**University of Prishtina “Hasan Prishtina”**

**Faculty of Computer and Electrical Engineering**



**Subject: Artificial Intelligence**

**Boolean Satisfiability Problem (SAT)**

**Professor: Students/ Emails:**

|  |  |  |
| --- | --- | --- |
| Adrian Ymeri | 1. Florian Halimi | [blina.smailaj@student.uni-pr.edu](mailto:blina.smailaj@student.uni-pr.edu) |
| 2. Blina Smailaj | [florian.halimi1@student.uni-pr.edu](mailto:florian.halimi1@student.uni-pr.edu) |
| 3. Valёza Grainca | [valёza.grainca@student.uni-pr.edu](mailto:valёza.grainca@student.uni-pr.edu) |

# Boolean Satisfiability Problem (SAT)

## Problem definition:

One hundred guests are invited to a party. Guests must be seated at ten tables, with each table having ten seats. However, certain conditions exist for seating guests at the tables. Suppose there is a list of guests who cannot sit at the same table. The list consists of pairs of guests who cannot sit together (e.g., if the list includes the pair (G1, G5), Guest G1 and Guest G5 cannot sit at the same table). Additionally, suppose there is a list of guests who must sit together no matter what. The objective is to seat all guests while also satisfying the given conditions.

## Problem Solution:

The problem can be translated into a SAT problem by creating a boolean variable for each possible seating arrangement of a guest at a table. We will write these variables as where is the guest number (from 1-100) and is the table number (from 1 to 10). The variable is if guest is seated at table , and otherwise.

The constraints of the problem can be translated to SAT as follows:

1. **Guests should be seated at tables with exactly ten seats.** For each table , ensure that exactly ten guests are seated at that table:
2. **Each guest must sit at exactly one table.** For each guest , we need to ensure that they are seated at exactly one table.
3. **Guests who cannot sit together.** If there is a pair (e.g. G1, G5) that cannot sit at the same table :
4. **Guests who must sit together.** If there is a pair (e.g. G3, G6) that must sit at the same table :
5. **Symmetry Breaking Constraints.** To reduce symmetrical solutions, add a constraint to ensure a unique solution.

**Complete SAT Formula:**