[Students Name]

[Course Name]

## [Instructors Name]

## [Institution]

## [Date]

**FUNCTIONAL DEPENDENCY:**

**F = {P-> M,PMSY->LRCE,IPMSY->G,LSY->PME,R->C}**

1. **Show how to derive two candidate keys for Student, or justify why you cannot do so.**

There are several methods to determine the candidate keys. One of them is :

1. **Armstrong's Axioms and Closure**
2. **Covering Algorithm**
3. **Attribute Closure Algorithm:**

Systematically find the closure of attribute sets to identify superkeys. This involves iterating through all possible combinations of attributes and determining their closures.

* 1. Closure of P:
     1. P+ = P (trivial closure)
     2. Candidate Key: P (minimal superkey)
  2. Closure of PMSY:
     1. PMSY+ = PMSYLRCE (from PMSY->LRCE)
     2. Candidate Key: PMSY (minimal superkey)
  3. Closure of IPMSY:
     1. IPMSY+ = IPMSYG (from IPMSY->G)
     2. Candidate Key: IPMSY (minimal superkey)
  4. Closure of LSY:
     1. LSY+ = LSY (trivial closure)
     2. Candidate Key: LSY (minimal superkey)
  5. Closure of R:
     1. R+ = RC (from R->C)
     2. Candidate Key: R (minimal superkey)

1. **Normalization Algorithms (e.g., BCNF and 3NF):**

Apply normalization algorithms to decompose the relation into higher normal forms. This process can reveal candidate keys and ensure that the relation adheres to specific normalization principles.

1. **P (Candidate Key):**

No partial dependencies, and it is already in BCNF and 3NF.

1. **PMSY (Candidate Key):**

No partial dependencies, and it is already in BCNF and 3NF.

1. **IPMSY (Candidate Key):**

No partial dependencies, and it is already in BCNF and 3NF.

1. **LSY (Candidate Key):**

No partial dependencies, and it is already in BCNF and 3NF.

1. **R (Candidate Key):**

No partial dependencies, and it is already in BCNF and 3NF.

1. **Find a minimal cover(i.e an irreducible set of functional dependencies)for Student.**
   1. ***Eliminate Extraneous Attributes:***

For each functional dependency, check if any attribute on the right-hand side is extraneous.

Remove any extraneous attributes to create a more minimal set.

***Applying this process:***

***For PMSY->LRCE:***

* + 1. PMSY+ = PMSYLRCE (from PMSY->LRCE)
    2. L, R, and E are not necessary, so the dependency becomes PMSY->C.

***For IPMSY->G:***

* + 1. IPMSY+ = IPMSYG (from IPMSY->G)
    2. No extraneous attributes, so it remains IPMSY->G.

***The revised set of functional dependencies is:***

* + 1. F' = {P->M, PMSY->C, IPMSY->G, LSY->PME, R->C}
  1. ***Remove Transitive Dependencies:***
     1. In the current set, there are no transitive dependencies.
  2. ***Final Minimal Cover:***
     1. The final minimal cover is **F' = {P->M, PMSY->C, IPMSY->G, LSY->PME, R->C}**

1. **Does F imply LSY->C? Show working that justifies your answer.**

To check if F implies LSY->C, we need to verify if LSY is a superkey for the given set of functional dependencies F = {P->M, PMSY->LRCE, IPMSY->G, LSY->PME, R->C}. A superkey is a set of attributes that can uniquely determine all other attributes in the relation.

Let's check if LSY+ includes the attribute C:

* 1. Closure of LSY (LSY+):
     1. LSY+ = LSY (trivial closure)
     2. There is no direct dependency involving LSY that determines C.
  2. Checking Dependencies Involving LSY:
     1. PMSY->C: LSY is not a subset of PMSY.
     2. IPMSY->G: LSY is not a subset of IPMSY.

Since there is no direct functional dependency involving LSY that determines C, and LSY is not a superkey for the given set of functional dependencies, F does not imply LSY->C.

1. **Is Student in the 3NF. If not, find a decomposition of Student into 3NF.Show Working that justifies your answer**

Given the functional dependencies for the Student relation:

**F = {P->M, PMSY->LRCE, IPMSY->G, LSY->PME, R->C}**

***1. Check for 3NF Compliance:***

1. P->M (3NF compliant)
2. PMSY->LRCE (3NF compliant)
3. IPMSY->G (3NF compliant)
4. LSY->PME (Potential transitive dependency)

***2. Decomposition to Achieve 3NF:***

Original Relation: Student(P, M, PMSY, G, LSY, PME, R, C)

Decomposed Relations:

1. New Relation 1: LSY\_PME(LSY, PME)
2. Updated Original Relation: Student(P, M, PMSY, G, R, C)

***3. Verification:***

1. New Relation 1 (LSY\_PME): No transitive dependencies.
2. Updated Original Relation: No transitive dependencies.

Therefore, the Student relation has been decomposed into 3NF through the removal of transitive dependencies.