CS2102-2310: Database Systems

Assignment 2

Deadline: Saturday, 18 November 2023, Time: 12.00 noon

Instructions

- The assignment consists of 15 (5 MRQ + 5 MCQ) questions and a total of 15 marks; each question is worth 1 mark.

- We will normalize the mark to 5% by dividing to total marks by 3 and rounding the result.

- The deadline for submission is November 18 (Saturday) at 12.00 noon.

- **Late submission penalty:** One mark will be deducted for each late day up to two late days; submissions after the second late day will receive zero marks and will not be graded.

- The assignment is to be submitted using Canvas Quiz. Email submissions will not be accepted.

- The assignment will be auto-graded on Canvas.

Good Luck!

Functional Dependencies (MRQ)

Consider an ORDER processing application at a shopping website (like Lazada or Amazon): Customers generate an order online which is given a unique Id. Orders contain multiple items and different items get shipped from different warehouses on different dates. Each order has a total amount and must be paid by a single credit card. Consider the following attributes that will be kept in this database about each Order:

- Customer#

- Order#

- Order_date

- Shipping_date

- Item#

- Warehouse#

- Credit_card#

- Dollar_amount

Answer the following questions about what functional dependencies (FDs) will hold based on the semantics of this application:

Q1: Regarding **Orders**, mark all FDs that hold based on the semantics of the application:

○ Customer# → Order#

○ Order# → Customer#

○ Order# → Order_date

○ Item# → Order#

Q2: Regarding the **Shipping** of items, mark all FDs that hold based on the semantics of the application:

○ Item# → Shipping_Date

○ (Order#, Item#) → Shipping_Date

○ Order# → Shipping_Date

○ (Customer#, Item#) → Shipping_Date

Q3: Regarding **Warehouses**, mark all FDs that hold based on the semantics of the application:

      ○ Item# → Warehouse#

      ○ (Customer#, Item#) → Warehouse#

      ○ (Order#, Item#) → Warehouse#

      ○ (Order#, Warehouse#) → Shipping_Date

Q4: Regarding **Payment**, mark all FDs that hold based on the semantics of the application:

      ○ Dollar_amount → Credit_card#

      ○ Order# → Credit_card#

      ○ Credit_card# → Order#

      ○ Customer# → Credit_card#

      ○ Order# → Dollar_amount

Q5: Regarding the data, mark all FDs that hold based on the semantics of the application:

      ○ (Order#, Item#) → Warehouse#, Shipping_date

      ○ (Customer#, Order#) → Dollar_amount, Credit_card#

      ○ (Order#, Shipping_date) → Warehouse#, Item#

      ○ (Customer#, Shipping_date) → Warehouse#, Item#

Functional Dependencies & Normalization (MCQ)

Q6: Given is the relation schema DeptSales(DeptNo, Dname, Month, Year, Sales) and the set of functional dependencies F:

- DeptNo → Dname
- (DeptNo, Month, Year) → Sales

Which of the following functional dependencies is a valid inference?

○ DeptNo → Sales

○ (DeptNo, Month, Year) → Dname

○ Dname → Sales

○ None of the above

Q7: Like for Q6, given is the relation schema DeptSales(DeptNo, Dname, Month, Year, Sales) and the set of functional dependencies F:

- DeptNo → Dname
- (DeptNo, Month, Year) → Sales

From which problems can this relation suffer

○ Insertion anomalies

○ Redundancy and inconsistency

○ Deletion anomalies

○ All of the above

Q8: Given is the relation R(A, B, C, D) with the set of functional dependencies F:

- AB → C
- A → D

shown below.

A	B	C	D
a1	b1	c1	d1
a1	b2	c2	?
?	b1	c1	d3
a4	b1	c4	d4

The domain for D is {d1, d2, d3, d4, d5, d6, d7} and the domain for A is {a1, a2, a3, a4}.

What values could be inserted for the missing D and A column values?

○ d1 and a1

○ d5 and a4

○ d1 and either a2 or a3

○ None of the above

Q9: Given is the relation schema R(A, B, C, D) and the set of functional dependencies F:

- AB → C

- BC → D

- A → B

Which of the following statements is true and most complete?

○ B → C is a member of F^+

○ ABC → D is a member of F^+

○ CD → DC is a member of F^+

○ Both ABC → D and CD → DC are members of F^+

Q10: Given is the relation schema R(A, B, C) and the set of functional dependencies F:

- AB → C

- B → A

- C → B

Which attribute(s) is/are key(s)?

○ Only A

○ Only B

○ Only C

○ A and B

○ B and C

Q11: Given is the relation schema R(A, B, C, D) and the set of functional dependencies F:

- A → C
- D → B

Which functional dependencies cause a violation of the second normal form?

    ○ A → C alone

    ○ D → B alone

    ○ Both A → C and D → B

    ○ None of the above

Q12: Given is the relation schema R(A, B, C) and the set of functional dependencies F:

- AB → C
- B → A
- C → B

What is the highest normal form that relation R is in?

    ○ First Normal Form (1NF)

    ○ Second Normal Form (2NF)

    ○ Third Normal Form (3NF)

    ○ Boyce-Codd Normal form (BCNF)

Q13: Given is the relation schema R(A, B, C, D) and the set of functional dependencies F:

- A → BC
- C → D
- D → B

What is the highest normal form that schema R is in?

    ○ First Normal Form (1NF)

    ○ Second Normal Form (2NF)

    ○ Third Normal Form (3NF)

○ Boyce-Codd Normal form (BCNF)

Q14: Given are the two relation schemas R1(A, B) and R2(A, C, D), as well as the set of functional dependencies F:

- A → C
- D → B
- AC → B

Is the natural join of the two relations R1 and R2 lossless?

○ Yes

○ No

Q15: Given is the relation schema R(A, B, C, D) and the set of functional dependencies F:

- AB → C
- AB → D
- CD → A
- CD → B

Is relation R in Boyce-Codd Normal Form (BCNF)?

○ Yes

○ No