HW 2 – Sampling-based & search-based motion planning

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Section 3 RRT

We used step size of 15 because it gave as the best run time, and the path cost is almost same to all step sizes.
Average performences to E2 method with 5% goal bias:

Cost: 517.2, Time: 11.1

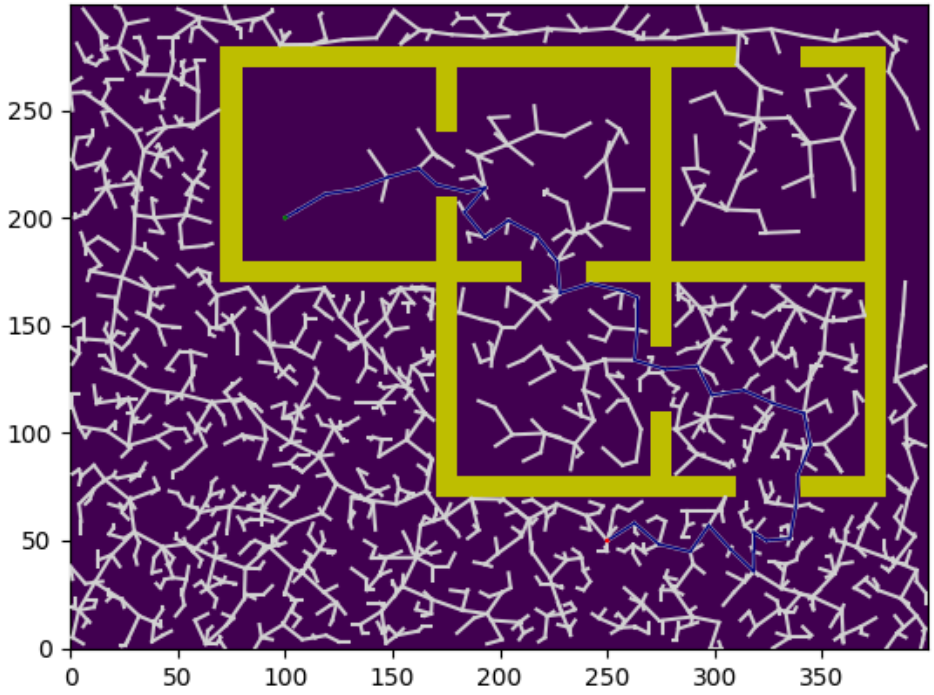


Figure 1: E2 with 5% goal bias

Average performences to E2 method with 40% goal bias:

Cost: 496.4, Time: 8.3

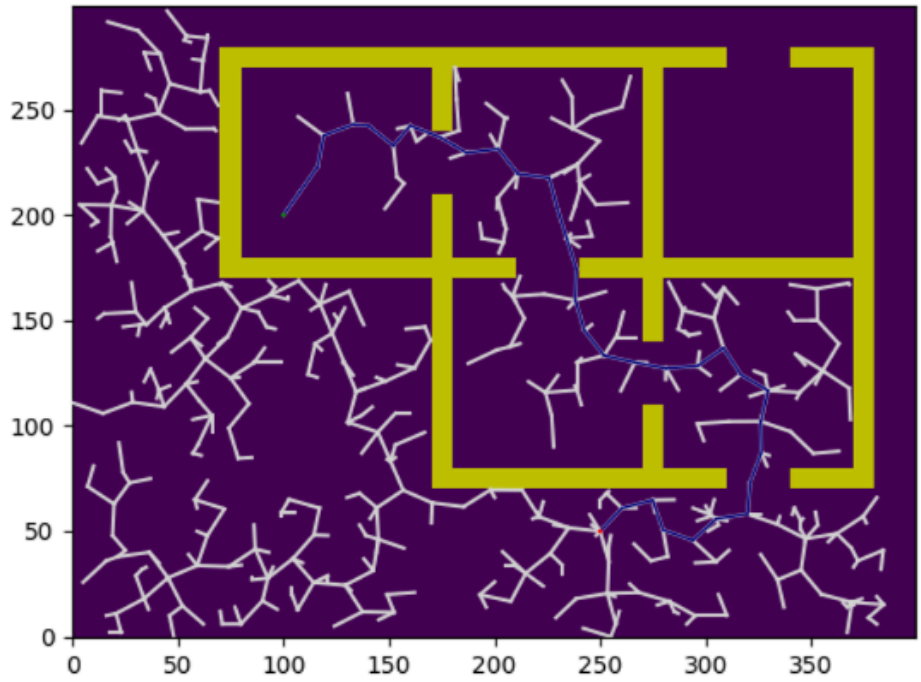


Figure 2: E2 with 40% goal bias

Average performences to E1 method with 5% goal bias:

Cost: 571.4, Time: 3.5

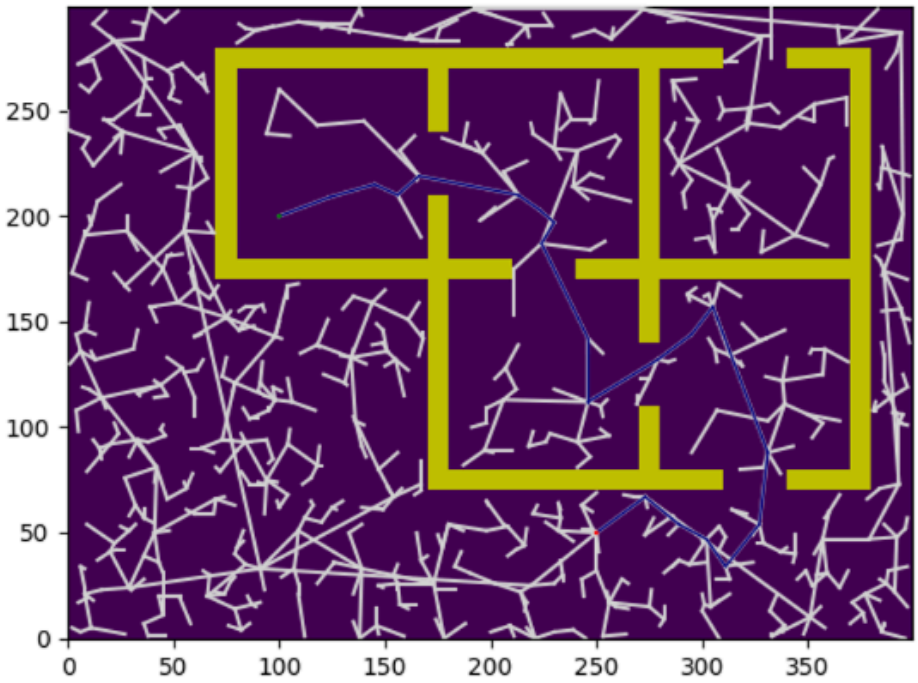


Figure 3: E1 with 5% goal bias

Average performences to E1 method with 40% goal bias:

Cost: 591.3, Time: 4.7

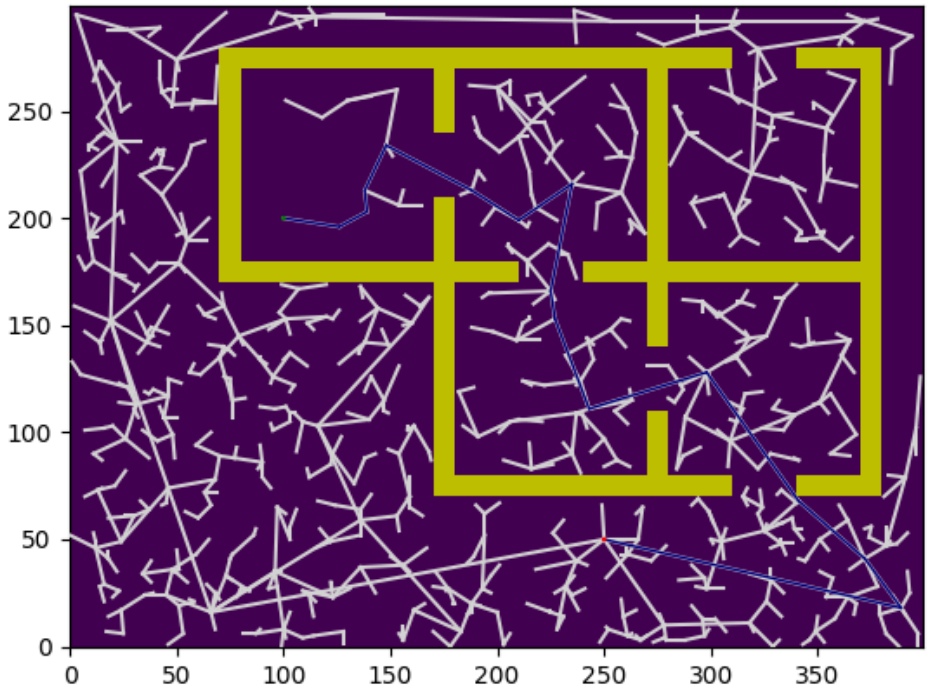
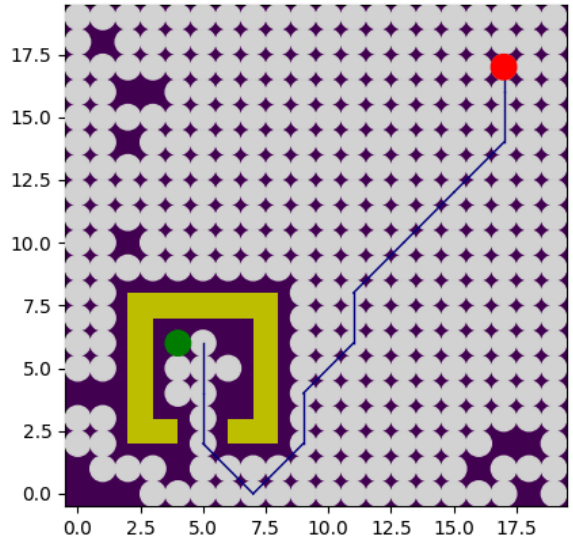


Figure 4: E1 with 40% goal bias

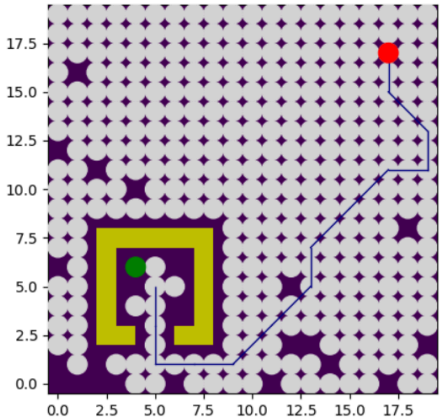
We can see thet we find the path much faster with E1 strategy on both goal biases, but the cost of the path is bigger. So if we need fast algorithm and we can live with high price we will use E1, and if we preffer long run time but cheap path we will use E2.

section 4 RCS



path length: 27.970562748477143
num of total steps: 13 num of fine steps: 2 num of coarse steps: 11
Coarse steps: 84.61538461538461 %
Fine steps: 15.384615384615385 %

when using set instead of list



path len: 30.14213562373095
num of total steps: 14 num of fine steps: 1 num of coarse steps: 13
Coarse steps: 92.85714285714286 %
Fine steps: 7.142857142857142 %

section 5

Q1.
curvature parameter
insertion length
axial rotation angle

Q2.
Configuration: Position and orientation.
Parent node: A reference to the node from which it was expanded.
Motion primitive: The control inputs that transition from the parent node to the current node.
Cost values: Accumulated cost C(v) and heuristic estimate h(v).
Rank: A combination of the depth and resolution level along the path

Q3.the same as q2

Q4.
by Rank and second order is by f(v)

> wherein nodes are ordered according to their *rank* (as defined in Sec. 4.1.2) and a secondary metric $f(\cdot)$. The secondary metric $f(v) = \mathcal{C}(v) + h(v)$ has $\mathcal{C}(v)$ denoting the cost of the trajectory from the root of $\mathcal{T}$ to v with respect to $\mathcal{C}$ and $h(v)$ being a heuristic function estimating the cost of the trajectory from the node v to the goal point. For example,

Q5
Selecting the node with the smallest rank or within a lookahead range
Among the eligible nodes we choose the one with the minimum f(v)
Q6
included in Q4 C(v) is the cost like the h(v) is the huristic like
Q7
In geometry, the term Dubins path typically refers to the shortest curve that connects two points in the two-dimensional Euclidean plane
since The heuristic represents the dubins curve length from the current node to the goal its never over estimate
Q8
ill use dict with str(conf) as the key