ME 145
Robotic Planning and Kinematics

Lab Session No. 2

BUG 1 ALGORITHM

Submit your code through iLearn. Your code and reports are due on Monday, 04/22, at 11:59 pm. Late submissions will not be accepted.

E1.8 **Programming Project: The Bug 1 algorithm (80 points).**

Requires Exercises (1) and (2) from Lab 1. In this programming project, you are asked to implement the Bug 1 algorithm. For your convenience we provide below a detailed pseudocode implementation of a simple Bug algorithm called BugBase; this pseudocode implementation contains all detailed steps required to execute a bug algorithm, but does not have any logic for getting around obstacles.

The BugBase algorithm

Input: Two locations `start` and `goal` in W_{free}, a list of polygonal obstacles `obstaclesList`, and a length `step-size`

Output: A sequence, denoted `path`, of points from `start` to the first obstacle between `start` and `goal` (or from `start` to `goal` if no obstacle lies between them). Successive points are separated by no more than `step-size`.

```
current-position = start
path = [start]
while distance(current-position, goal) > step-size :
    find polygon closest to current-position
    if distance from current-position to closest polygon < step-size :
        return "Failure: There is an obstacle lying between the start and goal"and path
    compute new current-position by taking a step of length step-size towards goal
    path = [path, current-position]
path = [path, goal]
return "Success" and path
```

Perform the following tasks and document them in a concise project report:

(i) (15 points) Sketch a flowchart and implement the BugBase algorithm.

(ii) (5 points) Describe in a paragraph how you will modify BugBase to implement the Bug 1 algorithm. Explain the roles of the geometric functions in Exercises (E1) and (E2) and what new logic will be needed.

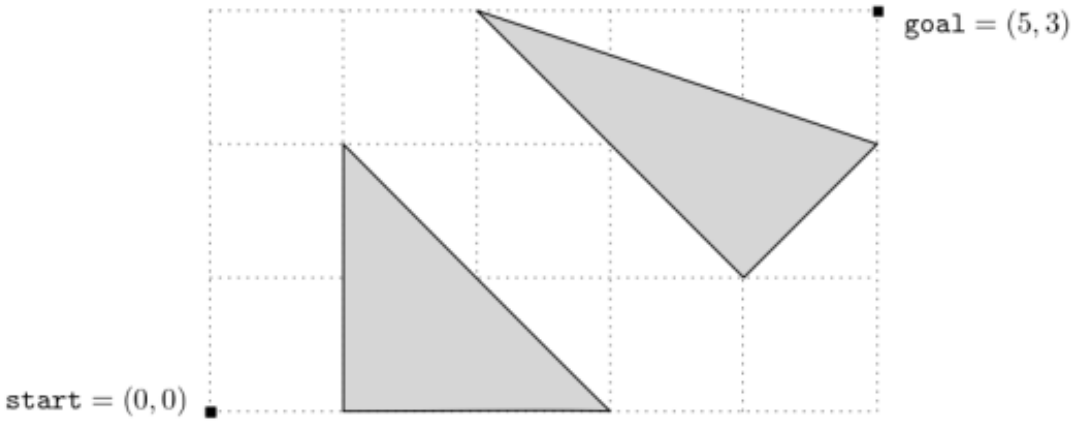
(iii) (40 points) Implement a fully-functioning version of Bug 1, described as follows:

computeBug1

Input: Two locations start and goal in W_{free}, a list of polygonal obstacles obstaclesList, and a length step-size

Output: A sequence, denoted path, of points from start to goal or returns an error message if such a path does not exists. Successive points are separated by no more than step-size and are computed according to the Bug 1 algorithm.

(iv) (20 points) Test your program on the following environment: start = (0, 0) and goal = (5, 3)step-size = 0.1 obstaclesList = {(1, 2), (1, 0), (3, 0)}, {(2, 3), (4, 1), (5, 2)}



Include in your report a plot of the path taken by your bug from start to goal, the total path length and the computing time, and a plot of the distance from the bug's position to the goal as a function of time.