

**The University of the West Indies**  
**Department of Computing & Information Technology**  
**COMP2605 – Enterprise Database Systems**  
**Worksheet 1**

A public library system has many members who borrow books. A portion of the library database schema is given below. Primary keys are underlined in solid line and foreign keys are underlined in dashed line.

BOOK (BookId, BookTitle)

MEMBER (UserId, UserName, Address, UnpaidFines)

LOAN (Loan Id, BookId, UserId, DateOut, DateDue, DateReturned)

1. LoanId is the primary key of the Loan table. Identify another possible primary key for this table (it may be a composite primary key). What advantage is there of using LoanId as primary over the other primary key that you have given. Explain the Entity Integrity rule that the primary key must satisfy; discuss this for both cases: using the LoanId as primary as well as using the alternative primary key that you have given.
2. Loan Table has two foreign keys. Explain (in detail) the Referential Integrity rule that these two foreign keys must satisfy. Why is it important to enforce Referential Integrity? What unexpected results could be obtained if the Referential Integrity rule is not enforced?

3. (a) Two basic relational algebra operators are

Restrict:  $\sigma_{\text{Predicate}}(R)$

And Project:  $\Pi_{a_1, \dots, a_n}(R)$

Explain these operators, giving an example of each from the Library database.

- (b) Explain the concept of ‘closure’ of relational operations.
- (c) Describe the relations that would be produced by the following relational algebra operations:

$\sigma_{\text{DateOut} = 05\text{-Jan-08}}(\text{Loan})$

$\Pi_{\text{BookId}, \text{UserId}}(\text{Loan})$

$\Pi_{\text{BookId}, \text{UserId}}(\sigma_{\text{DateOut} = 05\text{-Jan-13}}(\text{Loan}))$

$\Pi_{\text{BookTitle}, \text{UserId}}(\text{Loan} \bowtie_{\text{BookId}} \text{Book})$