Lab 15/10/19 – Relational Algebra

Assume the following relations:

BOOKS(DocId, Title, Publisher, Year)
STUDENTS(StId, StName, Major, Age)
AUTHORS(AName, Address)
borrows(DocId, StId, Date)
has-written(DocId, AName)
describes(DocId, Keyword)

1. List the year and title of each book.
2. List all information about students whose major is CS.
3. List all students with the books they can borrow.
4. List all books published by McGraw-Hill before 1990.
5. List the name of those authors who are living in Davis.
6. List the name of students who are older than 30 and who are not studying CS.
7. Rename AName in the relation AUTHORS to Name.

8. List the names of all students who have borrowed a book and who are CS majors.
9. List the title of books written by the author 'Silberschatz'.
10. As 9., but not books that have the keyword 'database'.
11. Find the name of the youngest student.
12. Find the title of the oldest book.

13. List each book with its keywords.
14. List each student with the books s/he has borrowed.
15. List the title of books written by the author 'Ullman'.
16. List the authors of the books the student 'Smith' has borrowed.
17. Which books have both keywords 'database' and 'programming'?
18. Query 16 using assignments.

Solutions

1. πYear, Title(BOOKS)
2. σMajor = 'CS'(STUDENTS)
3. STUDENTS × BOOKS
4. σPublisher = 'McGraw-Hill'∧Year<1990(BOOKS)
5. πAName(σAddress like '%Davis%'(AUTHORS))
6. πStName(σAge>30(STUDENTS)) − πStName(σMajor='CS'(STUDENTS))
7. ρAUTHORS(Name, Address)(AUTHORS)

8. πStName(σSTUDENTS.StId=borrows.StId (σMajor='CS'(STUDENTS) × borrows))
9. πTitle(σAName='Silberschatz' (σhas-written.DocId=BOOKS.DocID(has-written×BOOKS)))
   or
   πTitle(σhas-written.DocId=BOOKS.DocID (σAName='Silberschatz'(has-written) × BOOKS))
10. …as for 9... − πTitle(σdescribes.DocId=BOOKS.DocId (σKeyword='database'(describes) × BOOKS))
11. πStName(STUDENTS) − πS1.StName(σS1.Age>S2.Age(ρS1(STUDENTS) ×ρS2(STUDENTS)))
12. πTitle(BOOKS) − πB1.Title(σB1.Year>B2.Year(ρB1(BOOKS) × ρB2(BOOKS)))

13. BOOKS ✶ Descriptions
    Note that books having no keyword are not in the result.
14. BOOKS ✶ (borrows ✶ STUDENTS)
15. πTitle(σAName='Ullman'(BOOKS ✶ has-written)) Or
    πTitle(BOOKS ✶ σAName='Ullman'(has-written))
16. πAName(σStName='Smith'(has-written ✶ (borrows ✶ STUDENTS))
17. BOOKS ✶ (πDocId(σKeyword='database'(Descriptions)) ∩ πDocId(σKeyword='programming'(Descriptions)))
18. temp1 ←− borrows ✶ STUDENTS
    temp2 ←− has-written ✶ temp1
    result ←− πAName(σStName='Smith'(temp2))