# HOMEWORK

***FD:***

*1.* R (A, B, C, D, E, F);

S = {AB → C, BC → AD, D → E, CF → B};

Find {A,B} = { A, B, C }

1. R (A, B, C, D)

S = {BC→D, D→A, A→B}

What are all the keys of R?

A = { A, B }

B = { B }

C = {C}

D = { A, D}

AB = { A, B }

AC = { A, C}

AD = { A, B, D}

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

BD = { B, D, A }

CD= { C, D}

ABC = { A, B, C, D }

ABD = { A, B, D. }

ABCD = {a, b, c, d}

1. R (A, B, C, D)

S = {AD→B, AB→C, BC→D, CD→A}

AB = A B C

AC = A C

AD = A D B

ABC = A B C D

ABD = A B D C

A B C D

What are all the keys of R?

What are all the super-keys for R that are not keys?

1. Find closure of FD:

R = <U, F>, U = {ABCDEFGHK},

F = {ABH → CK, A → D, C →E, BGH → F, F → AD, E →F, BH → E}

FD = FDA

1. Find closure of FD:

R = <U, F>, U = {ABCDEGH},

F = {A→ BC, BE → G, E → D, D → G, A → B, AG → BC}

FD FDG

1. Find closure of FD:

R = <U, F>, U = {ABCDEGHIJ},

F = {A → BDE, DE → G, H → J, J → HI, E → DG, BC→ GH, HG→J, E→G}

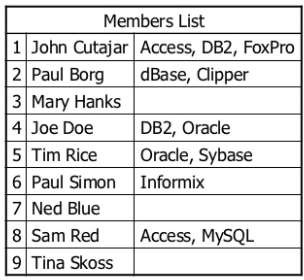
FD

## Hint for Ex. 4,5,6:

* *Convert the FD’s into singleton right sides*
* *Remove redundant attributes on left-hand sides of each FD*
* *Remove redundant FD*

***NF:***

1. Convert to 1NF  2NF  3NF for the ralation:



1. Are the following relations in BCNF? 3NF? (if R is not in BCNF, decompose it to BCNF)

8.1. S(A,B,C,D): A->B, A->C, D->A

8.2. T(A,B,C,D): A->B, B->C, C->D, BD->A

8.3. U(A,B,C,D): AD->B, AB->C, BC->D, CD->A 8.4. R(A,B,C,D,E): A->C, C->B, B->D, D->E, E->A

8.5. R(A,B,C,D,E): BC->DE, A->E, D->A, E->B

8.6. R(A,B,C,D,E): C->D, AD->E, BC->E, DE->A

8.7. R(A,B,C,D,E): AB->E, AC->D, BC->E, E->A, D->B 8.8. R(A,B,C,D): B->A, C->B, D->C, A->D

1. Are the following relations in BCNF? 3NF? (if R is not in BCNF, decompose it to BCNF; if R is not in 3NF, decompose it to 3NF)

9.1. R(X,Y, Z,T,V): XY->Z, Y->T, Z->V 9.2. R(X,Y,Z,T): X->Y, Y->Z, Z->T

9.3. R(A,B,C): AB->C, B->A, C->B

* 1. R(ABCD): BD->C, AB->D, AC->B, BD->A
  2. R(ABCD): AD->C, CD->B, BD->C
  3. R(ABCD): A->C, B->A, A->D, AD->C
  4. R(ABCD): A->D, C->A, D->B, AC->B
  5. R(XYZT): XYT->Z, ZT->X, XZ->Y, XZ->T
  6. R(XYZT): XY->Z, XYT->Z, XYZ->T, XZ->T
  7. R(XYZT): YT->Z, XY->T, XZ->Y, YT->X
  8. R(XYZT): YZ->X, XT->Z, ZT->Y, YT->Z

**Appendix:**

Ex.4:

* Convert the FD’s into singleton right sides:

ABH → C, ABH → K, A → D, C → E, BGH → F, F → A, F → D, E → F, BH → E

* Remove redundant attributes on left-hand sides of each FD:
  + ABH → C:

{B, H}+ = {B, H, E, F, D, A, K, C} including C

{A, H}+ = {A, H, D} not including C

{A, B}+ = {A, B, D} not including C

A **is redundant. So: BH → C**

o ABH → K:

{B, H}+ = {B, H, C, E, F, D, A, K} including K

{A, H}+ = {A, H, D} not including K

{A, B}+ = {A, B, D} not including K

**A redundant. So : BH → K**

o BGH → F:

{B, H}+ = {B, H, E, F, D, A, K, C} including F

{G, H}+ = {G, H} not including F

{B, G}+ = {B, G} not including F

**G redundant. So : BH → F**

**Therefore: F = {BH → C, BH → K, A → D, BH → F, F → A, F → D, E → F, BH → E}**

* Remove redundant FD: If
  + Remove BH → C: {B, H}+ = {BHFADEK} not include C
  + Remove BH → K: {B, H}+ = {BHCFADE} not include K
  + Remove A → D: {A}+ = {A} not include D
  + Remove BH → F: {B, H}+ = {BHCKEFAD} include F

* the FD is* ***redundant***

* + Remove F → A: {F}+ = {FD} not include A
  + Remove F → D: {F}+ = {FAD} include D

* the FD is* ***redundant***

* + Remove E → F: {E}+ = {E} not include F
  + Remove BH → E: {BH}+ = {BHCK} not include E

**Closure of FD is: BH → C, BH → K, A → D, F → A, E → F, BH → E**