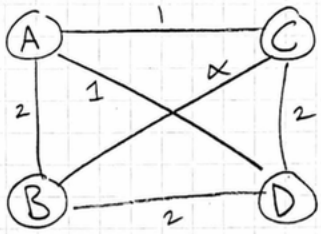
Part 1 A

Homework 3 Part 1

A) Cost-to-go Current = Cost-to-go Next + Cost to travel to next

Cost-to-go = C



$C_{ABCDA} = 0$ $C_{ABDCA} = 0$ $C_{ACBDA} = 0$ $C_{ACDBA} = 0$ $C_{ADBCA} = 0$ $C_{ADCBA} = 0$

$C_{ABCD} = C_{ABCD} + D \to A$ $C_{ABDC} = C_{ABDCA} + C \to A$ $C_{ACBD} = C_{ACBDA} + D \to A$ $C_{ACDB} = C_{ACDBA} + B \to A$ $C_{ADBC} = C_{ADBCA} + C \to A$ $C_{ADCB} = C_{ADCBA} + B \to A$

$C_{ABCD} = 0 + 1$ $C_{ABDC} = 0 + 1$ $C_{ACBD} = 0 + 1$ $C_{ACDB} = 0 + 2$ $C_{ADBC} = 0 + 1$ $C_{ADCB} = 0 + 2$

$C_{ABCD} = 1$ $C_{ABDC} = 1$ $C_{ACBD} = 1$ $C_{ACDB} = 2$ $C_{ADBC} = 1$ $C_{ADCB} = 2$

$C_{ABC} = C_{ABCD} + C \to D$ $C_{ABD} = C_{ABDC} + D \to C$ $C_{ACB} = C_{ACBD} + B \to D$ $C_{ACD} = C_{ACDB} + D \to B$ $C_{ADB} = C_{ADBC} + B \to C$ $C_{ADC} = C_{ADCB} + C \to B$

$C_{ABC} = 1 + 2$ $C_{ABD} = 1 + 2$ $C_{ACB} = 1 + 2$ $C_{ACD} = 2 + 2$ $C_{ADB} = 1 + \alpha$ $C_{ADC} = 2 + \alpha$

$C_{ABC} = 3$ $C_{ABD} = 3$ $C_{ACB} = 3$ $C_{ACD} = 4$ $C_{AD} = C_{ADB} + D \to B$ $C_{AD} = C_{ADC} + D \to C$

$C_{AB} = C_{ABC} + B \to C$ $C_{AB} = C_{ABD} + B \to D$ $C_{AC} = C_{ACB} + C \to B$ $C_{AC} = C_{ACD} + C \to D$ $C_{AD} = 1 + \alpha + 2$ $C_{AD} = 2 + \alpha + 2$

$C_{AB} = 3 + \alpha$ Min $C_{AB} = 3 + 2$ $C_{AC} = 3 + \alpha$ Min $C_{AC} = 4 + 2$ $C_{AD} = 3 + \alpha$ Min $C_{AD} = 4 + \alpha$

$C_A = C_{AB} + A \to B$ $C_{AB} = 5$ $C_A = C_{AC} + A \to C$ $C_{AC} = 6$ $C_A = C_{AD} + A \to D$ $C_A = C_{AD} + A \to D$

$C_A = 3 + \alpha + 2$ $C_A = C_{AB} + A \to B$ $C_A = 3 + \alpha + 1$ $C_A = C_{AC} + A \to C$ $C_A = 3 + \alpha + 1$ $C_A = 4 + \alpha + 1$

$C_A = 5 + \alpha$ $C_A = 5 + 2$ $C_A = 4 + \alpha$ $C_A = 6 + 1$ $C_A = 4 + \alpha$ $C_A = 5 + \alpha$

$C_A = 7$ $C_A = 7$

$C_A = \text{Min}$

Part1B

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B) Given $C_A = 5 + \alpha$, $C_A = 7$, $C_A = 4 + \alpha$, $C_A = 7$, $C_A = 4 + \alpha$, $C_A = 5 + \alpha$ for each respective path.

If α is ≤ 2, α is the optimal route.

This comes from either the ACBDA path or ADBCA path where the cost would be between 4 and 6 (if weight 0 is allowed), thus making it less than every other path that does not include α.

Part2B-iii

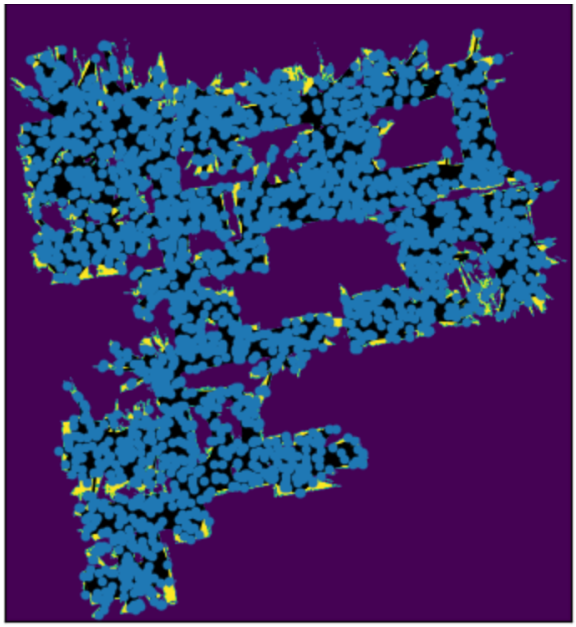
Total length: 801.7

```
A_star_Distance = findTotalDistance(inversePath)
A_star_Distance
```

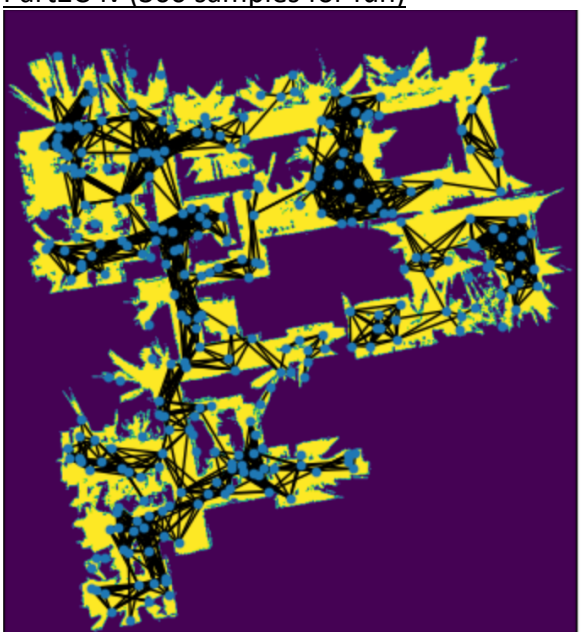
✓ 0.3s

```
801.7005768508895
```

Part2C-iv (2500 samples)



Part2C-iv (300 samples for fun)



PartC-v (2500 samples)

Total length = 806.41

```
PRM_A_star_Distance = findTotalDistance(inversePrmPath)
PRM_A_star_Distance
```

✓ 0.3s

```
806.4061476924891
```

PartC-v (300 samples for fun)