Homework for Artificial Intelligence for Robotics Assignment 9

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1 PRACTICAL PART

1.1 TASK

Given an initial location and a set of locations and time deadlines to reach those locations, implement an algorithm that finds a path that reaches every location within the given time deadline.

The locations for a single problem are stored in a text file. There are five different scenarios, i.e. there are five text files.

Use three different strategies for picking the next city:

- ordered by line number in provided file

- ordered by euclidean distance

- ordered by deadline

1.2 APPROACH

I chose a recursive approach. Starting with the initial city as the current city, I pass the fringe (list of cities left) and an empty list for the path taken so far as parameters into my recursive function.

In this function I first calculate the time needed for the whole path taken so far and check if the deadline for the current element is fulfilled. I then sort the fringe according to the strategy and for every city left in the fringe I call the function again. This time with the fringe

reduced by the chosen next element and the current path extended by the current element. The function directly returns if a solution is found and does not check the remaining cities. If for one function call the fringe is empty and the time deadline for the current element is fulfilled, a solution is found and returned.

1.3 RESULT

- Of the five given scenarios, four are solvable.

- Using euclidean distance always takes the least number of expansions, line numbering always the most.

- The length of the resulting path is always shortest or as short as the others for the euclidean distance.

- If a problem is not solvable at all, all strategies expand the whole search space.

1.3.1 SCENARIO 1

	Time Taken	# Expansions
Line Numbers	65.8426459044	306
Euclidean distance	65.8426459044	38
Remaining deadline	65.8426459044	88

1.3.2 SCENARIO 2

	Time Taken	# Expansions
Line Numbers	90.4324507719	157216
Euclidean distance	82.7338754883	38
Remaining deadline	105.930512517	60123

1.3.3 SCENARIO 3

	Time Taken	# Expansions
Line Numbers	75.1388213649	2995
Euclidean distance	74.2638321331	119
Remaining deadline	75.1388213649	5707

1.3.4 SCENARIO 4

Not solvable

	Time Taken	# Expansions
Line Numbers	N/A	325656
Euclidean distance	N/A	325656
Remaining deadline	N/A	325656

1.3.5 SCENARIO 5

	Time Taken	# Expansions
Line Numbers	194.889517611	608395
Euclidean distance	97.267315083	17
Remaining deadline	234.249535637	127

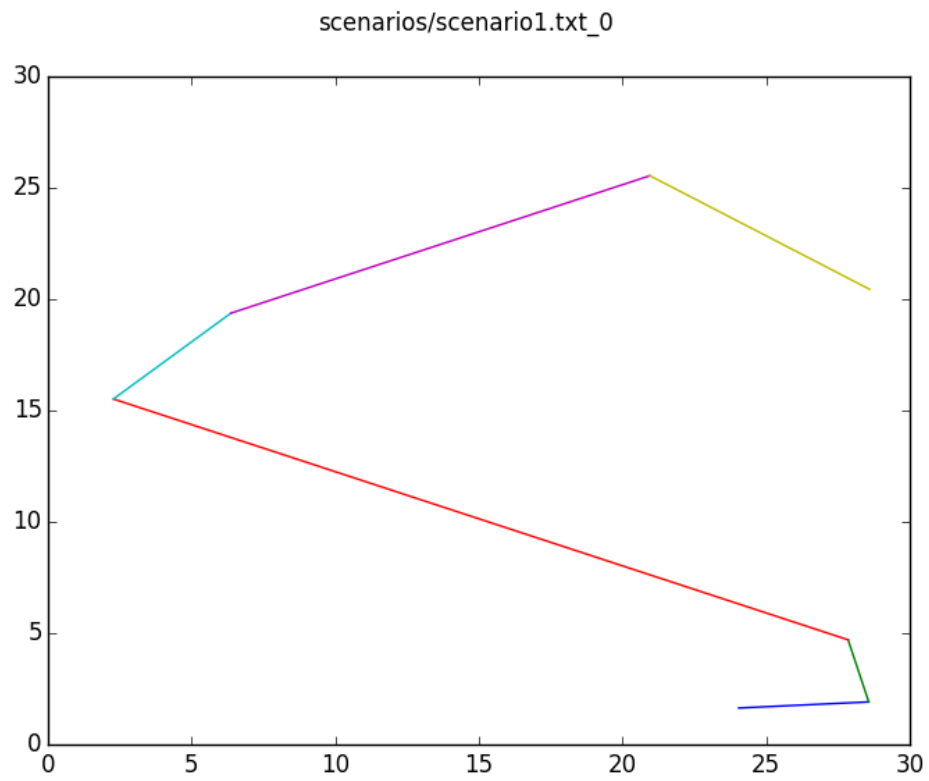### 1.3.6 PLOTS

scenarios/scenario1.txt_0

Figure 1.1: Path for scenario 1, line numbering
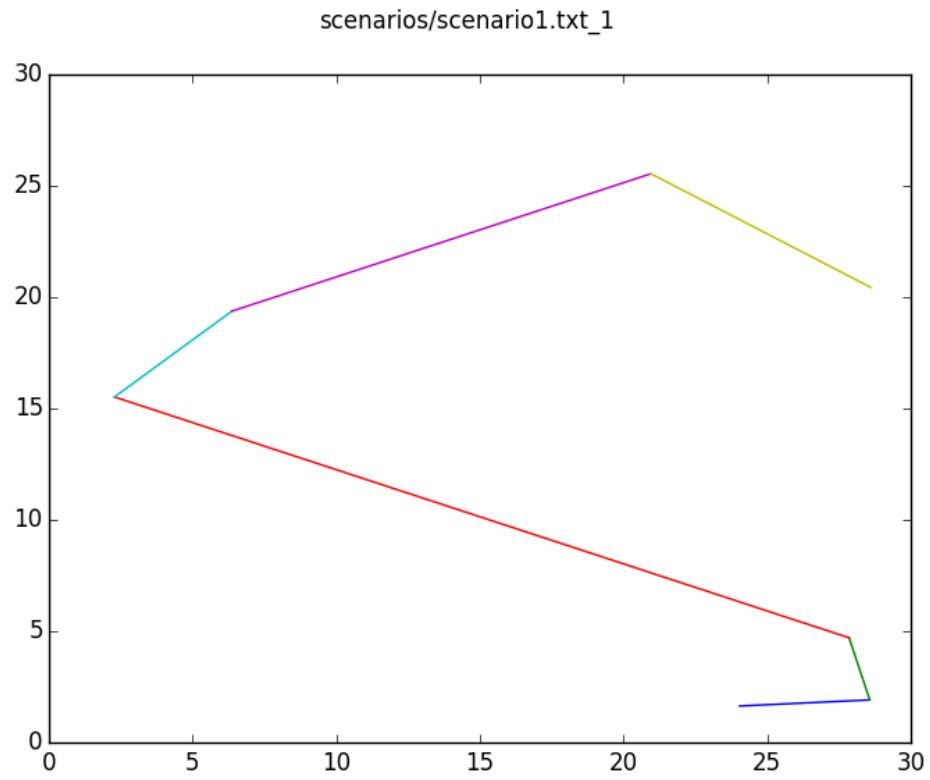
Figure 1.2: Path for scenario 1, euclidean distance
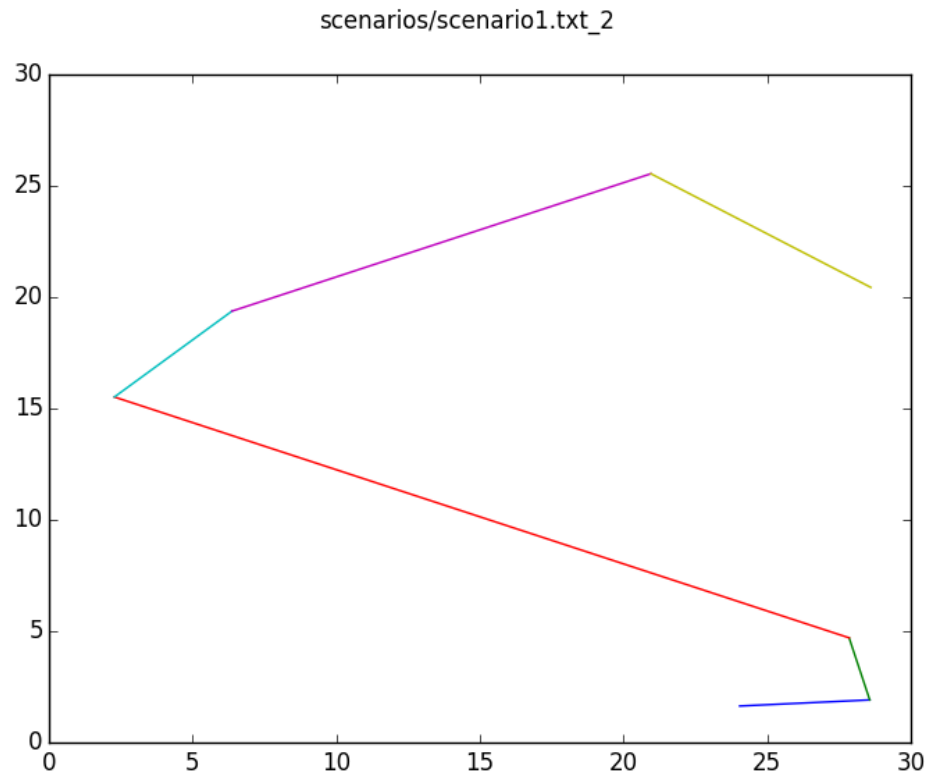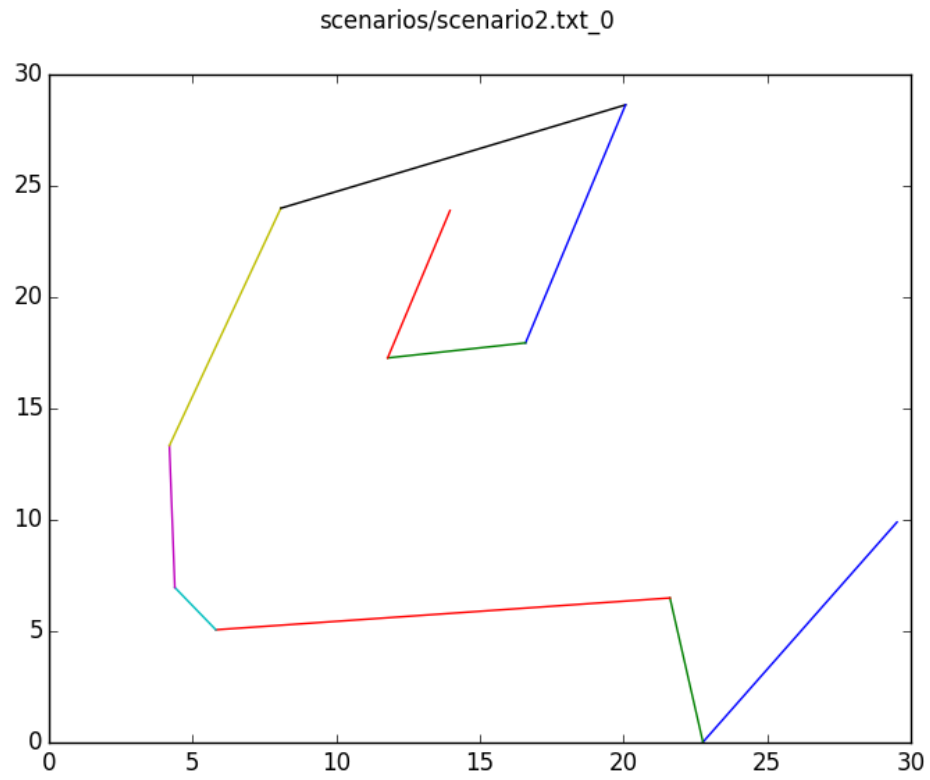
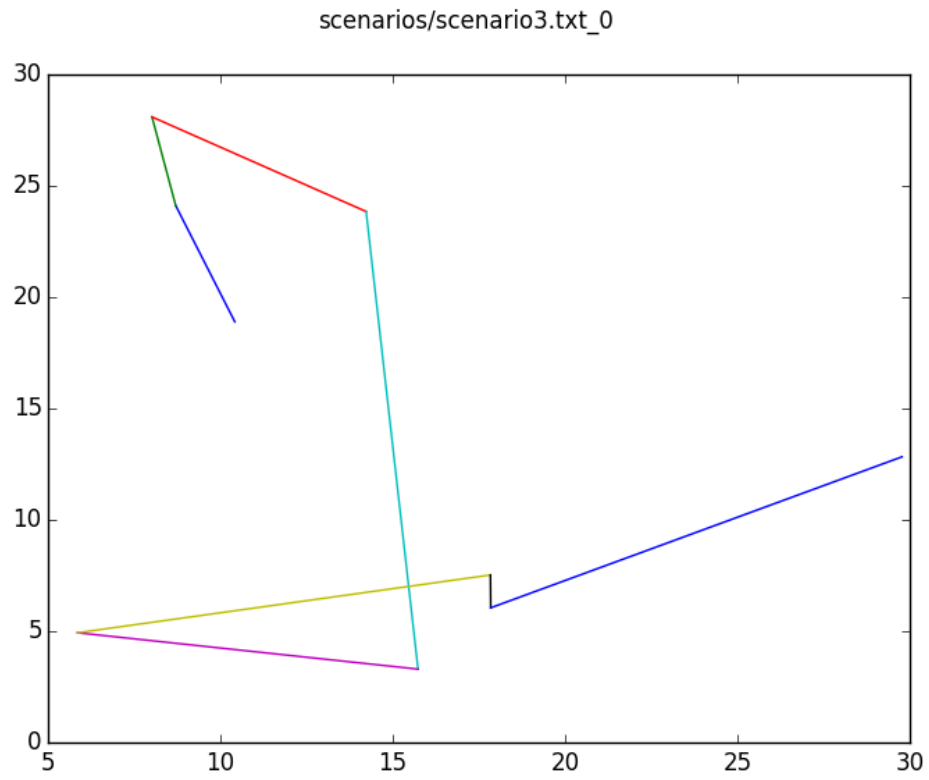Figure 1.3: Path for scenario 1, deadline

scenarios/scenario2.txt_0

Figure 1.4: Path for scenario 2, line numbering

scenarios/scenario2.txt_1
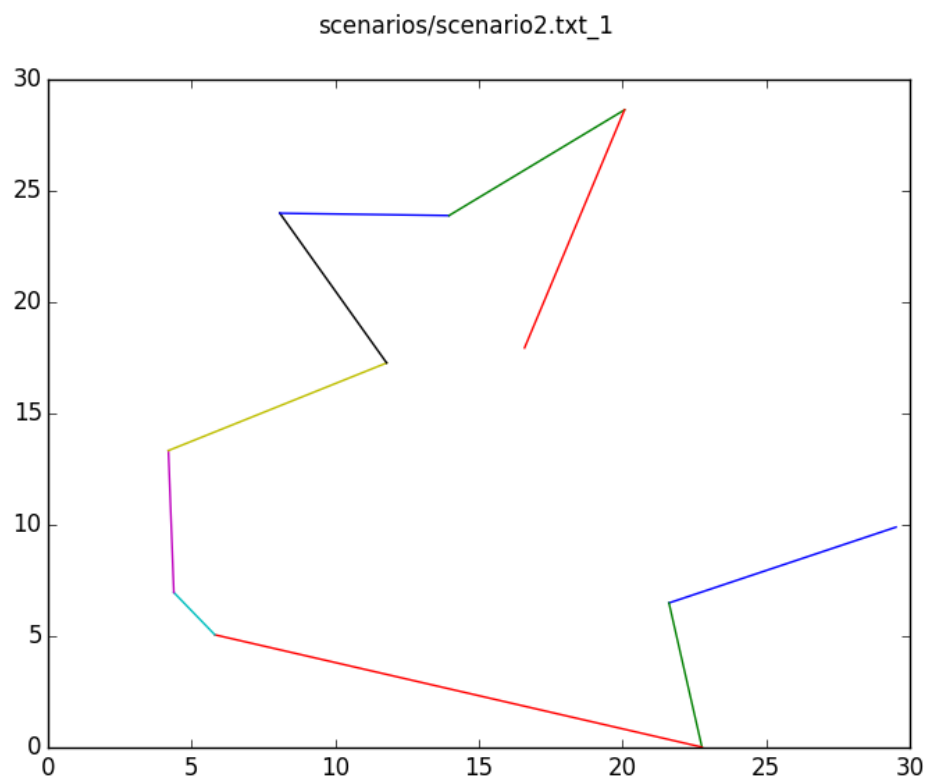
Figure 1.5: Path for scenario 2, euclidean distance
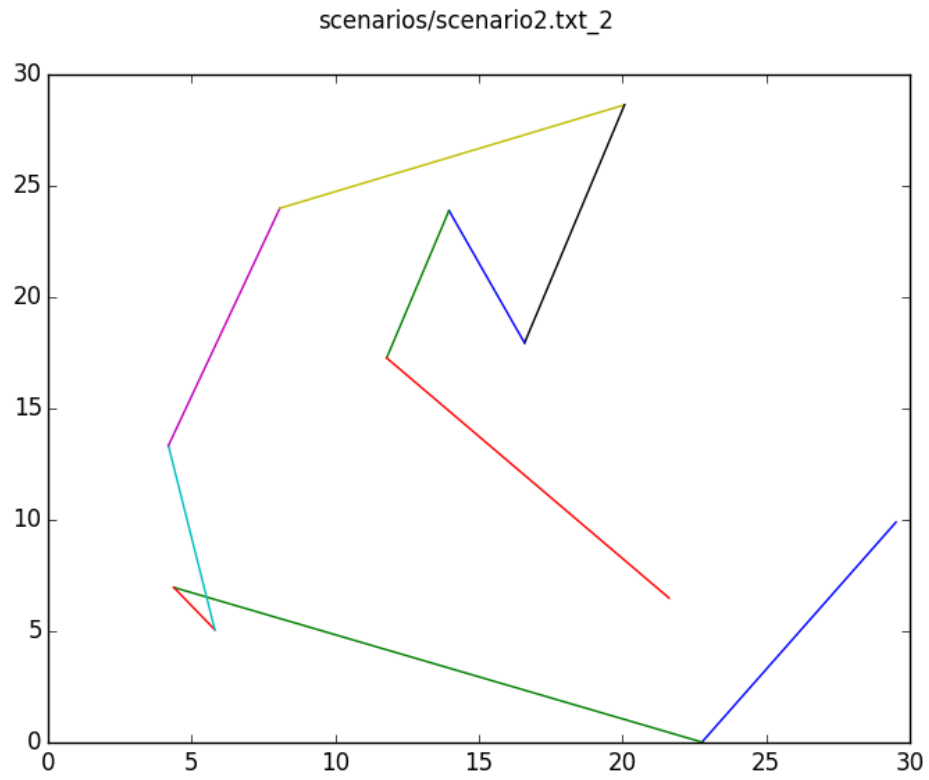
Figure 1.6: Path for scenario 2, deadline

scenarios/scenario3.txt_0

Figure 1.7: Path for scenario 3, line numbering

scenarios/scenario3.txt_1
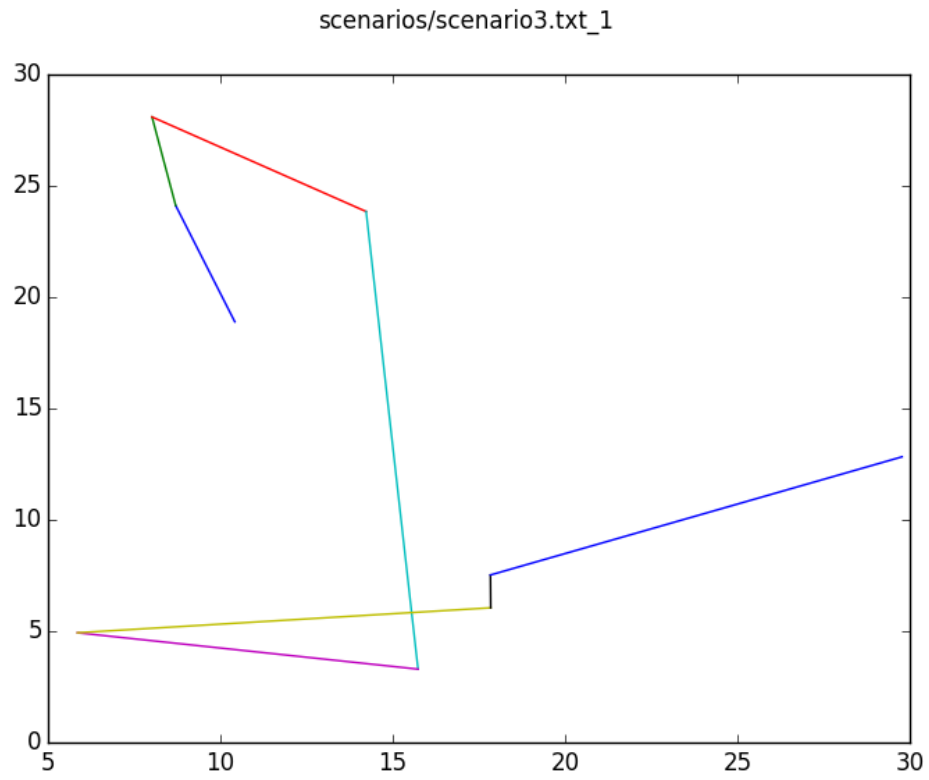
Figure 1.8: Path for scenario 3, euclidean distance
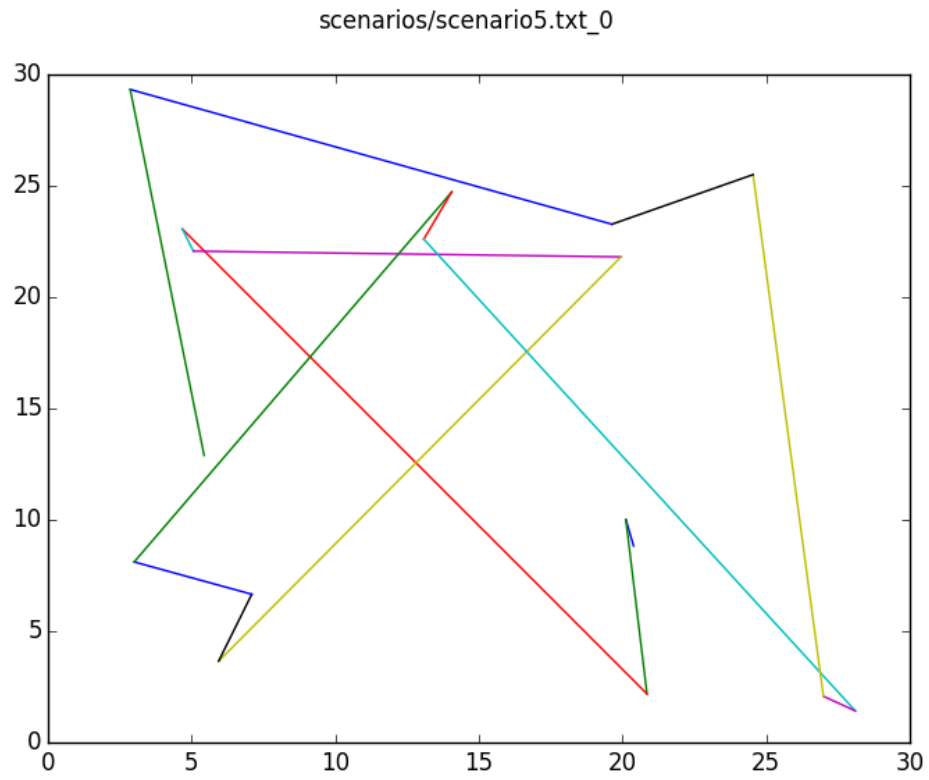
scenarios/scenario3.txt_2
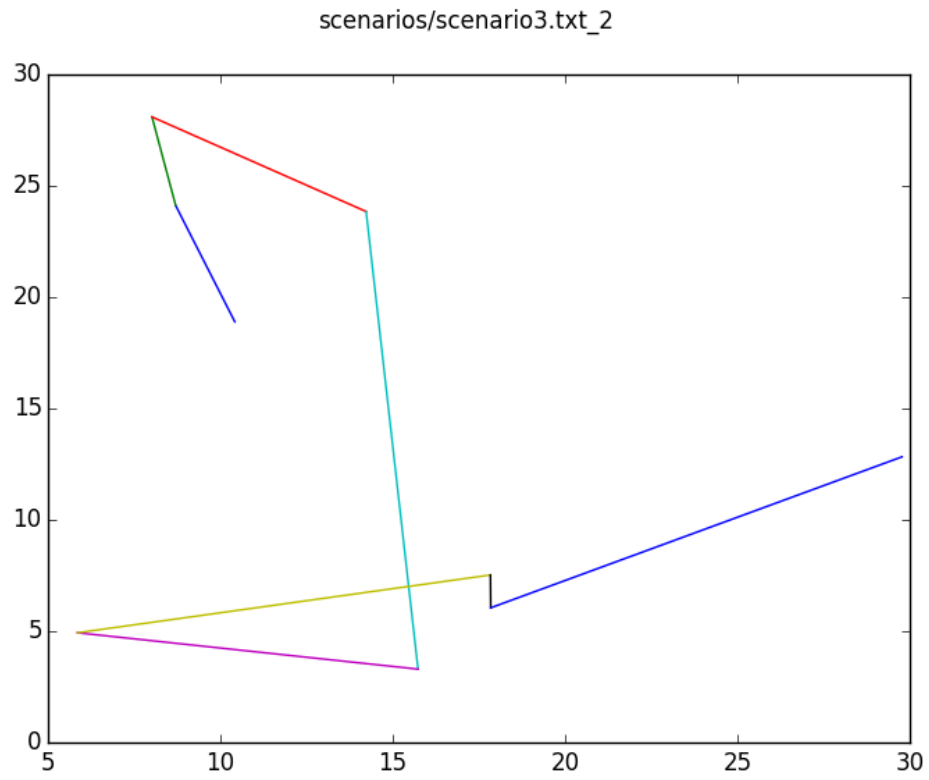
Figure 1.9: Path for scenario 3, deadline

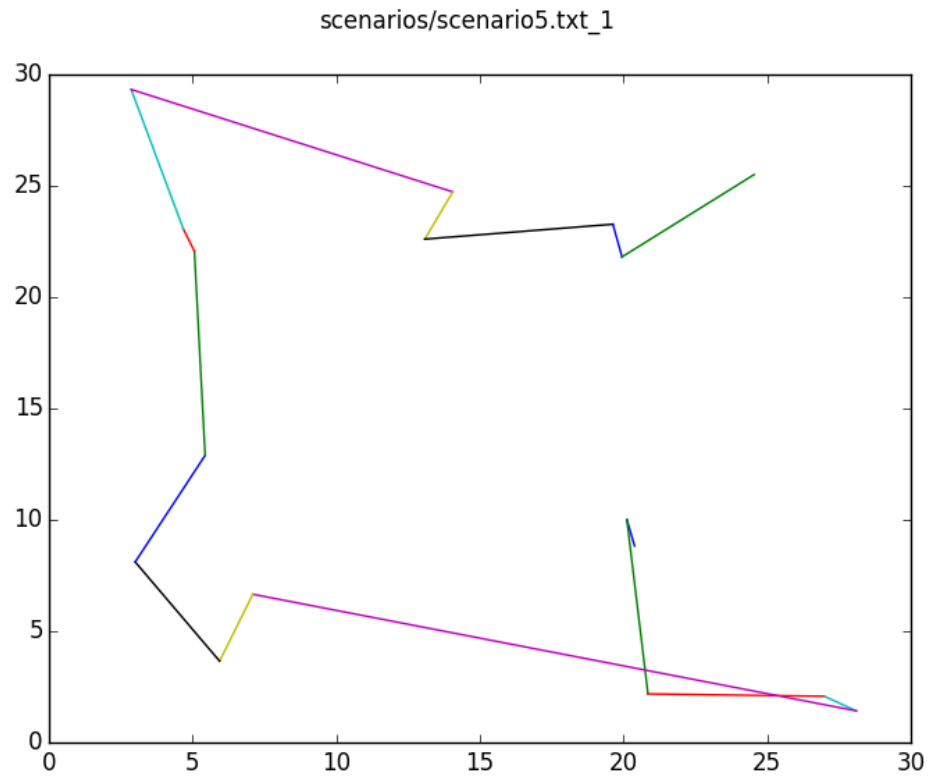Figure 1.10: Path for scenario 5, line numbering

scenarios/scenario5.txt_1

Figure 1.11: Path for scenario 5, euclidean distance

scenarios/scenario5.txt_2

Figure 1.12: Path for scenario5, deadline