

### SOLUTIONS:

1a) No because Pid is key for relation PARTS.

1.b) Yes as long as the value for attribute Sid is different.

1c) RA:  $\pi_{Pname} (\sigma_{Colour='red'} (PARTS))$

1d) Let R and R' be:

$R = \pi_{Sid} (\pi_{Pid} (\sigma_{Colour='red'} (PARTS)) \bowtie CATALOG);$

$R' = \pi_{Sid} (\sigma_{City='Dublin'} (SUPPLIERS))$

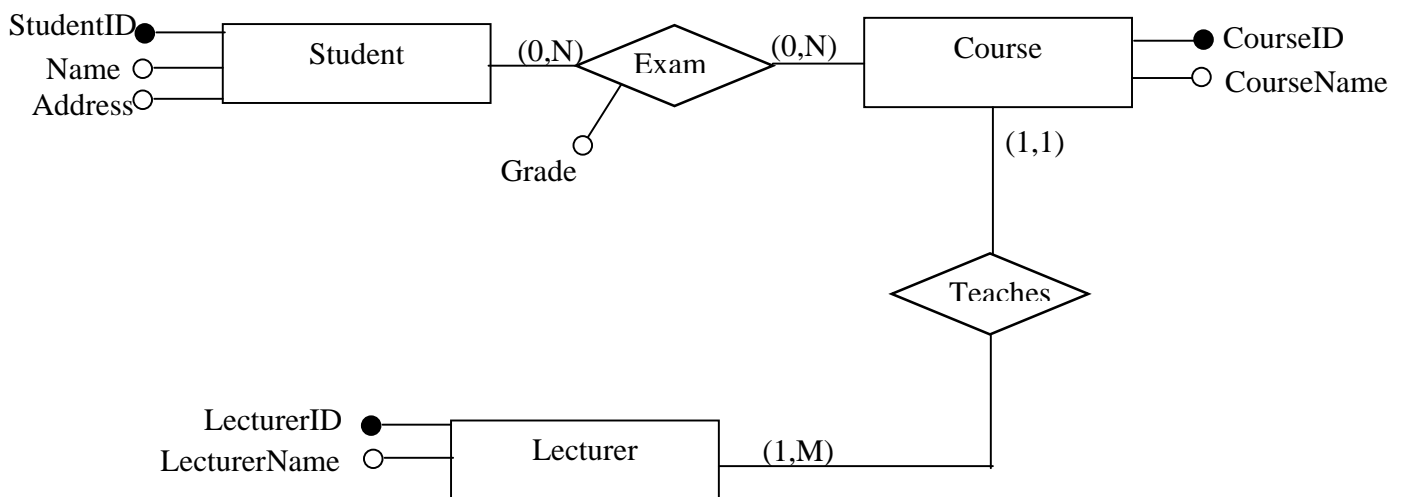
Solution:  $R \cap R'$

2a) **SELECT age**  
**FROM Sailors**  
**WHERE rating=10**

2b) **SELECT bname**  
**FROM Boats,Reserves**  
**WHERE Boats.bid=Reserves.bid AND Reserves.day='15/01/01'**

2c) **SELECT Sailors.sid, sname, age, Count(distinct bid)**  
**FROM Reserves,Sailors**  
**WHERE Sailors.sid=Reserves.sid and rating=10**  
**GROUP BY Sailors.sid, sname, age**

3) a)



ASSUMPTIONS and CONSTRAINTS:

1. A student can pass many exams for different courses: cardinality (0,N)
2. The exam for a given course can be passed by different students: cardinality (0,N)
3. Each student can only pass a given exam once (i.e., studentID + courseID uniquely identify an exam)
4. Each course (id) has only one lecturer: cardinality (1,1)
5. Each lecturer can teach several courses but at least one: cardinality (1,N)

Translation into relational model:

STUDENT(StudentID, Name, Address)  
 COURSE(CourseID, CourseName, LecturerID)  
 LECTURER(LecturerID, LecturerName)  
 EXAM(StudentID, CourseID, Grade)

**Note:** key of EXAM determined by assumption 3.

b) see lecture notes.

c) see lecture notes.

4) a) see lecture notes.

b) The relation is not in 3<sup>rd</sup> normal form (and therefore not in BCNF). The functional dependency BookTitle → Author, Category violates the conditions.

c) see lecture notes.

5) a)b)c)d) see lecture notes.