

ENPM661 - Homework 1

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To solve this problem I wrote the following Matlab code because I'm bad at doing math by hand.

1.a

```
M = [0 0 0 1; 1 1 1 1; 0 0 1 0; 3 2 1 0];

Hx = [2; 3.5; 1.2; 1];
Hy = [3; 9; 1; 2];
Hz = [8; 5; 2; 0.5];

Cx = M\Hx;
Cy = M\Hy;
Cz = M\Hz;

s = 0.8;
Sx = polyval(Cx, s)
Sy = polyval(Cy, s)
Sz = polyval(Cz, s)
```

The value at $s = 0.8$ is (3.2544, 8.1520, 5.3120)

1.b

$$x = g(s) = -0.8s^3 + 1.1s^2 + 1.2s + 2$$
$$y = f(s) = -9s^3 + 14s^2 + s + 3$$

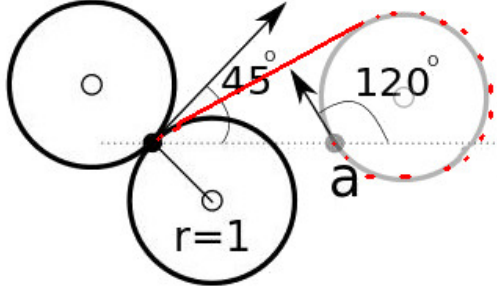


Figure 1: Shortest Dubins path from $(0,0)$ to a

$$z = h(s) = 8.5s^3 + -13.5s^2 + 2s + 8$$

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$${}^L p = {}^L_A T \times {}^A_B T \times {}^C_B T^{-1} \times {}^D_C T^{-1} \times {}^D_E T \times {}^E_F T \times {}^W_F T^{-1} \times {}^W p$$

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3.a

Figure 1 shows the Dubins path to a .

3.b

Figure 2 shows the Dubins path to b .

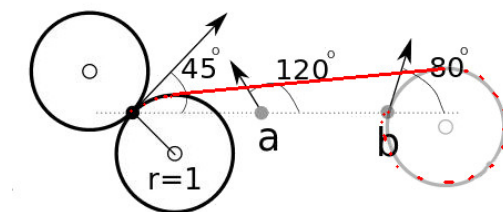


Figure 2: Shortest Dubins path from $(0,0)$ to b

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4.a

Front
G
F
D
E
Back

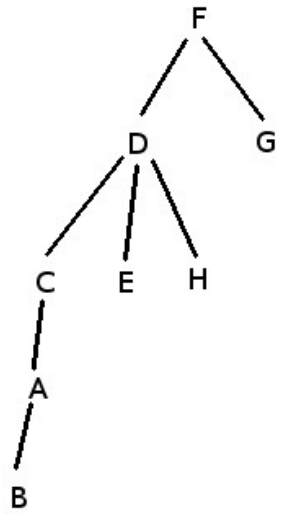
4.b

Front
D
F
B
A
Back

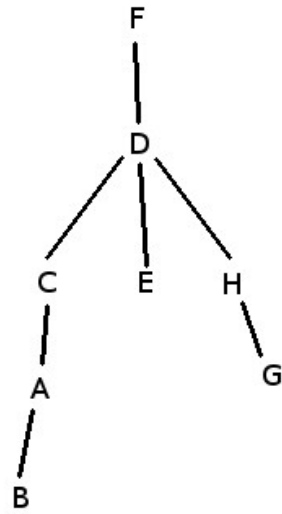
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5.a

Node discover order with BFS: F, D, G, C, E, H, A, B . Figure 3a shows the resulting search tree.



(a) Search graph with BFS



(b) Search graph with DFS

Figure 3

5.b

Node discover order with DFS: F, D, C, A, B, E, H, G . Figure 3b shows the resulting search tree.