

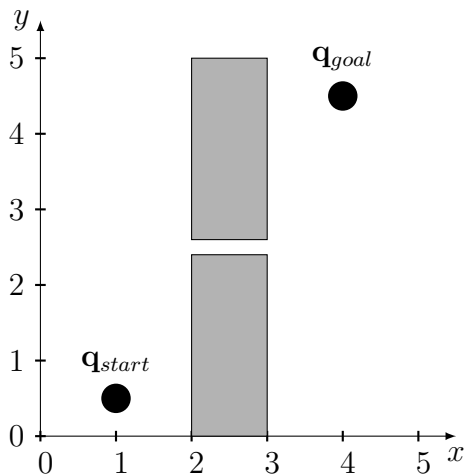
MOTION PLANNING — EXERCISE 7

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Non-Programming

1. Compare the Exploration/Exploitation trade-off of RRT with goal bias and A*. First, explain how both methods explore the space and exploit existing knowledge they have. Second, discuss advantages and disadvantages of the different exploration/exploitation strategies.
2. Consider the following *narrow-passage* problem for a point-robot operating in \mathbb{R}^2 .



- (a) Explain what the main challenge for RRT for such an environment is. Be specific (e.g., use probabilities and concrete line numbers from the pseudo code).
 - (b) You are now free to change the y -coordinates of both \mathbf{q}_{start} and \mathbf{q}_{goal} . Find a set of coordinates and RRT hyperparameters that make the instance trivial to solve.
 - (c) What properties should an (imaginary) **SAMPLE** function have to allow RRT to find a solution quicker in environments with narrow passages with arbitrary configurations for \mathbf{q}_{start} and \mathbf{q}_{goal} ?
3. Explain the differences between RRT and RRT*. Be specific about what additional methods are used in RRT* compared to RRT.
 4. The planner Informed-RRT* uses an informed set to prune states. This set is defined as $\{x \in Q \mid d(x_{start}, x) + d(x, x_{goal}) < c\}$, whereby x_{start} and x_{goal} are the start and goal state, c is the current best cost, and d is the metric. Explain if the informed set still makes sense if the function d is merely a pseudo-, quasi-, or semi-metric.