Exercise 1
Consider the TPC-H benchmark and the query:

```sql
select *
from lineitem l, orders o, customers c
where l.l_orderkey=o.o_orderkey
    and o.o_custkey=c.c_custkey
    and c.c_name="Customer#000014993".
```

Do canonical translation and logical optimization.

Exercise 2
Given $|R_1|$, $|R_2|$, the domain of $R_1.x$ and $R_2.y$, and the information if $R_1.x$ and/or $R_2.y$ are keys of $R_1$ and $R_2$.

1. How can we estimate the selectivity of $\sigma_{R_1.x=c}$, where $c$ is a constant?

2. How can we estimate the selectivity of $\bowtie_{R_1.x=R_2.y}$?

Note that we don’t know the output size of $\sigma_{R_1.x=c}$ ($\bowtie_{R_1.x=R_2.y}$, respectively), so we can’t simply use the definition of selectivity.

Exercise 3
Given are two relations $R$ and $S$, with sizes 1,000 and 100,000 pages respectively. Each page has 50 tuples. The relations are stored on a disk, the average access time for the disk is 10 ms and the transfer speed is 10,000 pages/sec. How long does it take to perform the Nested Loops Join of $R$ and $S$? How long does it take to perform the Block Nested Loops Join with a block size of 100 pages? Assume that CPU costs are negligible and ignore I/O costs for the join output.