Tony Nguyen

Dr. Shawn Bowers

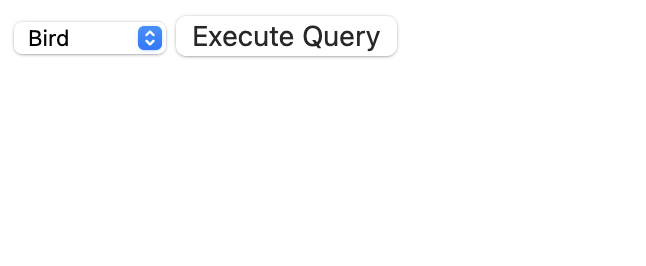
CPSC 321 01

14 November 2023

Homework 6

**Part 1**

1. Question 1



A grey rectangular object with white text

Description automatically generated

A close-up of a bird

Description automatically generated

1. Question 2

A screenshot of a computer

Description automatically generated

A screenshot of a computer

Description automatically generated

A close-up of a list of countries/regions

Description automatically generated

1. Question 3

A screenshot of a computer

Description automatically generated

A screenshot of a computer

Description automatically generated

A screenshot of a computer

Description automatically generated

**Part 2**

1. Question 4

* Aircraft(registration, country, make, type, airline, pax\_capacity, etops)
* Two bad functional dependencies:
  + (make, type, airline) 🡪 pax\_capacity
  + (make, type) 🡪 etops
* Example of redundant data:
  + (N12345, US, Airbus, 320, Delta, 180, 120)
  + (G-EDIW, GE, Airbus, 320, Lufthansa, 184, 120)
  + Two instances of two different aircraft. However, they are, in fact, the same type (Airbus 320), but it is recorded twice.
* Anomaly types:
  + Update: The Airbus 320 model has been approved to increase its ETOPS (Extended-range Twin-engine Operations Performance Standards) level to 130. We have to update all Airbus 320 instances, or we will have inconsistent data.
  + Insertion: Boeing has just rolled out a new aircraft called Boeing 797. Since the aircraft is brand new, it has yet to receive the ETOPS certificate, and no airlines have operated this type of aircraft. If we want to insert Boeing 797 into this table, we need to create dummy values since registration, country, airline, pax\_capacity, and etops information are unavailable; otherwise, we cannot insert it into the table.
  + Deletion: Delta is the last airline worldwide to operate Boeing 717. The airline has recently decided to retire its 717 fleet by sending all of the 717s to a graveyard for scrapping. If Delta does so, the Aircraft table will now be missing Boeing 717 information, as all of them have been removed.

1. Question 5

* Prove that given (1) X 🡪 Y and (2) YW 🡪 Z, then (3) XW 🡪 Z

4. XW 🡪 YW, Augmentation on (1), W is a subset of W

5. XW 🡪 Z, Transitivity on (4) and (2)

* Prove that given (1) X 🡪 YZ, then (2) X 🡪 Y and (3) X 🡪 Z

4. YZ 🡪 Y, Reflexivity on Y and Z, Y is a subset of YZ

5. YZ 🡪 Z, Reflexivity on Y and Z, Z is a subset of YZ

6. X 🡪 Y, Transitivity on (1) and (3)

7. X 🡪 Z, Transitivity on (1) and (4)

* Prove that given (1) X 🡪 Y and (2) X 🡪 Z, then (3) X 🡪 YZ

4. X 🡪 XY, Reflexivity on X, Augmentation by (1)

5. XY 🡪 YZ, Reflexivity on Y, Augmentation by (2)

6. X 🡪 YZ, Transitivity on (4) and (5)

1. Question 6

* R(a, b, c) and FDs {a 🡪 c}
  + Candidate key: a
  + b is not a part of a candidate key in this context. It is also not a part of any functional dependencies.
* R(a, b, c, d) and FDs {b 🡪 c, d 🡪 a}
  + Candidate key: (b, d)
  + Since we can use reflexivity and augmentation on both FDs, we result in bd 🡪 cd and cd 🡪ca.
  + We have bd 🡪 ca, so we have bd 🡪 c and bd 🡪 a.
* R(a, b, c, d) and FDs {a 🡪c, c 🡪 d)
  + Candidate key: a
  + Since a 🡪 c and c 🡪 d, we have a 🡪 d thanks to transitivity.
  + So, we have a 🡪 c and a 🡪 d. b is not involved in any candidate key.
* R(a, b, c, d, e) and FDs {c 🡪 b, bd 🡪 e, a 🡪 d, e 🡪 a}
  + Candidate key: (b, c), a, e
  + Apply transitivity on e 🡪 a and a 🡪 d, then we have e 🡪 d. Since we have bd 🡪 e, we have bd 🡪 d (transitivity), meaning d is a subset of b.
  + Apply augmentation with d on c 🡪 b, we have cd 🡪 bd. We then have bd 🡪 e, which leads to cd 🡪 e. Since e 🡪 a and a 🡪 d, we have cd 🡪 d, meaning d is a subset of c.
  + As d is both a subset of b and c, we can have bc 🡪 d.
  + Since we have proved that d is b and d’s subset, in addition to a 🡪 d, we have a 🡪 bcd. Besides, we have bd 🡪 e, so a 🡪 bcde.
  + For e, thanks to e 🡪 a, a 🡪 d, we have e 🡪 d. And since d is a subset of both b and c, we can have e 🡪 abcd.

1. Question 7

* Album(title, group, year, record\_label)
  + Bad FD: None
  + Normal form: 3NF
* Track(year, track\_name)
  + Bad FD: None
  + Normal form: BCNF
* Song(song\_title, year, track\_id)
  + Bad FD: track\_id 🡪 year
  + Normal form: 2NF
* MusicGroup(name, year\_formed)
  + Bad FD: None
  + Normal form: BCNF
* Artist(name, birth\_year)
  + Bad FD: None
  + Normal form: BCNF
* RecordLabel(name)
  + Bad FD: None
  + Normal form: BCNF
* Genre(label, description)
  + Bad FD: None
  + Normal form: BCNF
* Album&Track(alb\_title, track\_id, group\_name)
  + Bad FD: None
  + Normal form: BCNF
* Song&Artist(song\_title, artist\_name)
  + Bad FD: None
  + Normal form: BCNF
* Group&Genre(group\_name, genre\_label)
  + Bad FD: None
  + Normal form: BCNF
* Group&Influencer(group\_name, influenced\_by)
  + Bad FD: None
  + Normal form: BCNF
* Group&Artist(artist\_name, group\_name, start\_year, end\_year)
  + Bad FD: None
  + Normal form: BCNF