**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.

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

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

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

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

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

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

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.