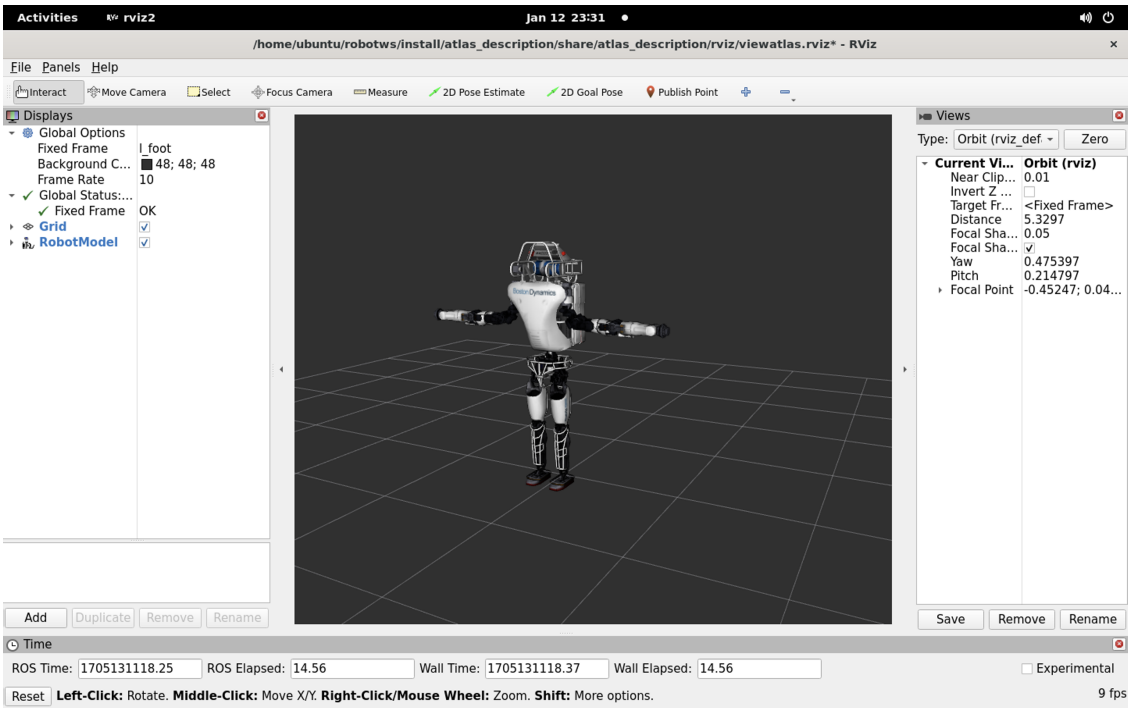
CS 133b **January 15, 2024**

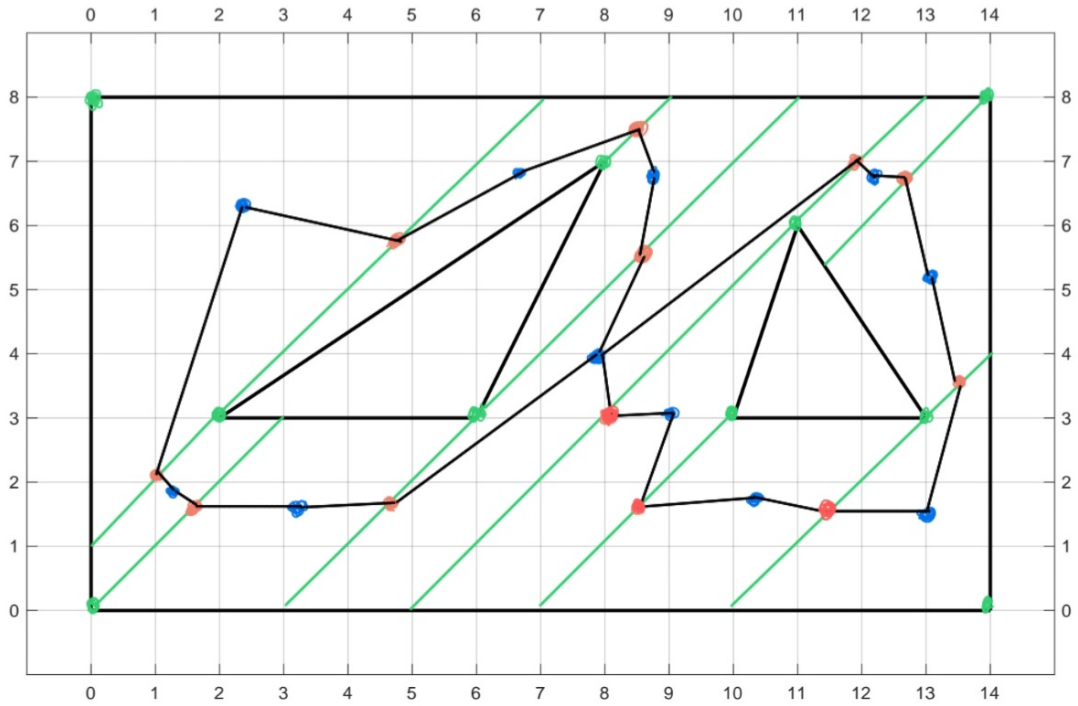
Problem Set 2

Problem 1 (Check Linux and ROS) - 16 points

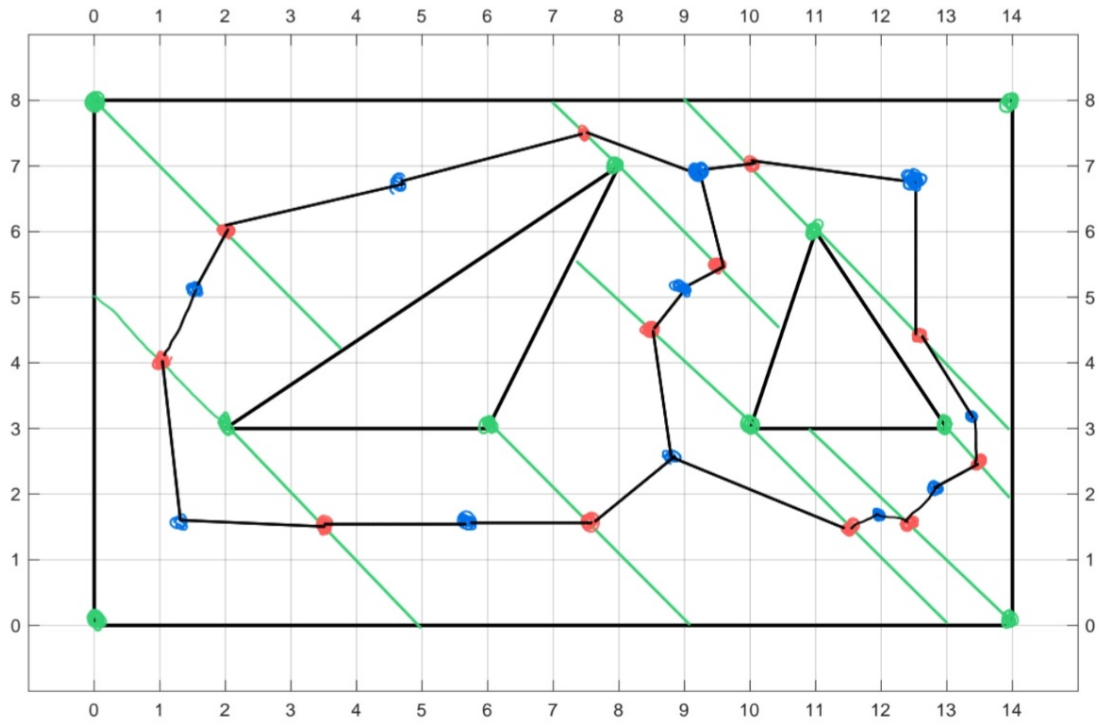


As shown above, everything works and ros has been installed. No issues were encountered.

Problem 2 (Trapezoidal Cell Decomposition) - 20 points

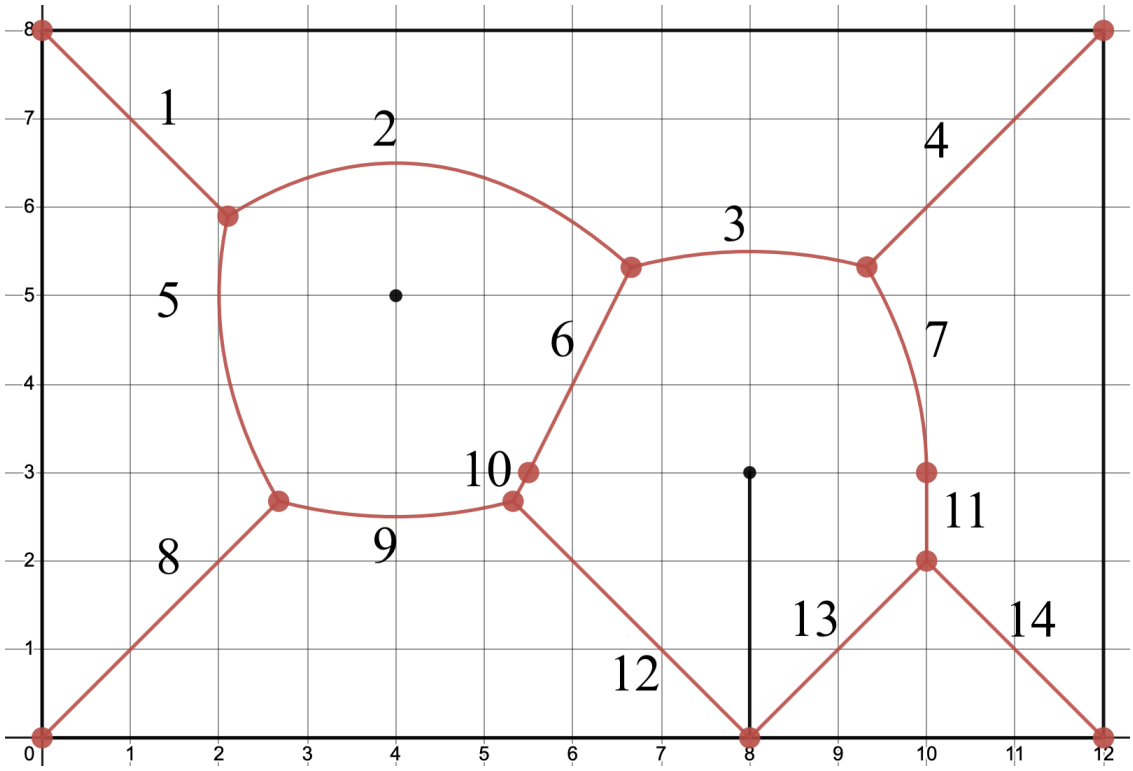


Problem 2a
The graph is shown above for 2a.
Number of Cells: 11
Number of nodes: 23
Number of edges: 24



Problem 2b
The graph is shown above for 2b.
Number of Cells: 11
Number of nodes: 23
Number of edges: 24

Problem 3 (Generalized Voronoi Diagram) - 20 points



Problem 3a
The Generalized Voronoi Diagram is shown above. Each path/edge between nodes are labeled to make it easy to list the equations in part e.

Problem 3b
Excluding the room border, there are 8 internal intersections.

Problem 3c
Including the nodes at the room border, there are a total of 13 nodes.

Problem 3d
There are 14 edges/paths.

Problem 3e
Segment 1: $y = 8 - x$

Segment 2: $y = -\frac{1}{6}(x-4)^2 + 6.5$

Segment 3: $y = -\frac{1}{10}(x-8)^2 + 5.5$

Segment 4: $y = (x-12) + 8$

Segment 5: $x = \frac{1}{8}(y-5)^2 + 2$

Segment 6: $y = 2(x-6) + 4$

Segment 7: $x = -\frac{1}{8}(y-3)^2 + 10$

Segment 8: $y = x$

Segment 9: $y = \frac{1}{10}(x-4)^2 + 2.5$

Segment 10: $x = -\frac{1}{8}(y-5)^2 + 6$

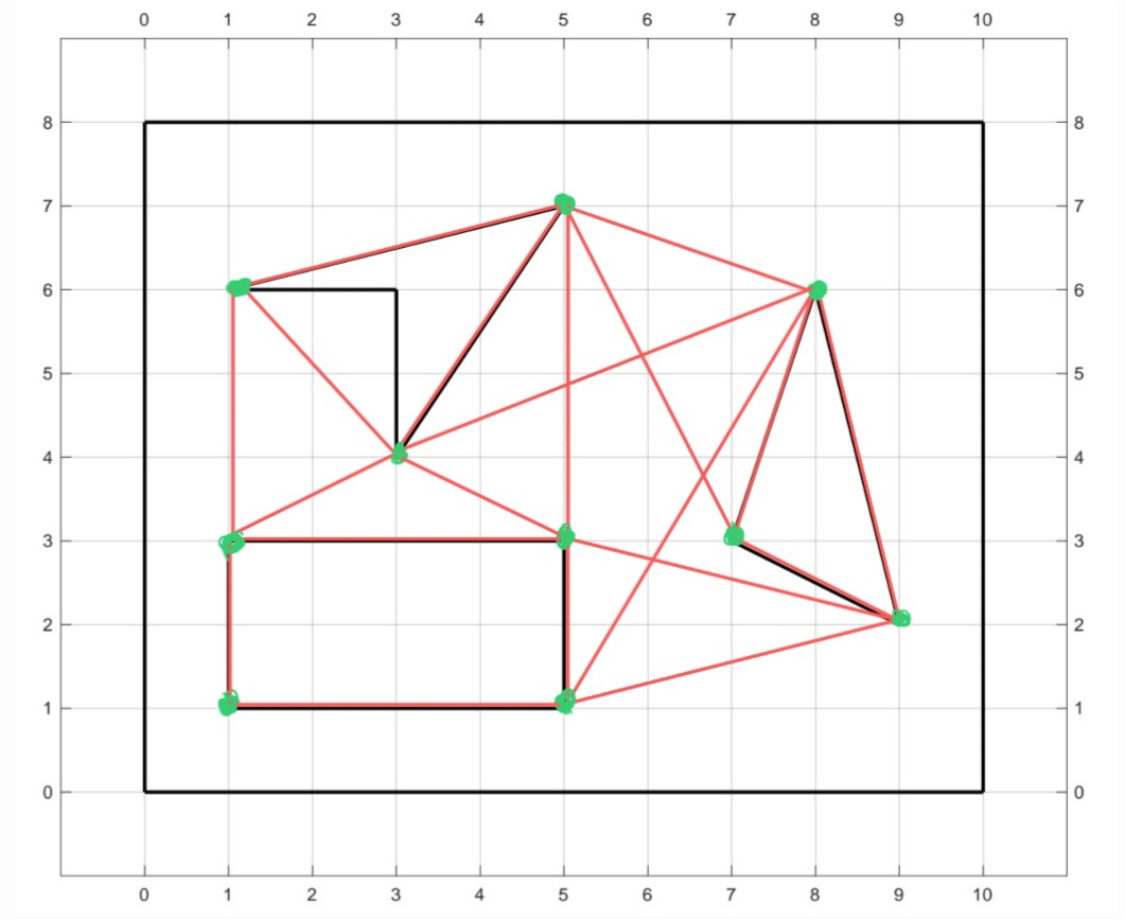
Segment 11: $x = 10$

Segment 12: $y = 8 - x$

Segment 13: $y = x - 8$

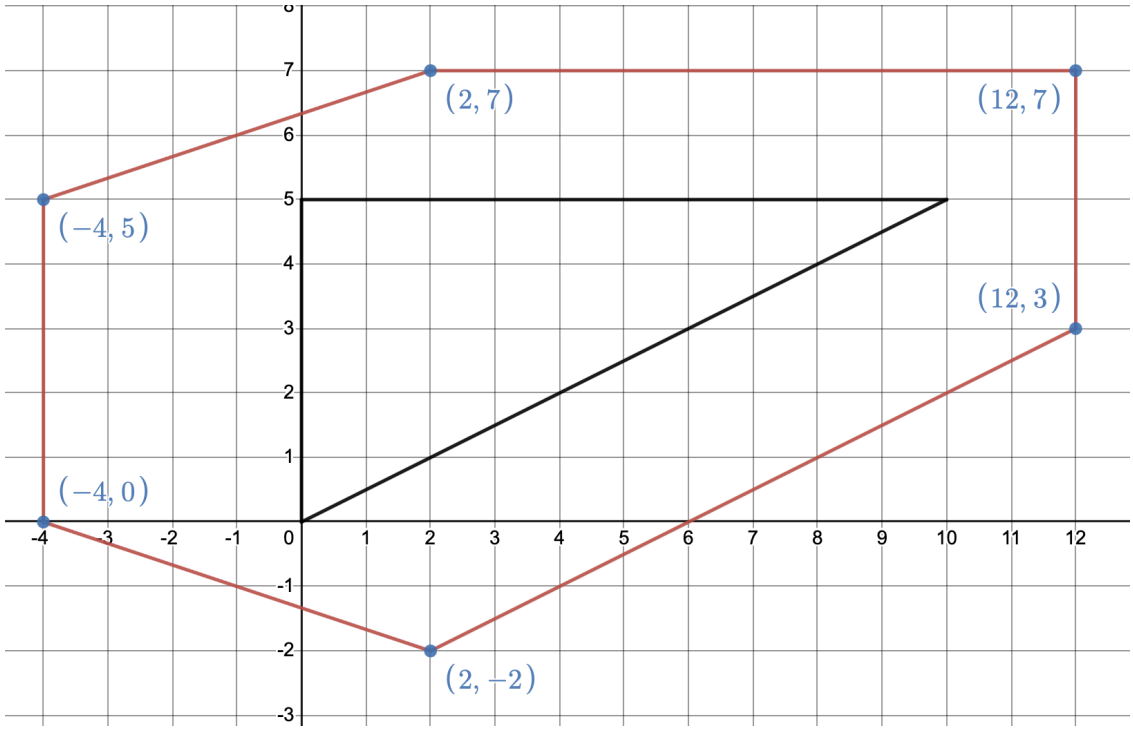
Segment 14: $y = -(x-12)$

Problem 4 (Visibility Roadmap) - 20 points

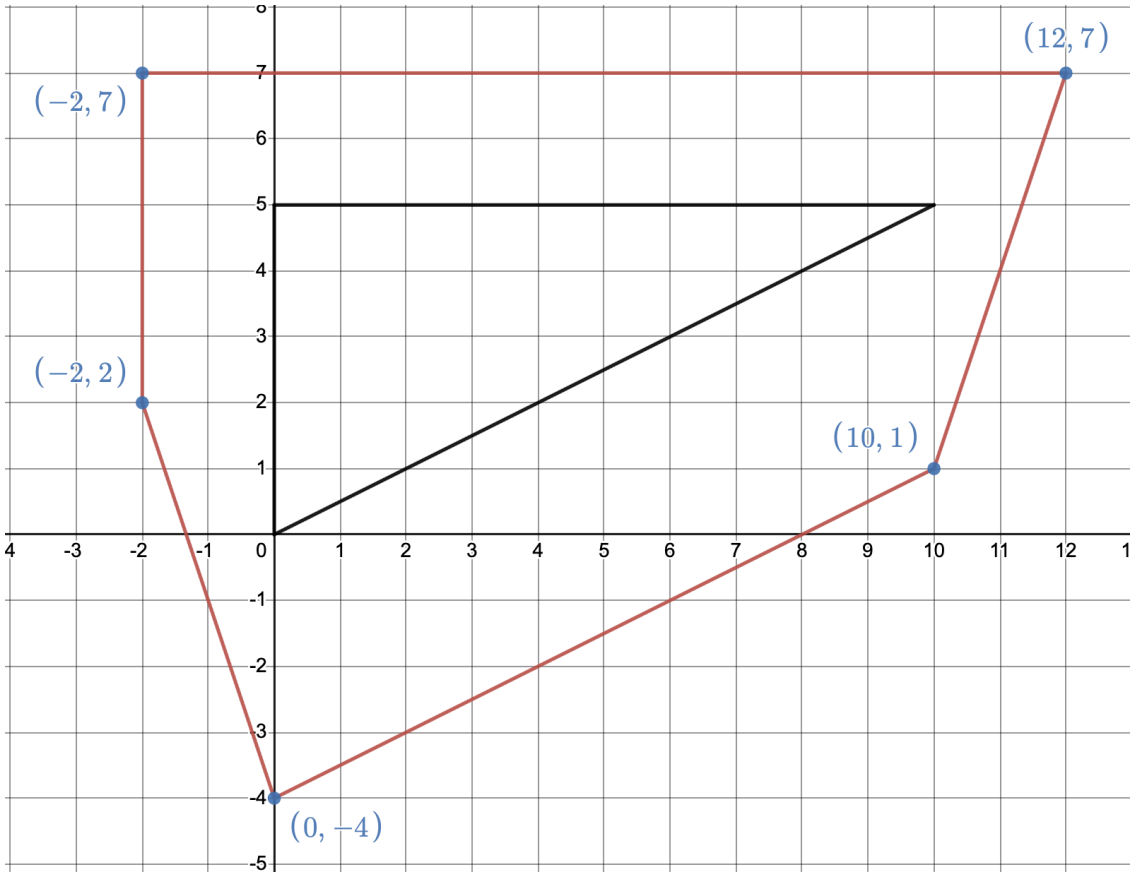


4a) Drawing shown above for the reduced visibility roadmap
4b) Number of nodes: 10
4c) Number of edges: 21

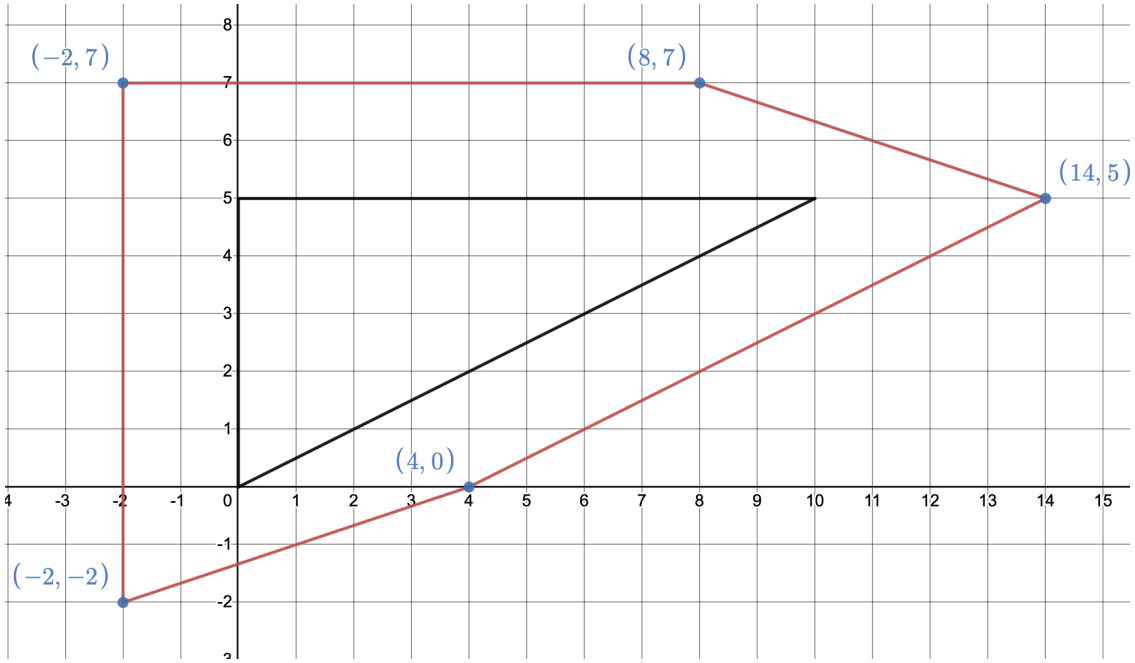
Problem 5 (C-Space Obstacle) - 20 points



5a ($\theta = 0°$)
The drawing is shown above for 5a. The red polygon is the boundary for the obstacle given $\theta = 0°$. All red segments between the points labeled (in blue) are straight lines. In other words, all (x,y) points within this red polygon are unreachable by the robot for the given theta. Note that the obstacle is shown in black.



5b ($\theta = 90°$)
The drawing is shown above for 5b. The red polygon is the boundary for the obstacle given $\theta = 90°$. All red segments between the points labeled (in blue) are straight lines. In other words, all (x,y) points within this red polygon are unreachable by the robot for the given theta. Note that the obstacle is shown in black.



5c ($\theta = 180°$)

The drawing is shown above for 5c. The red polygon is the boundary for the obstacle given $\theta = 180°$. All red segments between the points labeled (in blue) are straight lines. In other words, all (x,y) points within this red polygon are unreachable by the robot for the given theta. Note that the obstacle is shown in black.

Problem 6 (Time Spent) - 4 points

I spent about 4-5 hours on this set.