Experiment: 4

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Aim: To find the closure, candidate keys, prime attributes and highest normal form using the given relation and functional dependencies.

Question 1

R(ABCD), FDs = {AB -> C, C -> D, D -> A}

Solution

Closure:

AB+ = {A, B, C, D}

BC+ = {B, C, A, D}

BD+ = {B, D, A, C}

Candidate Key: AB, BD, BC

Prime Attributes: {A, B, C,D}

Non-Prime Attributes: { }

Normal Form: It cannot be BCNF as C is a SK(C -> D). All determinants have prime attributes, so the relation is in 3NF.

Question 2

R(ABCDE), FDs = {A -> D, B -> A, BC -> D, AC -> BE}

Solution

Closure:

A+ = {A, D}

B+ = {B, A, D}

C+ = {C}

BC+ = {B, C, A, D, E}

AC+ = {A, B, C, D, E}

Candidate Key: AC, BC

Prime Attributes: {A, B, C}

Non-Prime Attributes: {D, E}

Normal Form: Partial dependency exists (A -> D). Hence relation is in 1NF.

Question 3

R(ABCDE), FDs = {B -> A, A -> C, BC -> D, AC -> BE}

Solution

Closure:

B+ = {A, B, C, D, E}

A+ = {A, C, B, D, E}

Candidate Key: A, B

Prime Attributes: {A, B}

Non-Prime Attributes: {C, D, E}

Normal Form: All determinants are either CK or SK. So this relation is in BCNF.

Question 4

R(ABCDEF), FDs = {A -> BCD, BC -> DE, B -> D, D -> A}

Solution

Closure:

A+ = {A, B, C, D, E}

AF+ = {A, F, B, C, D, E}

DF+ = {D, F, B, C, A, E}

BF+ = {B, F, C, A, D, E}

Candidate Key: AF, DF, BF

Prime Attributes: {A, D, B, F}

Non-Prime Attributes: {C, E}

Normal Form: Partial dependency exists (A -> BCD). Hence relation is in 1NF.

Question 5

FDs = {X -> Y, WZ -> X, WZ -> Y, Y -> W, Y -> X, Y -> Z}

Solution

Closure:

Y+ = {Y, X, W, Z}

X+ = {X, Y, W, Z}

WZ+ = {W, Z, X, Y}

Candidate Key: Y, X, WZ

Prime Attribute: {X, Y, W,Z}

Non-Prime Attributes: { }

Normal Form: All determinants are CK. Highest NF = BCNF.

Question 6

R(ABCDEF), FDs = {A -> BC, A -> D, D -> E, BC -> D}

Solution

Closure:

A+ = {A, B, C, D, E}

AF+ = {A, B, C, D, E, F}

Candidate Key: AF Prime

Attributes: {A, F}

Non-Prime Attributes: {B, C, D, E}

Normal Form: A -> BC introduces partial dependency (A is part of key AF and BC is non-prime). Hence highest NF = 1NF.