A. Given two relations R1 and R2, where R1 contains N1 tuples, R2 contains N2 tuples, and N2>N1>0. Give the maximum and minimum possible sizes (in tuples) for the resulting relation produced by each of the following relational algebra expressions. State any assumptions you had to make.

(1) R1 ∪ R2, (2) R1 ∩ R2, (3) R1 − R2, (4) R1 × R2, (5) σ_{a\rightarrow b}(R1), (6) π_a(R1), and (7) R1 / R2

B. Consider the following supplier-parts-catalog schema:

Suppliers(sid: integer, surname: string, address: string)
Parts(pid: integer, pname: string, color: string)
Catalog(sid: integer, pid: integer, cost: real)

State what the following queries compute.

1. \( \pi_{sname}(\pi_{sid}(\sigma_{\text{color='red'}}Parts) \bowtie (\sigma_{\text{cost}<100}Catalog) \bowtie Suppliers) \)

2. \( \pi_{sname}(\pi_{sid}((\sigma_{\text{color='red'}}Parts) \bowtie (\sigma_{\text{cost}<100}Catalog) \bowtie Suppliers)) \)

3. \( (\pi_{sname}((\sigma_{\text{color='red'}}Parts) \bowtie (\sigma_{\text{cost}<100}Catalog) \bowtie Suppliers)) \cap (\pi_{sname}((\sigma_{\text{color='green'}}Parts) \bowtie (\sigma_{\text{cost}<100}Catalog) \bowtie Suppliers)) \)

4. \( (\pi_{sid}((\sigma_{\text{color='red'}}Parts) \bowtie (\sigma_{\text{cost}<100}Catalog) \bowtie Suppliers)) \cap (\pi_{sid}((\sigma_{\text{color='green'}}Parts) \bowtie (\sigma_{\text{cost}<100}Catalog) \bowtie Suppliers)) \)

5. \( \pi_{sname}(\pi_{sid,sname}((\sigma_{\text{color='red'}}Parts) \bowtie (\sigma_{\text{cost}<100}Catalog) \bowtie Suppliers)) \cap (\pi_{sid,sname}((\sigma_{\text{color='green'}}Parts) \bowtie (\sigma_{\text{cost}<100}Catalog) \bowtie Suppliers)) \)