EXAMPLE ALGEBRA: INTEGER ARITHMETIC

DOMAIN: integers

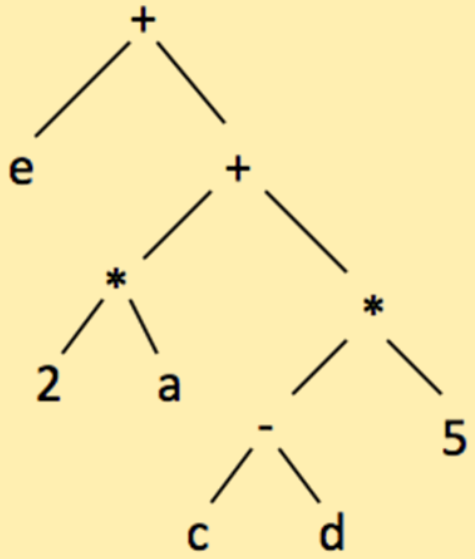
OPERATORS: -, + , *, ...

EXPRESSIONS: e + ((2*a) + ((c + (-d)) * 5))

LAWS: Commutative, Associative, Distributive

- a * b = b * a
- a * (b * c) = (a * b) * c
- a * (b + c) = a * b + a * c

Tree form



EQUIVALENCE RULES FOR SIMPLIFYING EXPRESSIONS

Examples for the relations R(A, B, C, D), S(E, F), and T(G, H) :

$$\pi_A(\pi_{A,B}(R)) \equiv \pi_A(R)$$

$$\sigma_{C_1}(\sigma_{C_2}(R)) \equiv \sigma_{C_1 \wedge C_2}(R)$$

$$\sigma_{C_R \wedge C_S}(R \bowtie S) \equiv \sigma_{C_R}(R) \bowtie \sigma_{C_S}(S)$$

$$R \bowtie (S \bowtie T) \equiv (R \bowtie S) \bowtie T$$

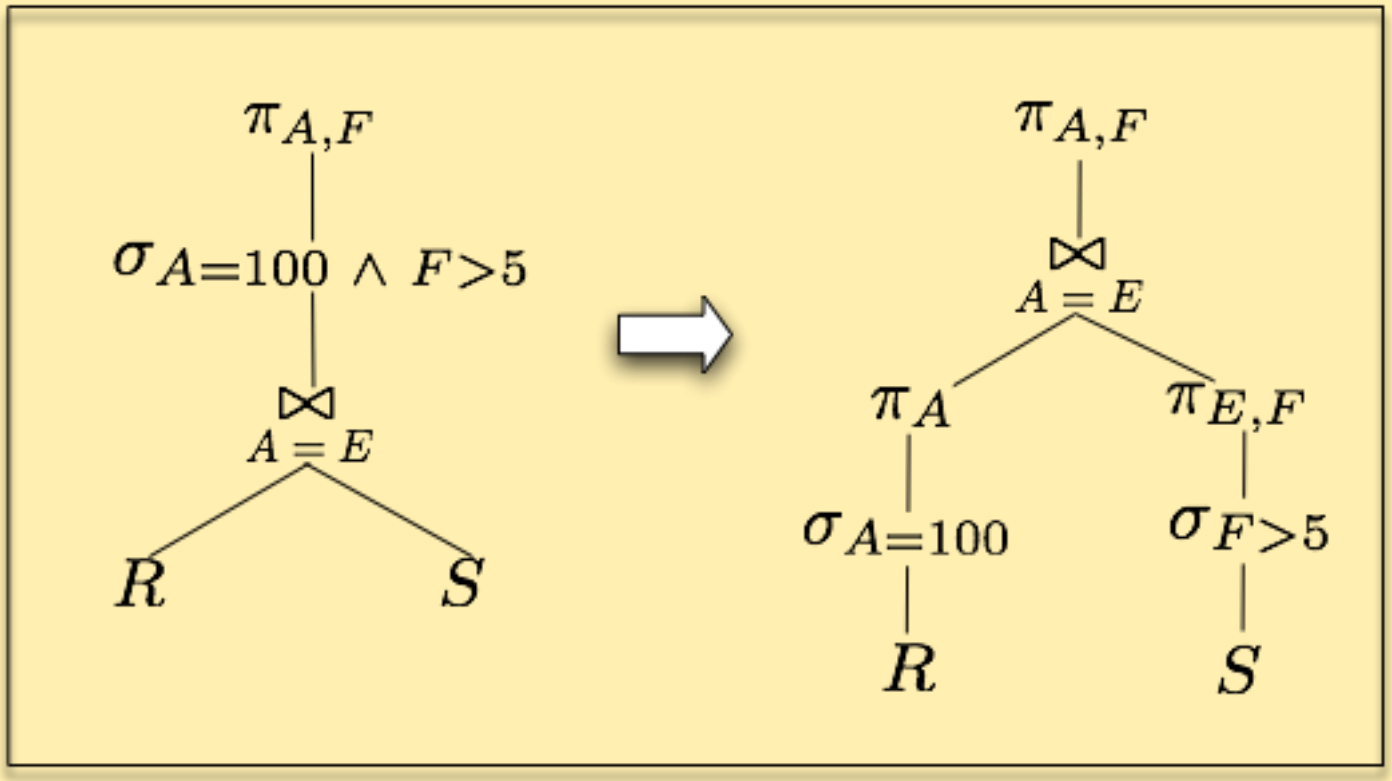
$$(R \bowtie S) \equiv (S \bowtie R)$$

$$\sigma_{C_X}({}_X\gamma_F(R)) \equiv {}_X\gamma_F(\sigma_{C_X}(R))$$

LOGICAL TREE (LOGICAL QUERY PLAN)

Let us consider R(A, B, C, D), S(E, F, G) and the expression:

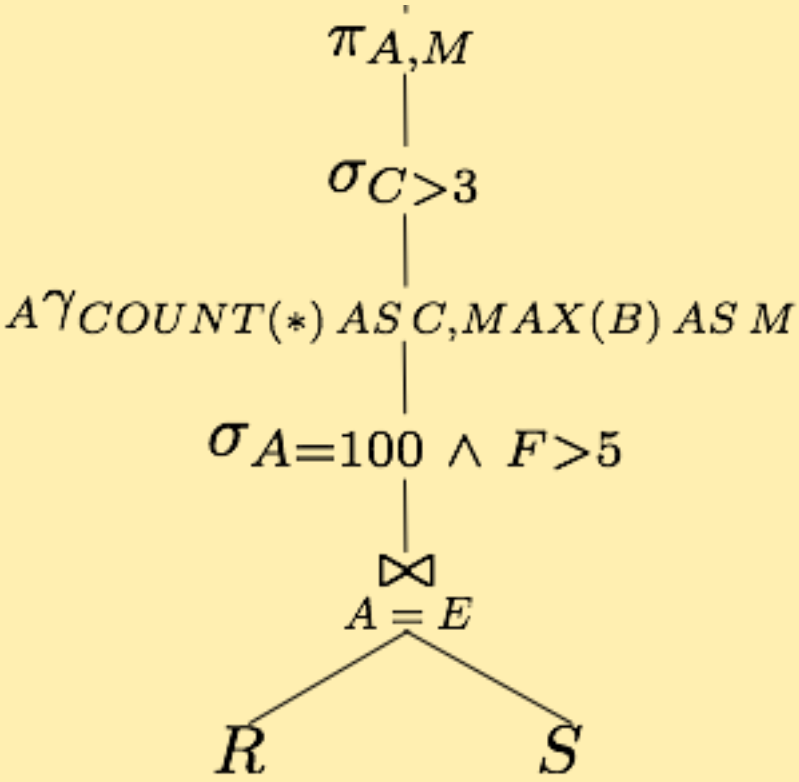
$$\pi_{A,F}(\sigma_{A=100 \wedge F>5}(R \overset{\bowtie}{}_{A=E} S))$$



LOGICAL TREE (LOGICAL QUERY PLAN)

Let us consider R(A, B, C, D), S(E, F, G) and the expression:

$$\pi_{A,M}(\sigma_{C>3}({}_{A}\gamma_{COUNT(*)\ AS\ C,MAX(B)\ AS\ M}(\sigma_{A=100 \wedge F>5}(R \overset{\bowtie}{}_{A=E} S))))$$



ASSIGNMENT IV:
WRITE RELATIONAL EXPRESSIONS / LOGICAL TREES

Schema:
Students(Name: string, StudCode: string, City: string, BirthYear:int)
Exams(Subject: string, Candidate*: string, Date: string, Grade: int)

1. Find the number of students who have passed the BSD exam with grade 30.
2. Find the name and student code of of students who have passed **some** exam.
3. Find the name, student code and the number of exams passed of students who have passed **some** exam.
4. Find the name and the student code of students who have passed 3 exams.
5. Find the name and the student code of students who have not passed exams.
6. Find the student code of students who have passed **all** exams.

RELATIONAL ALGEBRA DERIVED OPERATORS: DIVISION (÷)

Integers: M = 2 N = 3 O = M x N = 6 O/N = 2 O/M = 3

Relations:

M

C
4
8

N

D
3
1
7

O = M x N

C	D
4	3
4	1
4	7
8	3
8	1
8	7

O ÷ N =

C
4
8

O ÷ M =

D
3
1
7

DIVISION (÷)

Let **XY** be the attributes of **R** and **Y** be the attributes of **S**.
The **W** = **R** ÷ **S** is a relation with attributes **X** such that:

$$W = R \div S = \{x \mid \forall s \in S.\ (x \circ s \in R)\}$$

R

C	D
4	3
4	1
4	7
8	3
8	1

S

D
3
1
7

W = R ÷ S =

C
4

R(StudentNo, Course) S(Course)

TestStar DB on JRS

Schema:

InvoiceLines(FkInvoiceNo*, LineNo, FkProduct*, Qty, Price)

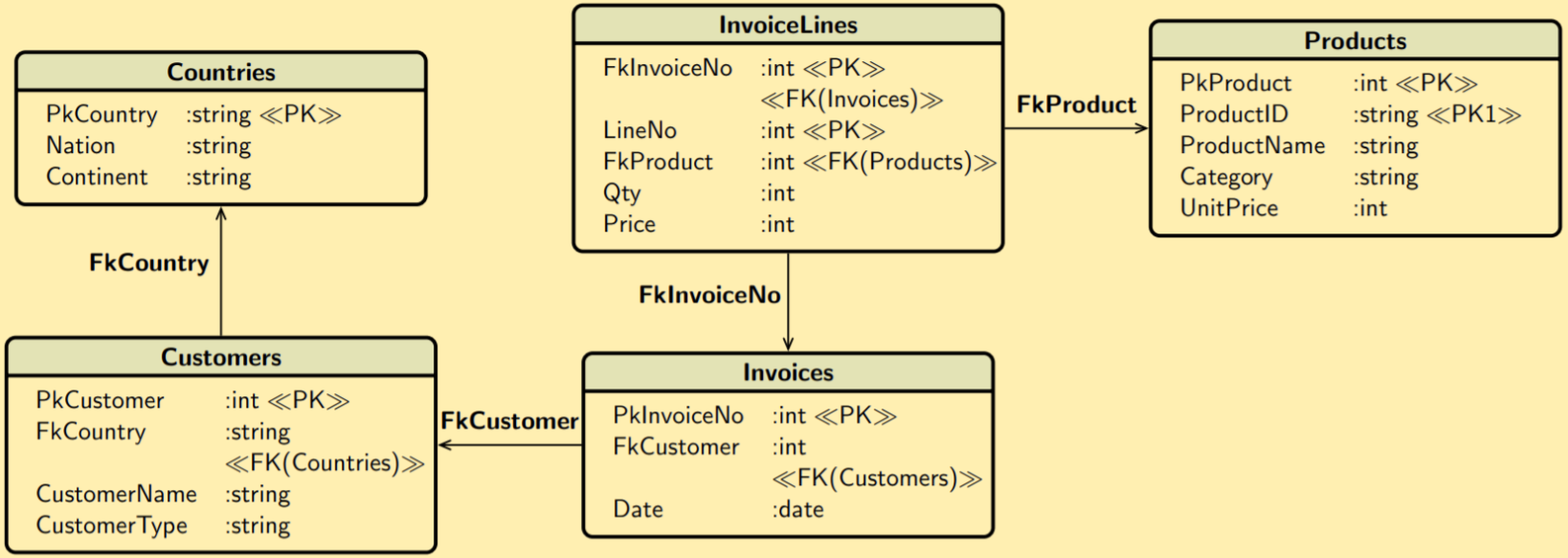
Invoices(PkInvoiceNo, Date, FkCustomer*)

Customers(PkCustomer, CustomerName, CustomerType, FkCountry*)

Countries(PkCountry, Nation, Continent)

Products(PkProduct, ProductID, ProductName, Category, UnitPrice)

Schema diagram?



EXERCISES: WRITE RELATIONAL EXPRESSIONS / LOGICAL TREES

- *Revenue is Qty*Price*

1. Find the revenue of every invoice line
2. Find the invoice lines with revenue > 5000
3. Find the FkProduct's sold in at least one invoice line
4. Find the total revenue by FkProduct
5. Find the total revenue by FkProduct for invoice lines with Price > 2000
6. Find the total revenue by FkProduct with at least 10 pieces of total quantity sold

EXERCISES: WRITE RELATIONAL EXPRESSIONS / LOGICAL TREES

- *Revenue is Qty*Price*

1. Find the total revenue by product category
2. Find the total revenue by customer nation for sales of product category 'Cat01'
3. Sort the customer names by total revenue descending
4. Find the total revenue of sales to customers from Finland of products from category 'Cat01'
5. Find customers with no sales