12.2

$\prod_{branch\_name}((\prod_{branch\_name,assets}(\rho_T(branch))) \bowtie_{T.assets>S.assets} (\prod_{assets}(\sigma_{branch\_city='\text{Brooklyn}'}(\rho_S(branch)))))$

The right operand is restricted and many irrelevant attributes are removed. The restriction $T.assets > S.assets$ is implemented when joining two relations.

12.3

b

r_1 has $20,000/25 = 800$ blocks and r_2 has $45,000/30 = 1,500$ blocks.

- If there is one block for the outer relation
  - If r_1 is used as the outer relation:
    block transfer: $800 + 800 * 1,500 = 1,200,800$
    seek: $800 + 800 = 1,600$
  - If r_2 is used as the outer relation:
    block transfer: $1,500 + 800 * 1,500 = 1,201,500$
    seek: $1,500 + 1,500 = 3,000$
- If there are $M - 2$ blocks for the outer relation:
  - If r_1 is used as the outer relation:
    block transfer: $\lceil \frac{800}{M-2} \rceil * 1,500 + 800$
    seek: $2\lceil \frac{800}{M-2} \rceil$
  - If r_2 is used as the outer relation:
    block transfer: $\lceil \frac{1,500}{M-2} \rceil * 800 + 1,500$
    seek: $2\lceil \frac{1,500}{M-2} \rceil$