Problem 1. [100pts] Consider the following schema of a bank:

customer (name: string, credit: integer)
loan (no: string, type: string, minCredit: integer)
borrower (cname: string, lno: string, due: date)

where borrower.cname and borrower.lno are foreign keys referencing customer, respectively loan, whose keys are name, respectively no (number). Attribute loan.minCredit indicates the minimum credit required of a customer to qualify for that loan.

Write the following queries in Relational Tuple Calculus (RTC) and in Relational Algebra (RA).

1. (15 pts): Find the names of customers who took a “jumbo mortgage” and a “student” loan.

2. (15 pts): Find the names of customers who took a “jumbo mortgage” loan or have a credit rating of at least 750.

3. (16 pts): Find pairs of names of customers who share the same loan. Avoid listing a customer with himself (e.g. do not list (Joe, Joe)). Also avoid repeating pairs which are equal modulo swapping the components (e.g. only one of (John, Jane), (Jane, John) should be listed).

4. (18 pts): Find the names of customers who took every loan.

5. (18 pts): Find the numbers for the loans with highest minCredit requirement among the loans taken by the borrower named “Smith”.

6. (18 pts): Find the loan numbers shared by every customer with a credit rating below 600.

Do not use grouping and aggregation (we haven’t even covered grouping and aggregation extensions of RA and RTC)!

You may use views, with the SQL-analogous syntax CREATE VIEW viewName AS RTC or RA expression.