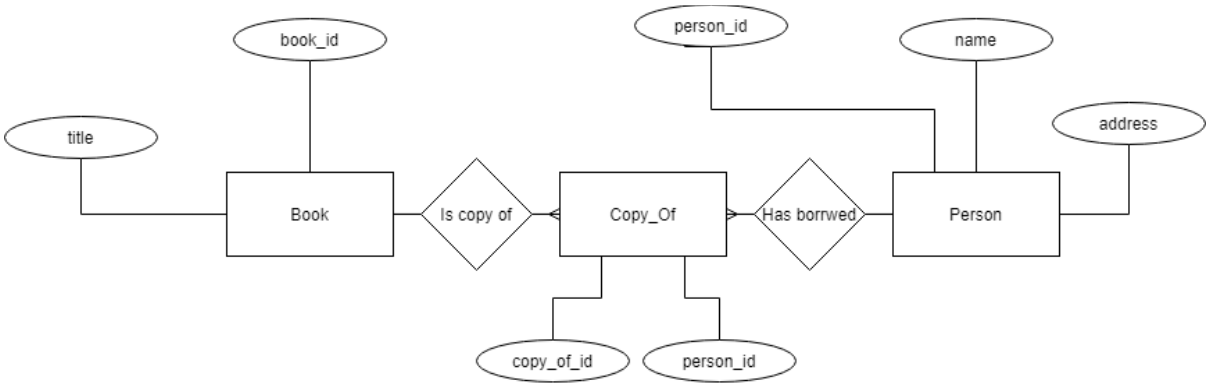
Candidate Number: 2031B
Paper 3
Question 1

a.

```
SELECT * FROM (
      SELECT
            Book.book_id AS book_id,
            Book.number_borrowed as number_borrowed,
            SUM(Borrowed.number) as actual_number_borrowed
      FROM Book
      JOIN Borrwed ON Book.book_id = Borrowed.Book_id
      GROUP BY Book.book_id
)
WHERE number_borrowed != actual_number_borrowed
```

b.



c. One option would be to have 4 tables: Book, Copy_Of, Person, and Is_Copy_Of. This would allow for modelling "Is copy of" as a many-to-many relationship if the library every wanted to, allowing for the possibility of possibly treating multiple books as a single copy (e.g., if the library lent out the entire Game of Thrones series to the same person it might want to be treated as one copy).

Table	Rows				
Book	book_id	title			
Is_Copy_Of	book_id	copy_of_id			
Copy_Of	copy_of_id	person_id			
Person	person_id	name	address		

Is_Copy_Of would have a composite primary key consisting of book_id and copy_of_id as foreign keys. Copy_Of would also have a foreign key person_id to specify which person has the copy, or NULL if the library still has the copy.
Another option would be to only have 3 tables: Book, Copy_Of, and Person. Here the difference is that Copy_Of has another foreign key: book_id, to indicate which book it is a copy of. This would allow for fewer joins when querying.

Table	Rows				
Book	book_id	title			
Copy_Of	copy_of_id	book_id	person_id		
Person	person_id	name	address		

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```
SELECT
      Book.book_id,
      title,
      COUNT(*) AS number_owned,
      COUNT(CASE person_id WHEN NULL THEN NULL ELSE 1 END) AS
number_borrowed
FROM Book
JOIN Copy_Of ON Book.book_id = Copy_Of.book_id
GROUP BY Book.book_id
```

d.