

Consider the following relational schema of a marina database:

Sailor (SID, Sname, Age)
Boat (BID, Bname, Color)
Reserve (SID, BID, Day)

Express the following queries in the relational algebra:

i) Find the names and ages of sailors who have reserved boat "103".

```
R1 := select(Reserve, BID = "103")
R2 := join(R1, SID, Sailor, SID)
R3 := project(R2, Sname, Age)
```

ii) Find the names of sailors who have reserved a red boat and a green boat.

```

Red := select(Boat, Colour = "Red")
Green := select(Boat, Colour = "Green")
RedSailors := project(join(Red,BID,Reserve,BID),SID)
GreenSailors := project(join(Green,BID,Reserve,BID),SID)
Both := RedSailors   GreenSailors
Result := project(join(Both,SID,Sailor, SID), Sname)

```

iii) Find the names of sailors who have reserved at least two boats.

$$\text{Reservations (sid1,bid1,sid2,bid2)} := \text{project (Reserve,SID,BID) } \times \text{ project(Reserve,SID,BID)}$$

Twice := project(select(Reservations, sid1=sid2 and bid1 \triangleleft bid2), sid1)

ThoseTwice := project(join(Twice,sid1,Sailor,SID),Sname)

iv) Find the SIDs of sailors with age over 30 and who have never reserved a green boat.

```

Green := select(Boat, Color = "Green")
ReserveGreen := project(join(Green, BID, Reserve, BID), SID)
Age30 := project(select(Sailor, Age > 30), SID)

```

$\text{NoGreen} := \text{Age30} - \text{ReserveGreen}$

v) *Find the names of sailors who have reserved all boats called “Blue Sky”.*

$\text{BlueSky} := \text{project}(\text{select}(\text{Boat}, \text{Bname} = \text{“Blue Sky”}))$

$\text{ReserveBoat} := \text{project}(\text{Reserve}, \text{SID}, \text{PID})$

$\text{AllBlueSky} := \text{ReserveBoat} \text{ divide } \text{BlueSky}$

$\text{SailorAllBlueSky} := \text{project}(\text{join}(\text{AllBlueSky}, \text{SID}, \text{Sailor}, \text{SID}), \text{Sname})$