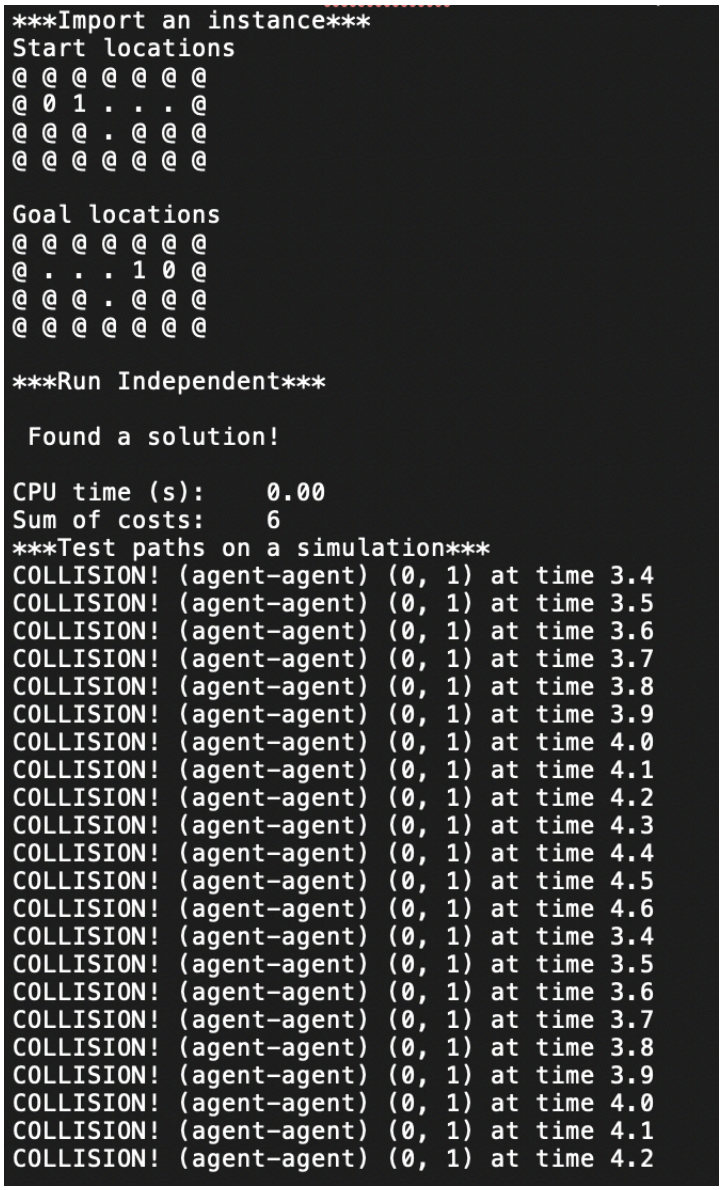
CMPT417 Individual Project Report

- Custom instance:

  Those instances are included in the custominstance folder and is for question 2.5. See detail below.

- 1.1 Terminal output:



- 1.2 Terminal output:

```
***Import an instance***
Start locations
@ @ @ @ @ @ @
@ 0 1 . . . @
@ @ @ . @ @ @
@ @ @ @ @ @ @

Goal locations
@ @ @ @ @ @ @
@ . . . 1 0 @
@ @ @ . @ @ @
@ @ @ @ @ @ @

***Run Prioritized***
prune

 Found a solution!

CPU time (s):    0.00
Sum of costs:    7
[[(1, 1), (1, 2), (1, 3), (1, 4), (1, 4), (1, 5)], [(1, 2), (1, 3), (1, 4)]]
***Test paths on a simulation***
COLLISION! (agent-agent) (0, 1) at time 3.4
COLLISION! (agent-agent) (0, 1) at time 3.5
COLLISION! (agent-agent) (0, 1) at time 3.6
COLLISION! (agent-agent) (0, 1) at time 3.7
COLLISION! (agent-agent) (0, 1) at time 3.8
COLLISION! (agent-agent) (0, 1) at time 3.9
COLLISION! (agent-agent) (0, 1) at time 4.0
COLLISION! (agent-agent) (0, 1) at time 4.1
COLLISION! (agent-agent) (0, 1) at time 4.2
COLLISION! (agent-agent) (0, 1) at time 4.3
COLLISION! (agent-agent) (0, 1) at time 4.4
COLLISION! (agent-agent) (0, 1) at time 4.5
COLLISION! (agent-agent) (0, 1) at time 4.6
COLLISION! (agent-agent) (0, 1) at time 4.7
COLLISION! (agent-agent) (0, 1) at time 4.8
COLLISION! (agent-agent) (0, 1) at time 4.9
COLLISION! (agent-agent) (0, 1) at time 5.0
COLLISION! (agent-agent) (0, 1) at time 5.1
COLLISION! (agent-agent) (0, 1) at time 5.2
COLLISION! (agent-agent) (0, 1) at time 5.3
COLLISION! (agent-agent) (0, 1) at time 5.4
COLLISION! (agent-agent) (0, 1) at time 5.5
COLLISION! (agent-agent) (0, 1) at time 5.6
```

- 1.4 answer:
  - Agent 0 is at **(1,4)** at time step 10 in my solution.
  - Changes to the goal test condistion:
    I compute the maximal time step that constraint table contains, and then **add another condition in goal test condition that current node time step must great than or equal to that time** in order to reutrn the solution path.
- 1.5 answer:
  - Constraints:

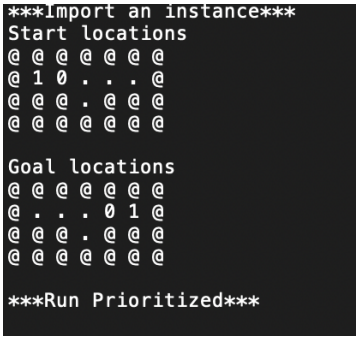
```
{'agent':1, 'loc':[(1,3), (1,2)], 'timestep':2}
{'agent':1, 'loc':[(1,3), (1,3)], 'timestep':2}
{'agent':1, 'loc':[(1,3), (1,4)], 'timestep':2}
{'agent':1, 'loc':[(1,2)], 'timestep':1}
```

  - Solution:

    [[(1, 1), (1, 2), (1, 3), (1, 4), (1, 5)], [(1, 2), (1, 3), (2, 3), (1, 3), (1, 4)]]
  - Sum of path length: 8

- 2.4 answer:
  - what happened:

    There is infinite loop and my solver didn't terminate.
  - Terminal output:



- 2.5 answer:
  - Instance that prioritized planning does not find an collision-free solution for a given ordering of agents:

```
5 7
@ @ @ @ @ @ @
@ @ . @ @ . @
@ . . . . . @
@ @ . @ @ . @
@ @ @ @ @ @ @
3
1 2 2 5
2 1 1 5
3 2 3 5
```

  - Instance that prioritized planning does not find an collision-free solution, no matter which ordering of the agents it used:

```
5 7
@ @ @ @ @ @ @
@ @ . @ @ . @
@ . . @ . . @
@ @ . @ @ . @
@ @ @ @ @ @ @
3
1 2 2 5
2 1 1 5
3 2 3 5
```

- Instance that prioritized planning does not find an collision-free solution for a given ordering of the agents even if an ordering of the agents exists for which prioritized planning finds an optimal collision-free solution:

```
5 7
@ @ @ @ @ @ @
@ @ . @ @ . @
@ . . . . . @
@ @ . @ @ . @
@ @ @ @ @ @ @
3
1 2 2 5
2 1 1 5
3 2 3 5
```

- 3.3 Terminal output transcript:

```
/second_semester/cmpt417/cmpt417_individual_projectode$ python3
run_experiments.py --instance instances/exp2_1.txt --solver CBS
***Import an instance***
Start locations
@ @ @ @ @ @ @
@ 0 1 . . . @
@ @ @ . @ @ @
@ @ @ @ @ @ @

Goal locations
@ @ @ @ @ @ @
@ . . . 1 0 @
@ @ @ . @ @ @
@ @ @ @ @ @ @

***Run CBS***
Generate node 0
Expand node 0
Generate node 1
Generate node 2
Expand node 1
Generate node 3
Generate node 4
Expand node 2
Generate node 5
Generate node 6
```

```
Expand node 3
Generate node 7
Expand node 6
Generate node 8
Generate node 9
Expand node 9
Generate node 10
Generate node 11
Expand node 11
Generate node 12
Generate node 13
Expand node 13
Generate node 14
Generate node 15
Expand node 15

 Found a solution!

CPU time (s):    0.00
Sum of costs:    8
Expanded nodes:  9
Generated nodes: 16
Paths:  [[(1, 1), (1, 2), (1, 3), (1, 4), (1, 5)], [(1, 2), (1, 3), (2, 3),
(1, 3), (1, 4)]]
***Test paths on a simulation***
```

- 4.3 answer:
  - nodes expanded in CBS disjoint using exp2_1.txt: 9
  - nodes generated in CBS disjoint using exp2_1.txt: 13
  - Terminal output transcript:

```
/second_semester/cmpt417/cmpt417_individual_projectode$ python3
run_experiments.py --instance instances/exp2_1.txt --solver CBS --disjoint
***Import an instance***
Start locations
@ @ @ @ @ @ @
@ 0 1 . . . @
@ @ @ . @ @ @
@ @ @ @ @ @ @

Goal locations
@ @ @ @ @ @ @
@ . . . 1 0 @
@ @ @ . @ @ @
@ @ @ @ @ @ @
```

```
***Run CBS***
Generate node 0
Expand node 0
Generate node 1
Generate node 2
Expand node 2
Generate node 3
Generate node 4
Expand node 1
Generate node 5
Expand node 3
Generate node 6
Generate node 7
Expand node 5
Generate node 8
Expand node 8
Generate node 9
Generate node 10
Expand node 10
Generate node 11
Expand node 11
Generate node 12
Expand node 12

 Found a solution!

CPU time (s):    0.00
Sum of costs:    8
Expanded nodes:  9
Generated nodes: 13
Paths:  [[(1, 1), (1, 2), (1, 3), (1, 4), (1, 5)], [(1, 2), (1, 3), (2,
3), (1, 3), (1, 4)]]
***Test paths on a simulation***
```