Section 2:

This section covers relational algebra (50 points).

(A) Consider the following schema:

> Suppliers (sid: *integer,* sname: *varchar(20),* address: *varchar(50)*)
> Parts (pid: *integer*, pname: *varchar(20)*, color: *varchar(15)*)
> Catalog (sid: *integer*, pid: *integer*, cost: *real*)

- The key fields are underlined
- Domains of each field are listed after field name
- The Catalog relation lists prices charged for parts by Suppliers

Write the following queries in relational algebra (30 points):

(i) Find the *names* of suppliers who supply some blue part

- $\pi_{sname}(\pi_{sid}\ ((\pi_{pid}\sigma_{color='blue'}\ \text{Parts}) \bowtie \text{Catalog}) \bowtie \text{Suppliers})$

(ii) Find the *sids* of suppliers who supply some blue or red part

- $\rho(\text{tempParts}, (\pi_{pid}\sigma_{color='blue'}\ \text{Parts}) \cup (\pi_{pid}\sigma_{color='red'}\ \text{Parts}))$
  $\pi_{sid}(\pi_{sid}(\text{tempParts} \bowtie \text{Catalog}) \bowtie \text{Suppliers})$

(iii) Find the *sids* of suppliers who supply some blue part and some red part

- $\rho(\text{tempParts}, (\pi_{pid}\sigma_{color='blue'}\ \text{Parts}) \cap (\pi_{pid}\sigma_{color='red'}\ \text{Parts}))$
  $\pi_{sid}(\pi_{sid}(\text{tempParts} \bowtie \text{Catalog}) \bowtie \text{Suppliers})$

(iv) Find the *sids* of suppliers who supply every blue part

- $\pi_{sid}(((\pi_{pid}\sigma_{color='blue'}\ \text{Parts}) \bowtie \text{Catalog}) \bowtie \text{Suppliers})$

(v) Find the pids of parts supplied by every supplier at less than $50. (If a supplier either does not supply the part or charges more than $50, the part is not selected.)

- $\pi_{pid}((\pi_{pid}\sigma_{cost < 50}\ \text{Catalog}) \bowtie \text{Parts})$

(vi) Find the *sids* of suppliers who do not supply a red part

- $\pi_{sid}((\sigma_{color \neq 'red'}\ \text{Parts}) \bowtie \text{Catalog} \bowtie \text{Suppliers})$

(B) Consider the following schema:

PLAYER

PlayerID	Name	Birth_dt	Draft_year
1204	Chris Paul	May, 1985	2005
1392	Derek Fisher	Aug, 1974	1996
1590	Josh Smith	Dec, 1985	2004
1597	Tyson Chandler	Oct, 1982	2001

TEAM

TeamID	City	Name	DIV_ID	Championships
5	LA	Clippers	5	0
11	Houston	Rockets	6	0
23	Dallas	Mavericks	6	1

PLAYER_TEAM

PlayerID	TeamID	Start_date	End_date	No_of_games
1204	5	2011	null	234
1597	23	2010	2011	126
1590	11	2014	null	4
1597	23	2014	null	28

- PlayerID is a key for Player (P)
- TeamID is key for Team (T)
- (PlayerID, TeamID) is a composite key for Player_Team (PT)

Show the results of the following Relational Algebra expressions (20 points):

(i) π P.name, T.name (P⋈T⋈PT)

P.name	T.name
Chris Paul	Clippers
Tyson Chandler	Maverick
John Smith	Rockets

(ii) π P.name (P ⋈ PT ⋈ σ city="Dallas" or city="Houston" T)

P.name
John Smith
Tyson Chandler

(iii) ρ (PP (1 → playerid1, 2 → draftyear1, 3 → playerid2, 4 → draftyear2), (π playerid, draft_year P) × (π playerid, draft_year P)) (π playerid P - π playerid1 σ draftyear1 < draftyear2 PP) ⋈ P

playerid1	draftyear1	playerid2	draftyear2
1392	1996	1204	2005
1590	2004	1204	2005
1597	2001	1204	2005

(iv) π P.name ((σ no_of_games > 100 PT) ⋈ T ⋈ P)

P.name
Chris Paul
Tyson Chandler