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CPSC 321 01

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Homework 6

Part 1

1. Question 1

☒ Bird
☐ Cat
☐ Dinosaurs
☐ Dog
☐ Pig
☐ Tiger
☐ Turtle

Pet Type: Bird

1. 11, Meredith
2. 12, Olivia

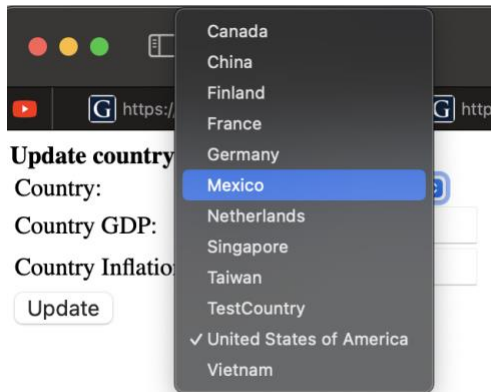
2. Question 2

✓ Canada
China
Finland
France
Germany
Mexico
Netherlands
Singapore
Taiwan
TestCountry
United States of America
Vietnam

Country Code: CA, Country Name: Canada

1. Burnaby, British Columbia, 249197
2. Vancouver, British Columbia, 675218
3. Toronto, Ontario, 2930000
4. Surrey, British Columbia, 570000
5. Red Deer, Alberta, 100418
6. Quebec City, Quebec, 531902
7. Ottawa, Ontario, 934243
8. Montreal, Quebec, 1704694
9. Mississauga, Ontario, 721599
10. Lethbridge, Alberta, 101482
11. Laval, Quebec, 422993
12. Hamilton, Ontario, 536917
13. Gatineau, Quebec, 276245
14. Edmonton, Alberta, 981280
15. Calgary, Alberta, 1237656
16. Victoria, British Columbia, 344615

3. Question 3



Update country information:

Country:

Country GDP:

Country Inflation:

All Countries

1. CA, Canada, 4837, 4.1
2. CN, China, 10200, 0.1
3. DE, Germany, 47603, 4.5
4. FI, Finland, 54000, 5.3
5. FR, France, 43551, 5.7
6. MX, Mexico, 9000, 6.1
7. NL, Netherlands, 53000, 4.9
8. SG, Singapore, 72794, 4
9. TW, Taiwan, 35000, 3.7
10. US, United States of America, 57000, 3.2
11. VN, Vietnam, 2566, 4.9
12. XX, TestCountry, 99000, 99

Part 2

4. 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.

5. Question 5

- Prove that given (1) $X \rightarrow Y$ and (2) $YW \rightarrow Z$, then (3) $XW \rightarrow Z$
4. $XW \rightarrow YW$, Augmentation on (1), W is a subset of W

5. $XW \rightarrow Z$, Transitivity on (4) and (2)

- Prove that given (1) $X \rightarrow YZ$, then (2) $X \rightarrow Y$ and (3) $X \rightarrow Z$

4. $YZ \rightarrow Y$, Reflexivity on Y and Z, Y is a subset of YZ

5. $YZ \rightarrow Z$, Reflexivity on Y and Z, Z is a subset of YZ

6. $X \rightarrow Y$, Transitivity on (1) and (3)

7. $X \rightarrow Z$, Transitivity on (1) and (4)

- Prove that given (1) $X \rightarrow Y$ and (2) $X \rightarrow Z$, then (3) $X \rightarrow YZ$

4. $X \rightarrow XY$, Reflexivity on X, Augmentation by (1)

5. $XY \rightarrow YZ$, Reflexivity on Y, Augmentation by (2)

6. $X \rightarrow YZ$, Transitivity on (4) and (5)

6. Question 6

- $R(a, b, c)$ and FDs $\{a \rightarrow c\}$
 - 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 $\{b \rightarrow c, d \rightarrow a\}$
 - Candidate key: (b, d)
 - Since we can use reflexivity and augmentation on both FDs, we result in $bd \rightarrow cd$ and $cd \rightarrow ca$.
 - We have $bd \rightarrow ca$, so we have $bd \rightarrow c$ and $bd \rightarrow a$.
- $R(a, b, c, d)$ and FDs $\{a \rightarrow c, c \rightarrow d\}$
 - Candidate key: a
 - Since $a \rightarrow c$ and $c \rightarrow d$, we have $a \rightarrow d$ thanks to transitivity.

- So, we have $a \rightarrow c$ and $a \rightarrow d$. b is not involved in any candidate key.
- $R(a, b, c, d, e)$ and FDs $\{c \rightarrow b, bd \rightarrow e, a \rightarrow d, e \rightarrow a\}$
 - Candidate key: $(b, c), a, e$
 - Apply transitivity on $e \rightarrow a$ and $a \rightarrow d$, then we have $e \rightarrow d$. Since we have $bd \rightarrow e$, we have $bd \rightarrow d$ (transitivity), meaning d is a subset of b .
 - Apply augmentation with d on $c \rightarrow b$, we have $cd \rightarrow bd$. We then have $bd \rightarrow e$, which leads to $cd \rightarrow e$. Since $e \rightarrow a$ and $a \rightarrow d$, we have $cd \rightarrow d$, meaning d is a subset of c .
 - As d is both a subset of b and c , we can have $bc \rightarrow d$.
 - Since we have proved that d is b and d 's subset, in addition to $a \rightarrow d$, we have $a \rightarrow bcd$. Besides, we have $bd \rightarrow e$, so $a \rightarrow bcde$.
 - For e , thanks to $e \rightarrow a$, $a \rightarrow d$, we have $e \rightarrow d$. And since d is a subset of both b and c , we can have $e \rightarrow abcd$.

7. Question 7

- $\text{Album}(\text{title}, \text{group}, \text{year}, \text{record_label})$
 - Bad FD: None
 - Normal form: 3NF
- $\text{Track}(\text{year}, \text{track_name})$
 - Bad FD: None
 - Normal form: BCNF
- $\text{Song}(\text{song_title}, \text{year}, \text{track_id})$
 - Bad FD: $\text{track_id} \rightarrow \text{year}$
 - 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