Research: Work Due for 1/24

**General Questions-**

How is grad school financed for you?

Who do I need to talk to be able to get lab access?

Who do I need to talk to about getting class credit for my research?

For this week I have done readings for the following papers.

The Compass That Steered Robotics

**General Idea:**

This paper is an extension of “The Power of the Compass”, explaining concepts at a high level and stating their applications. The paper starts off by asserting that the compass can lower a finite, two-dimensional search maze from O(n) to O(log(n)) in space complexity. The author goes on to explain the results of the papers as

“1) There are two (unenhanced automata that together can search all mazes.

2) There is a two-pebble automaton that can search all mazes.

3) There is a one-counter automaton that search all mazes.”

(Page 53)

The other then goes on to say that since any of these automaton can search all mazes, there is an equivalence and tradeoff between communication, state, and side-effecting the environment.

The author then went on to explain invariants and tradeoffs between communication, state, and side-effecting the environment. The author mentioned what is necessary to measure the information complexities through the automaton.

Finally the author talked about real world microscale assembly applications.

**Questions:**

What is the counter automaton counting?

Are states relative to robotics the same thing as states relative to computation?

What does the following mean? “We imagine this implementation as a tree of computation, in which the vertices are control and sensing actions, computation, and state retention” (Page 51).

Explain the application difference between a turing machine and an automaton with 1 counter.

Why is it possible for 2 automatons to be able to fully traverse a finite 2D space, but not a 3D space? What about the trivial case where there is just 1 space to visit in either spaces?

How is a force field made (magnetic? Electric? Gravity?). How would this get to move a part if it were plastic or ceramic (like a resistor)?

**Ideas:**

In paragraph 3 of page 58, the paper discusses using a clock to synchronize the changes of a force field for automation assembly. Instead why not use CAM (Where the force field changes based on the current position of the parts, instead of a timer). This will keep the process closed loop and in most real life assembly tends to be better.

Programmable Self-Assembly

**General Idea:**

A description of how local behavior dictates the global behavior. This can be done by modeling the environment with graph grammar, and then using a “stochastic process over the transition system and pose and optimization problem that maximizes the yield of a desired assembly type.”

**Questions:**

What is a stochastic process?

**Ideas:**

Emergent Structures Assembled By Large Swarms of Simple Robots

**General Idea:**

How we can use a large swarm of simple robots to achieve higher level goals through “mechanical programming”. The author performed testing by putting hundreds of hexbugs on a floor with different mechanical parts changed (Bending legs of bot, changing top of robots, changing foam that was pushed by bot to form a cluster of bots). The results of this study show that the hexbugs grouping was mostly affected the size of a swarm are density (of robots/blocks), cluster stability (interlocking), directed motion, and how the interlocking alters the motion of the robots.

**Questions:**

**Ideas:**

I like the idea of exploring how different mechanical shapes would affect how the cluster interacts with each other. However, I don’t have an end goal for this.

Could we increase the complexity of the robots to be able to incorporate “The compass that steered robotics”?

Big Hero 6.

Towards the Design and Analysis of Blind, Bouncing Robots.

**General Idea:**

What conditions cause the robot to get stuck? How can we find the position of the robot? With how much computation, sensors, and time?

**Questions:**

Can we tell the position of the robot through it eventually getting stuck in a pattern? What happens if the pattern has no definable way of getting the robot stuck?

What software do you use for the graphics?

**Ideas:**

On the Power of the Compass

**General Idea:**

**Questions:**

**Ideas:**