# Assignment 1

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## Question 1

1. **Statement:**

   Designing a student database involves certain dependencies which are listed below:

   - $X \rightarrow Y$
   - $WZ \rightarrow X$
   - $WZ \rightarrow Y$
   - $Y \rightarrow W$
   - $Y \rightarrow X$
   - $Y \rightarrow Z$

   The task here is to remove all the redundant FDs for efficient working of the student database management system.

2. **Solution:**

   a. Create closure for each attribute:

   $X+ = XYWZ$  [1ST Candidate Key]
   $Y+ = YXZW$  [2nd Candidate Key]
   $WZ+ = WZXY$ [3rd Candidate Key]

b.  Identify the candidate keys and prime attributes:
    **Candidate Keys** : {X, Y, WZ}
    **Prime Attributes** : {W, X, Y, Z}
    **Non-Prime Attributes** : {}

c.  Final Result:

    WZ ->X / WZ->Y are the redundant functional dependencies

    The given table is in **BCNF** as all the dependencies in the form of

$$a{\rightarrow}b$$

    have 'a' as a candidate key

**Question 2**

1. **Statement:**
   Debix Pvt Ltd needs to maintain database having dependent attributes ABCDEF. These attributes are functionally dependent on each other for which functionally dependency set F given as:
   **{A -> BC, D -> E, BC -> D, A -> D}**
   Consider a universal relation R1(A, B, C, D, E, F) with functional dependency set F, also all attributes are simple and take atomic values only. Find the highest normal form along with the candidate keys with prime and non-prime attributes.

2. **Solution:**
   a. Create closure for each dependency:

   $AF+ = AFBCDE$ [$1^{ST}$ Candidate Key]

   b. Identify the Candidate keys and prime attributes:

   **Candidate Keys :** {AF}
   **Prime Attributes :** {A, F}
   **Non Prime Attributes:** {B, C, D, E}

   c. Final Result:

   The given table is in **1NF** as in the dependencies A->BC and A->D, a subset(A) of the candidate key(AF) is deriving a non-prime attribute(B, C and D), therefore the table is not in 2NF.
   As the given table is not in 2NF, it must be in 1NF.