23BCS10193 – Shivanshu Ranjan

Session-9 :- Data Normalization

Q13

Relation: R(A, B, C, D, E, F, G, H, I, J)
Functional Dependencies:

$$AB \to C, \quad AD \to GH, \quad BD \to EF, \quad A \to I, \quad H \to J$$

Solution:
Candidate Key Determination:

$$(ABD)^+ = \{A, B, C, D, E, F, G, H, I, J\}$$

Candidate Key: $\{A, B, D\}$
Prime Attributes: A, B, D
Non-Prime Attributes: C, E, F, G, H, I, J
Highest Normal Form: 2NF (Partial dependency exists: $AB \to C$)
Decomposition (to remove redundancy):

- R_1(A, B, C)
- R_2(A, D, G, H)
- R_3(B, D, E, F)
- R_4(A, I)
- R_5(H, J)
- R_6(A, B, D)

Number of New Tables: 6

Q14

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

$$A \to B, \quad B \to E, \quad C \to D$$

Solution:
Candidate Key Determination:

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

Candidate Key: $\{A, C\}$

Prime Attributes: A, C
Non-Prime Attributes: B, D, E
Highest Normal Form: 2NF (Partial dependencies: $A \to B$, $C \to D$)
Decomposition:

- R_1(A, B)
- R_2(B, E)
- R_3(C, D)
- R_4(A, C)

Number of New Tables: 4

Q15

Relation: R(A, B, C, D, E, F, G, H, I, J)
Functional Dependencies:

$$AB \to C, \quad B \to F, \quad F \to GH, \quad D \to IJ, \quad A \to DE$$

Solution:
Candidate Key Determination:

$$(AB)^+ = \{A, B, C, D, E, F, G, H, I, J\}$$

Candidate Key: $\{A, B\}$
Prime Attributes: A, B
Non-Prime Attributes: C, D, E, F, G, H, I, J
Highest Normal Form: 2NF (Partial and transitive dependencies exist)
3NF Decomposition:

- R_1(A, B, C)
- R_2(B, F)
- R_3(F, G, H)
- R_4(A, D, E)
- R_5(D, I, J)

Number of Relations after Decomposition: 5
Lossless Join: Yes (Common key attributes preserved)