Extended relational algebra

Union: $R \cup S$ (sum of appearances)
Intersection: $R \cap S$ (minimum of appearances)
Difference: R - S (difference of appearances)
Selection: $\sigma_C(R)$ (where C is a condition)
Projection: $\pi_L(R)$ (in L: arithmetic expressions, renaming)
Product: $R \times S$
Join: $R \bowtie S$ ($R \bowtie_\theta S$) (where θ is a condition)
Duplicate elimination: $\delta(R)$
Grouping and aggregation: $\gamma_L(R)$
(in L: grouping expressions and aggregated expressions, plus renaming)
Sorting: $\tau_L(R)$

Examples:

$\pi_{A,B+C->X}(R)$	`SELECT A, B+C AS X FROM R;`
$\delta(R)$	`SELECT DISTINCT * FROM R;`
$R \cup S$	`SELECT * FROM R UNION ALL SELECT * FROM S;` (**multiset**)
$R \cap S$	`SELECT * FROM R INTERSECT SELECT * FROM S;` (**set!**)
R - S	`SELECT * FROM R MINUS SELECT * FROM S;` (**set!**)
$R \bowtie S$	`SELECT * FROM R NATURAL JOIN S;`
$R \bowtie_\theta S$	`SELECT * FROM R JOIN S ON (θ);`
$R \times S$	`SELECT * FROM R CROSS JOIN S;` or `SELECT * FROM R, S;`
$\gamma_{A,SUM(B)}(R)$	`SELECT A, SUM(B) FROM R GROUP BY A;`
$\gamma_{A,COUNT(B)}(\delta \pi_{A,B} R)$	`SELECT A, COUNT(DISTINCT B) FROM R GROUP BY A;`
$\tau_{A, B+C}(R)$	`SELECT * FROM R ORDER BY A, B+C;`

Complex example query in SQL and extended relational algebra:

```
SELECT dname, AVG(sal) + 100 sal_plus
FROM emp e, dept d
WHERE e.deptno = d.deptno
GROUP BY dname
HAVING COUNT(empno) > 3
ORDER BY dname;
```

$\tau_{dname}(\pi_{dname,av+100->sal\_plus}(\sigma_{cnt>3}(\gamma_{dname,AVG(sal)->av,COUNT(empno)->cnt}(\sigma_{E.deptno=D.deptno}(Emp \times Dept)))))$