Exercise 1

a. $\Pi_{storeid}\sigma_{employeeNumber < 100}(Store) \cup \Pi_{storeid}\sigma_{city = 'Ottawa'}(Store)$

b. $\Pi_{sname}\sigma_{Product.pname = 'pencil'}((Store \bowtie \sigma_{Store.storeid = Supply.storeid} Supply) \bowtie \sigma_{Product.pid} Product)$

c. $\Pi_{sname,city}((\Pi_{storeid}(Supply) \div (\Pi_{pid}\sigma_{storeid='0808'}(Supply))) \bowtie$ Store)

Exercise 2

a. $\Pi_{Employee.eid}\sigma_{C1.companyName='Google' \wedge C2.companyName='Facebook' \wedge sharenum>500}$
$(((Employee \bowtie_{Employee.cid=C1..cid\ \rho\ C1} Company)$
$\bowtie_{Employee.eid=Shares.eid} Shares) \bowtie_{Shares.cid = C2.cid\ \rho\ C2} Company)$

b. $\Pi_{Employee.eid}\sigma_{Shares.cid = Employee.cid}(Employee \bowtie_{Shares.eid = Employee.managerid} Shares)$

c. $\Pi_{Shares.eid}((Shares \bowtie_{Shares.eid = S2.eid \wedge Shares.cid \neq S2.cid\ \rho\ S2} Shares)$
$\bowtie_{Shares.eid = S3.eid \wedge Shares.cid \neq S3.cid \wedge S2.cid \neq S3.cid\ \rho\ S3} Shares$

d. $\Pi_{Employee.eid}(Shares \bowtie_{Shares.cid = Company.cid} Company) \div \Pi_{cid}(Company)$

Exercise 3

a. $\Pi_{Store.sname}\sigma_{P1.itsabag = true \wedge P1.color = 'black' \wedge P2.itsabag = true \wedge P2.color = 'black' \wedge P1.barcode \neq P2.barcode}$
$((((Store \bowtie_{Store.storeid = HS1.storeid\ \rho\ HS1} HasStock) \bowtie_{HS1.barcode = P1.barcode\ \rho\ P1} Product)$
$\bowtie_{Store.storeid=HS2.storeid\ \rho\ HS2} HasStock) \bowtie_{HS2.barcode = P2.barcode\ \rho\ P2} Product)$

b. $\Pi_{price}\sigma_{Store.sname = 'LaFollie'}((Product \bowtie_{Product.barcode = HasStock.barcode \wedge Product.itsshoes = true} HasStock)$
$\bowtie_{HasStock.storeid = Store.storeid} Store)$

c. $\Pi_{name}\sigma_{productCount \geq 5}\rho_{SupplierProductCount}($
$\Pi_{Supplier.supplierId,Supplier.name,productCount}\gamma_{Supplier.supplierId,Supplier.name;COUNT(*)\rightarrow productCount}$
$(Supplier \bowtie_{Product.supplierId=Supplier.supplierId} Product))$

d. $\Pi_{H1.barcode}\sigma_{H1.storeid = 1 \wedge H2.storeid = 2}(\rho\ H1\ HasStock \bowtie_{H1.barcode = H2.barcode} \rho\ H1\ HasStock)$

Exercise 4

a. {t | t∈Product ∧ t.price>40}
b. {t.barcode | t∈Product ∧ t.price>40}
c. {t.barcode | t∈Has_stock ∧ t.store-id='1' ∧ ∄s∈Has_stock(s.barcode=t.barcode ∧ s.store-id='2')}
d. {t | t∈Product ∧ ∀ s(s∈Store ∧ s.city='Ottawa'→ ∃ h(h∈Has_stock ∧ h.store-id=s.store-id ∧ h.barcode =t.barcode))}