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CS 165a – Artificial Intelligence

Generic Algorithms: Problem Solving Scheduling

The scenario that was given to us in the lab to create a schedule that assigns courses to classrooms based on certain requirements. These requirements included that we have a set of *N* rooms, a set of *M* courses that need to be scheduled and a set of *L* buildings. More importantly our search algorithms had to be more efficient and faster than the base search provided for us in the lab.

We started off by creating a stimulated annealing algorithm that creates random schedules and compares the schedule with the previous one to see which one is more efficient. This was model by the equation *e^((delta(E)/T)* where *delta(E)* is the difference of the probability of the schedules being compare and *T* is the temperature. As the temperature decreases the probability for finding a better schedule increase. The method consists of evaluating the current room schedule with the next one. If the next schedule has a better probability, then the current then the current one becomes the next one. With the annealing we created two methods each having a different yet similar rate change to see if they have similar results.

The next method the we did was back tracking with constraints, minimum heuristic and degree heuristic to make the backtracking more efficient. Through recursion Backtracking would allow us to keep finding a solution even if we end up going into a fail state. With the constraints and the heuristic that we implemented it will allow us to minimize the amount of fail states that we will encounter. Because of the recursion in backtracking, if we do end up in a fail state, we

will be able to backtrack to a different path and keep doing that until we find a solution, or we have exhausted our options.

The following naïve method was run with the following tests

```
mmedina-a@Leviathan ~/Desktop> java -jar homework3.jar 2 15 15 200 0 1000
Number of Buildings: 2
Number of Rooms: 15
Number of Courses: 15
Time limit (s): 200
Algorithm number: 0
Random seed: 1000
Deadline: 1554340883919
Current: 1554340683920
Time remaining: 199999

Score: 432.06200481663234

mmedina-a@Leviathan ~/Desktop> java -jar homework3.jar 15 45 60 500 0 1000
Number of Buildings: 15
Number of Rooms: 45
Number of Courses: 60
Time limit (s): 500
Algorithm number: 0
Random seed: 1000
Deadline: 1554341296445
Current: 1554340796446
Time remaining: 499999

Score: 1202.0533448996002

mmedina-a@Leviathan ~/Desktop> java -jar homework3.jar 5 99 120 500 0 1000
Number of Buildings: 5
Number of Rooms: 99
Number of Courses: 120
Time limit (s): 500
Algorithm number: 0
Random seed: 1000
Deadline: 1554341319432
Current: 1554340819433
Time remaining: 499999

Score: 2705.9062731011027

mmedina-a@Leviathan ~/Desktop>
```

The following stimulated annealing was run with the following test cases

```
mmedina-a@Leviathan ~/Desktop> java -jar homework3.jar 2 15 15 200 1 1000
Number of Buildings: 2
Number of Rooms: 15
Number of Courses: 15
Time limit (s): 200
Algorithm number: 1
Random seed: 1000
Deadline: 1554341038565
Current: 1554340838621
Time remaining: 199944

Score: 622.0743468064179

mmedina-a@Leviathan ~/Desktop> java -jar homework3.jar 15 45 60 500 1 1000
Number of Buildings: 15
Number of Rooms: 45
Number of Courses: 60
Time limit (s): 500
Algorithm number: 1
Random seed: 1000
Deadline: 1554341349705
Current: 1554340849837
Time remaining: 499867

Score: 1495.7319147092157

mmedina-a@Leviathan ~/Desktop> java -jar homework3.jar 5 99 120 500 1 1000
Number of Buildings: 5
Number of Rooms: 99
Number of Courses: 120
Time limit (s): 500
Algorithm number: 1
Random seed: 1000
Deadline: 1554341357465
Current: 1554340857715
Time remaining: 499749

Score: 2900.6994203573854

mmedina-a@Leviathan ~/Desktop>
```

The following backtracking was run with the following test

```
mmedina-a@Leviathan ~/Desktop> java -jar homework3.jar 2 15 15 200 2 1000
Number of Buildings: 2
Number of Rooms: 15
Number of Courses: 15
Time limit (s): 200
Algorithm number: 2
Random seed: 1000
Deadline: 1554341078537
Current: 1554340878539
Time remaining: 199998

Score: 820.7742348820788

mmedina-a@Leviathan ~/Desktop> java -jar homework3.jar 15 45 60 500 2 1000
Number of Buildings: 15
Number of Rooms: 45
Number of Courses: 60
Time limit (s): 500
Algorithm number: 2
Random seed: 1000
Deadline: 1554341392407
Current: 1554340892417
Time remaining: 499990

Score: 2496.9382603077906

mmedina-a@Leviathan ~/Desktop> java -jar homework3.jar 5 99 120 500 2 1000
Number of Buildings: 5
Number of Rooms: 99
Number of Courses: 120
Time limit (s): 500
Algorithm number: 2
Random seed: 1000
Deadline: 1554341403479
Current: 1554340903510
Time remaining: 499968

Score: 5597.235879832346

mmedina-a@Leviathan ~/Desktop>
```