

23BCS10193 – Shivanshu Ranjan

Session-7 :- Data Normalization

Q1

Relation: R(A, B, C, D)

Functional Dependencies:

$$AB \rightarrow C, \quad C \rightarrow D, \quad D \rightarrow A$$

Solution:

Attribute Closure:

- $(AB)^+ = \{A, B, C, D\}$
- $(BC)^+ = \{A, B, C, D\}$
- $(BD)^+ = \{A, B, C, D\}$

Candidate Keys: $\{AB, BC, BD\}$

Prime Attributes: A, B, C, D

Non-Prime Attributes: None

Q2

Relation: R(A, B, C, D, E)

Functional Dependencies:

$$A \rightarrow D, \quad B \rightarrow A, \quad BC \rightarrow D, \quad AC \rightarrow BE$$

Solution:

Attribute Closure:

- $(BC)^+ = \{A, B, C, D, E\}$
- $(AC)^+ = \{A, B, C, D, E\}$

Candidate Keys: $\{BC, AC\}$

Prime Attributes: A, B, C

Non-Prime Attributes: D, E

Q3

Relation: R(A, B, C, D, E)

Functional Dependencies:

$$B \rightarrow A, \quad A \rightarrow C, \quad BC \rightarrow D, \quad AC \rightarrow BE$$

Solution:

Attribute Closure:

$$(B)^+ = \{A, B, C, D, E\}$$

Candidate Key: {B}

Prime Attributes: B

Non-Prime Attributes: A, C, D, E

Q4

Relation: R(A, B, C, D, E, F)

Functional Dependencies:

$$A \rightarrow BCD, \quad BC \rightarrow DE, \quad B \rightarrow D, \quad D \rightarrow A$$

Solution:

Candidate Keys: {B, D}

Prime Attributes: A, B, D

Non-Prime Attributes: C, E, F

Q7

Relation: R(A, B, C, D, E)

Functional Dependencies:

$$CE \rightarrow D, \quad D \rightarrow B, \quad C \rightarrow A$$

Solution:

Attribute Closure:

$$(CE)^+ = \{A, B, C, D, E\}$$

Candidate Key: {CE}

Highest Normal Form: 2NF

Q8

Relation: R(A, B, C, D, E, F)

Functional Dependencies:

$$AB \rightarrow C, \quad DC \rightarrow AE, \quad E \rightarrow F$$

Solution:

Attribute Closure:

$$(BD)^+ = \{A, B, C, D, E, F\}$$

Candidate Key: {BD}

Highest Normal Form: 3NF