**Problem 1**: *(3 pts each)* Consider the relational schema below where the primary key ﬁelds are underlined, and the domain of each ﬁeld is listed after the ﬁeld name.

Suppliers(sid: integer, sname: varchar(20), city: varchar(20))

Parts(pid: integer, pname: varchar(20), color: varchar(10))

Catalog(sid: integer, pid: integer, cost: real)

Give the **relational algebra expression** for the following queries:

a. List the names and ids of parts that are red.

πpname(πpid,color((πpidσcolor="red" parts)))

b. List the names of parts that supplied by some supplier for less than $10.

πpname((σcost>=10Catalog)⋈catalog)

c. List the names of suppliers who supply a red part.

πsname(πsid((πpidσcolor="red" parts)⋈catalog)⋈suppliers)

d. List the names of suppliers that are located in Seattle.

πsname(σcity=’seattle’Suppliers)

e. List the sids of suppliers who supply reds or green parts.

Red <- πsname(πsid((πpidσcolor="red" parts)⋈catalog)⋈suppliers)

Green <- πsname(πsid((πpidσcolor="green" parts)⋈catalog)⋈suppliers)

πsname(red∪green)

f. List the names of parts supplied by the supplier named Acme.

πpName(πsid((πsid="Acme" suppliers)⋈catalog)⋈parts)

g. Find the pids of parts supplied by at least two diﬀerent suppliers.

πP1.pid(σR1.pid=R2.pid^R1.sid)=/=R2.sid(ρR1Catalog×ρR2Catalog)

**Problem 2:** *(2 pts each)* Using the Supplier-Parts-Catalog schema from above, verbally describe what the following queries compute.

a.



b.

1. supplier name of the suppliers who supply a red part that costs less than 100 dollars
2. does not return anything, because of the sequence of projection operators. when the sid is projectes, it is the only field in the set, so looking for sname will not result on anything.