERT INTO student\_room VALUES

('7894520', 'SciGS 106', TO\_DATE('23-08-2020 07:00:00', 'dd-mm-yyyy hh24:mi:ss'), 3);

INSERT INTO student\_room VALUES

('9658201', 'SciGS G01', TO\_DATE('25-08-2020 11:00:00', 'dd-mm-yyyy hh24:mi:ss'), 2);

CREATE TABLE student\_book(

student\_id CHAR(10) PRIMARY KEY

CONSTRAINT student\_f REFERENCES student(student\_ID) DISABLE,

barcode CHAR(12) NOT NULL

CONSTRAINT bar\_fk REFERENCES bookinfo(barcode) DISABLE,

borrow\_date DATE,

due\_date DATE

);

ALTER TABLE student\_book ENABLE CONSTRAINT student\_f;

ALTER TABLE student\_book ENABLE CONSTRAINT bar\_fk;

INSERT INTO student\_book VALUES('1234567', '278462740182', TO\_DATE('30-04-2000','DD-MM-YYYY'), TO\_DATE('30-05-2000','DD-MM-YYYY'));

INSERT INTO student\_book VALUES('7895623', '123649071295', TO\_DATE('02-04-2001','DD-MM-YYYY'), TO\_DATE('02-05-2000','DD-MM-YYYY'));

INSERT INTO student\_book VALUES('4562359', '874021833362', TO\_DATE('30-03-2000','DD-MM-YYYY'), TO\_DATE('30-04-2000','DD-MM-YYYY'));

INSERT INTO student\_book VALUES('4513150', '938566720192', TO\_DATE('15-12-2000','DD-MM-YYYY'), TO\_DATE('15-01-2001','DD-MM-YYYY'));

INSERT INTO student\_book VALUES('5147967', '876543645110', TO\_DATE('17-11-2002','DD-MM-YYYY'), TO\_DATE('17-11-2002','DD-MM-YYYY'));

CREATE TABLE book\_category(

category VARCHAR2(20) NOT NULL,

barcode CHAR(12) PRIMARY KEY

CONSTRAINT bookinfo\_fk references bookinfo(barcode) DISABLE

);

ALTER TABLE book\_category ENABLE CONSTRAINT bookinfo\_fk;

INSERT INTO book\_category VALUES('Fiction', '278462740182');

INSERT INTO book\_category VALUES('Nonfiction', '123649071295');

INSERT INTO book\_category VALUES('Nonfiction', '874021833362');

INSERT INTO book\_category VALUES('Fiction', '938566720192');

INSERT INTO book\_category VALUES('Romance', '876543645110');

INSERT INTO book\_category VALUES('Fiction','198567651657');

INSERT INTO book\_category VALUES('Romance','198567651657');

COMMIT;

**5. Teamwork Summary**

The ER diagram was revised based on feedback from Assignment 1. Once the diagram had been updated, the assignment work was divided between the team members using a mixture of Facebook messenger, email and communication via a google doc. All of the team members worked on the same google doc, and we divided the workload as equally as possible.

**ERD Diagram:** Elsie updated the ERD diagram from assignment 1 with the agreed upon changes. The changes that were made to the diagram were then described by Nikki and checked by the rest of the group.

**Relational Schema and normalisation:** These were worked on within the

Google doc. Elsie modelled the relational schema with what the group had agreed upon. Ben went through this and made changes where appropriate.

**SQL:**The sql statements were divided as equally as possible on our google document,

with each group member writing the corresponding insert statements for their tables. We all double checked each other's work and discussed any changes that needed to be made. The statements were divided as follows: Elsie completed the student and staff tables and insert statements, Nikki completed the book category, works in and student room tables and insert statements, Ben completed the room info, lib building and book info tables and insert statements and Andy completed the student book, student job and job info tables and insert statements.