Practical Discrete Mathematics (CSE 1402)

MAJOR ASSIGNMENT-1: EXPLORING SETS, LOGIC, AND RELATIONS USING PYTHON

Scenario: University Enrollment System

A university is developing a student enrollment system that manages student information using **sets, logic, and relations**. The system should be able to:

- Store and manipulate student data using **sets**.
- Implement **logical operations** to filter students based on conditions.
- Analyze relationships between students and courses using **relations**.
- Generate **truth tables** for logical conditions used in decision-making.

Dataset: Student Enrollment Data

The following dataset contains student IDs, names, enrolled courses, and participation in extracurricular activities.

Student_ID	Name	Courses	CGPA	Extracurricular
101	Alice	{Math, CS}	8.9	True
102	Bob	{Math, Physics}	7.8	False
103	Charlie	{CS, Physics}	8.0	True
104	David	{Math, Physics}	6.5	False
105	Eve	{CS}	7.2	True
106	Frank	{Math, CS, Physics}	9.1	False
107	Grace	{Physics}	6.8	False
108	Hannah	{Math}	7.5	True

Table 1: Student Enrollment Data

Task 1: Working with Relations (Reflexive, Symmetric, Transitive)

Problem Statement

1. Create a dataframe using the library PANDAS from the given table. Print the dataframe.
2. From the dataframe, define a relation where two students are related if they are enrolled in at least one common course.
3. Check if is **Reflexive, Symmetric, and Transitive**.

Task 2: Logical Operations on Student Data

Problem Statement

1. A student qualifies for a research grant if:

   - They have a **CGPA** 8.5 **OR**
   - They have a **CGPA** 7.5 **AND** participate in **extracurricular activities**

   Create a truthtable for this argument.

2. Create a new column called Scholarship_Eligibility that contains True if the student qualifies for the scholarship, and False otherwise. Print the updated dataframe.