Quiz 1 Answers, Fall 2019
CSCI 4380 DB Sys
Time: 25 minutes

Question (Points: a-9 b-8 c-8). You are given the following data model for bird watchers describing the birds they saw for understanding the size of bird populations (adapted from Backyard Bird Database):

```
BirdWatchers(bwid, name, homestate, education, email, password)
Birds(birdname, scientificName, family, genus, ismigratory)
Habitat(birdname, state, howcommon)
Observations(oid, birdname, quantity, behavior, odate, otime, latitute, longitude,
city, state, bwid)
```

Keys are underlined. There are many `birdwatchers` (people who enter where they saw birds) and birds (identified by `birdname`). Birds have scientific names, family genus and the migratory status (`ismigratory` values are True/False). Birds have habitats, `state` that they are native in and `howcommon` they are for a specific state. Observations are by a bird watcher (`bwid`) and describe which bird was seen (`birdname`), where they were observed (`latitute, longitude, city, state`), when (`odate, otime`), in which `quantity` and the `behavior` of the birds (such as healthy, aggressive, indistress).

Answer the following questions:

(a) For the following, circle one of yes/no based on the relations above and its keys, and write a short one line explanation:

Can a given bird be observed multiple times at the same date, time, latitude, longitude by two different bird watchers? As long as the `oid` is different, this is possible.	**YES**.
Can a bird have two different habitats? As the key is bird and state together, it is possible to have two tuples with the same bird name and different states.	**YES**
Can a bird have two different ismigratory values ? We can store at most one tuple for a bird, which has a single value for the ismigratory attribute.	**NO**

(b) Write the following query using relational algebra:

Return the bird name of all birds that have been observed once, but never since 2018 (you can use `> or < '1/1/2018'`).

Answer.

$$(\Pi_{birdname}(Observations)) - (\Pi_{birdname}(\sigma_{odate>=\text{'}1/1/2018\text{'}}\ Observations))$$

(c) Write the following query using relational algebra:

Return the bird name and habitat states of all `migratory` birds with `genus` value `Buteo`. (Buteo is a hawk family including red tailed hawks).

Answer.

$$\Pi_{birdname,state}((\sigma_{ismigratory=True\ and\ genus='Buteo'}Birds) \bowtie Habitat)$$

Alternative Answer.

$$\begin{aligned} R1 &= \sigma_{ismigratory=True\ and\ genus='Buteo'}Birds \\ R2(b2, state, howcommon) &= Habitat \\ Result &= \Pi_{birdname,state}(\sigma_{birdname=d2}\ (R1 \times R2)) \end{aligned}$$