Experiment-4

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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.