

CS5205: Advanced Artificial Intelligence Lab

Assignment - 5

28/02/2025

Consider a parking area that has the facility to charge electric vehicles. There are m number of ports to charge the vehicles. Each port can charge one vehicle at a time. Let us assume that there are n number of vehicles. Each vehicle has an arrival time (a_i) in the parking area and a departure time (d_i). While the vehicle is in the parking area, it needs to be charged uninterruptedly for a given duration (e_i). Given a set of vehicles and their arrival and departure time, does there exist a schedule such that each vehicle can be charged for its stipulated duration while it is in the parking area? A sample input will look as follows:

```
% number of ports
NumPorts 5

% number of vehicles
NumVehicles 10

% vehicle details
% vehicle vehicle-id arrival-time departure-time charging-time
V 1 4 10 3
V 2 7 20 6
V 3 8 27 10
...
```

- Develop SAT-based formulation to model the problem using the following encoding schemes. You need to generate DIMACS file for a given inputs and then run Z3 on the same.
 - Option-1: x_{ijt} — i-th vehicle *starts charging* at the j-th charging port at time t
 - Option-2: x_{ij} — i-th vehicle is assigned to j-th port, y_{it} — i-th vehicle *starts charging* at time t
- Which encoding scheme is better? You need to analyze this based on number of variables, clauses, clauses with 2/3/3+ literals, computation time, memory usage, etc.
- Explore the performance of different encoding schemes using various solvers. Apart from Z3, use two other SAT solvers from satcompetition.
- Write a generator that will generate 100 random test-cases. Apply both encoding schemes, run SAT solvers and observe the performance.