Assume the following relations:

BOOKS (DocID, Title, Publisher,Year)

STUDENTS (StID, StName, Age, Major)

AUTHORS (AName, Address)

borrows(DocID,StID, Date)

has-written(DocID, AName)

describes(DocID,Keyword)

a) List the year and title of each book
b) List all information about students whose major is CS
c) List all students with the books they can borrow
d) List all books published by McGraw-Hill before 1990
e) List the name of those authors who are living in Davis
f) List the name of students who are older that 30 and who are not studying CS
g) Rename AName in the relation Authors to Name
h) List the names of all students who have borrowed a book and who are CS majors
i) List the title of books written by the author 'Silberschatz'
j) As i, but not books that have the keyword 'database'
k) List each book with its keywords
   -note that books having no keyword are not in the result
l) List each student with the books s/he has borrowed
m) List the tiltle of books written by the author 'Ullman'
n) List the authors of the books the student 'Smith' has borrowed
o) Which books have both keywords 'database' and 'programming'?

ANSWERS

a	$\pi_{\text{Year, Title}}(\text{BOOKS})$
b	$\sigma_{\text{Major} = \text{'CS'}}(\text{STUDENTS})$
c	$\text{STUDENTS} \times \text{BOOKS}$
d	$\sigma_{\text{Publisher} = \text{'McGraw-Hill'} \wedge \text{Year} < 1990}(\text{BOOKS})$

e	$\pi_{\text{AName}}(\sigma_{\text{Address like '\%Davis\%'}}(\text{AUTHORS}))$
f	$\pi_{\text{StName}}(\sigma_{\text{Age}>30}(\text{STUDENTS})) - \pi_{\text{StName}}(\sigma_{\text{Major}='\text{CS}'}(\text{STUDENTS}))$
g	$\rho_{\text{AUTHORS(Name, Address)}}(\text{AUTHORS})$
h	$\pi_{\text{StName}}(\sigma_{\text{STUDENTS.StId}=\text{borrows.StId}}(\sigma_{\text{Major}='\text{CS}'}(\text{STUDENTS}) \times \text{borrows}))$
i	$\pi_{\text{Title}}(\sigma_{\text{AName}='\text{Silberschatz}'}(\sigma_{\text{has-written.DocId}=\text{BOOKS.DocID}}(\text{has-written} \times \text{BOOKS})))$ or $\pi_{\text{Title}}(\sigma_{\text{has-written.DocId}=\text{BOOKS.DocID}}(\sigma_{\text{AName}='\text{Silberschatz}'}(\text{has-written}) \times \text{BOOKS}))$
j	$- \pi_{\text{Title}}(\sigma_{\text{describes.DocId}=\text{BOOKS.DocId}}(\sigma_{\text{Keyword}='\text{database}'}(\text{describes}) \times \text{BOOKS}))$ As in i, ...
k	$\text{BOOKS} \bowtie \text{Descriptions}$
l	$\text{BOOKS} \bowtie (\text{borrows} \bowtie \text{STUDENTS})$
m	$\pi_{\text{Title}}(\sigma_{\text{AName}='\text{Ullman}'}(\text{BOOKS} \bowtie \text{has-written}))$ or $\pi_{\text{Title}}(\text{BOOKS} \bowtie \sigma_{\text{AName}='\text{Ullman}'}(\text{has-written}))$
n	$\pi_{\text{AName}}(\sigma_{\text{StName}='\text{Smith}'}(\text{has-written} \bowtie (\text{borrows} \bowtie \text{STUDENTS}))$
o	$\text{BOOKS} \bowtie (\pi_{\text{DocId}}(\sigma_{\text{Keyword}='\text{database}'}(\text{Descriptions})) \cap \pi_{\text{DocId}}(\sigma_{\text{Keyword}='\text{programming}'}(\text{Descriptions})))$ or $\text{BOOKS} \bowtie (\text{Descriptions} \div \{('\text{database}'), ('\text{programming}')\})$ with $\{('\text{database}'), ('\text{programming}')\})$ being a constant relation.

REFERENCES

Lecture Notes, Dept. of Computer Science UC Davis 3. Relational Model and Relational Algebra, ECS-165A WQ'11