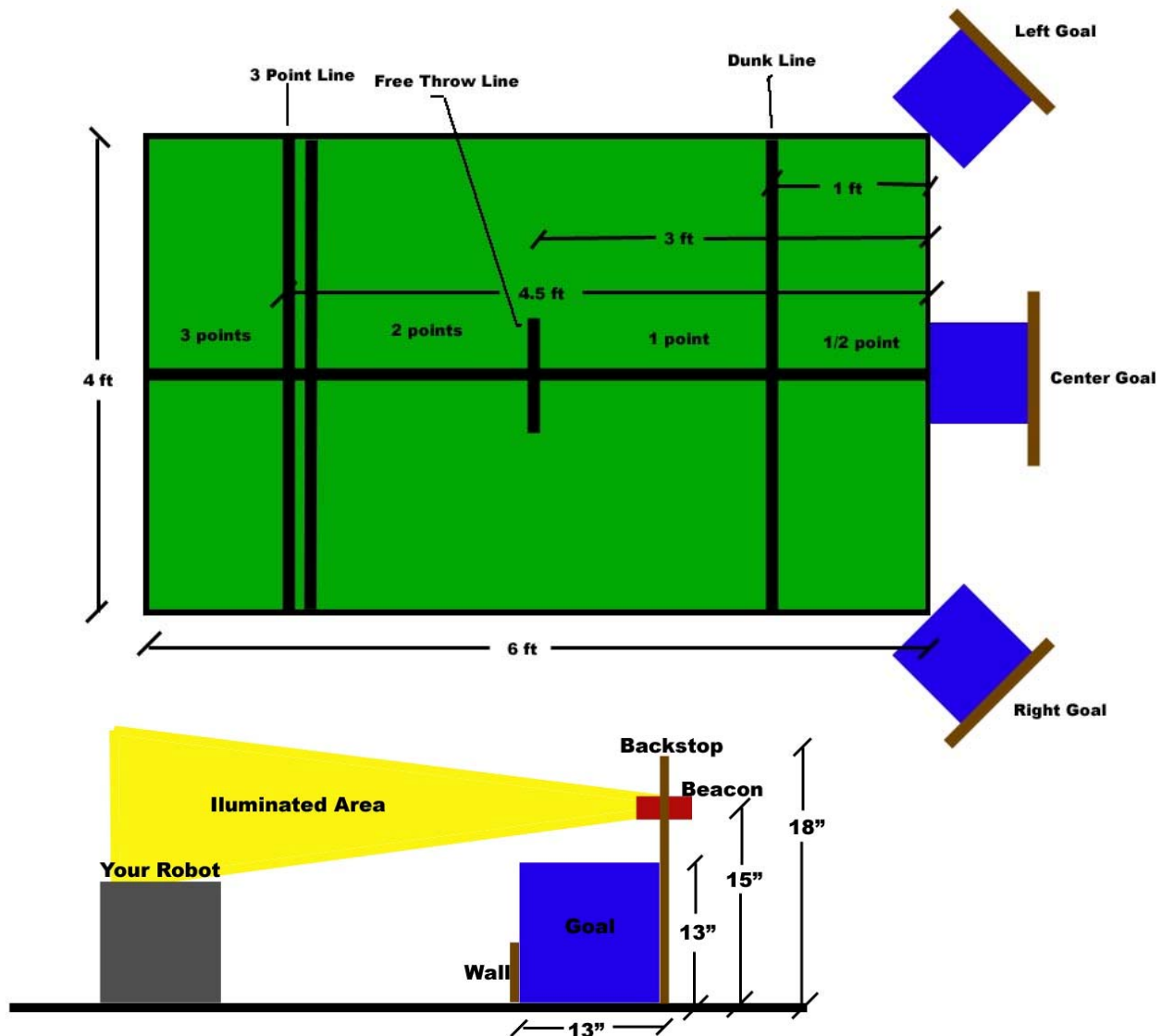




## SLUG MADNESS — WINTER 2008

### Purpose:

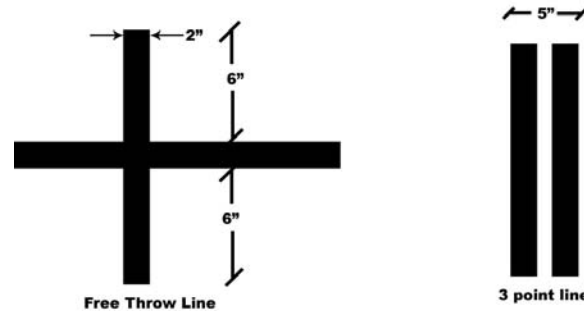
The purpose of this project is to provide an opportunity to apply all that you have learned in CMPE-118 to solve an open-ended problem. Since UCSC's basketball team wasn't up to the challenge, your task is to design an autonomous machine to compete in this year's "March Madness" basketball tournament: *Slug Madness*.



## **Background Briefing:**

Since the traditional game of basketball has proven too difficult for UCSC, their brilliant coaches have come up with a new game that might be a little more robot-friendly and they're seeking your help.

The game of **S-L-U-G** requires the robotic players to make baskets only while a beacon is on behind the basket. Only a single basket is illuminated at a time and may change every 10 seconds. The coaches considered having you compete against their old players, but figured you'd like more of a challenge. Like a standard game of basketball, a different number of points will be given based on where your slime trail was when you shot. Instead of a traditional basketball, however, you'll be shooting ping-pong balls or small foam (nerf) balls as found in lab.



It is your CMPE118 team's job to bring pride back to the Banana Slugs by showing just how well you can play the game of S-L-U-G. Unfortunately, the UCSC Cheerleading Squad cannot or will not attend our games.

## **Project Specifications:**

The droid must be a stand-alone entity, capable of meeting all specifications while drawing power only from batteries. Your code must be flashed into the HC12, and for setup purposes, you may be able to communicate to your droid using a standard terminal program. Once operational status is complete, the computer will be disconnected.

The court for the Slug Madness Tournament consists of two areas of plywood board that measures 4' x 6' each, with walls that are constructed from 1" x 4" pine boards, secured firmly to the plywood floor. The surface of the court is covered with green felt. The 3-point zone is marked by two stripes of 2" wide black tape, separated by 1", with the far line 4.5' from the center basket. The Free Throw line marks the boundary for the 2-point zone and is a 14" long strip of tape 3' away from the center basket. The Dunk line marks the start of the 1-point zone 1' away from the center basket. Despite the unlikely event of a slug dunking, you will be awarded ½ point for baskets made from inside the dunk line. See the attached sketch of the playing field for details.

Your machine will be placed behind the 3-point line in a random orientation. In a head-to-head match, two courts will be placed back-to-back separated by their baskets. Each milk crate basket will be marked by a beacon, which transmits a modulated infrared signal at 2 KHz, with a 50% duty cycle. Although the corner baskets on each court will

have their own beacons, mirrored pairs will light up at the same time. Any shot fired into an unlit basket will count as a free throw for the other team.

Robots are placed onto the court and then have 2 minutes to score as many points as possible. The tournament will be run in a single elimination fashion until just one remains. Your machine is required to occupy a volume not to exceed 13" x 13" in horizontal dimensions and 13" in height when initiated. Your machine must contain the complete supply of balls to be used during the event.

The minimum requirement for a passing grade is that you score two baskets from the free throw line, *in different baskets*. Scoring does not affect grading, but will be used as the basis of a competition between teams. Once your machine has been activated, the operator may not touch it until the entire sequence is complete. During operation, the machine is required to stay within the boundaries of the field.

A report describing the technical details of the machine will be required. The report should be of sufficient detail that a person skilled at the level of CMPE118 could understand, reproduce and modify the design.

### **Safety:**

The machines should be safe to the user, the lab and the spectators. For this project, excessively high velocity foam ball delivery will be discouraged (so go ahead and forget about that CO<sub>2</sub> PVC pipe launcher you were thinking of). Voltages are limited to the rechargeable batteries in the lab (and you may purchase your own if you'd like), and intentional jamming of the opposing robot is considered foul play.

Prior to competition your robot should not transcend space or time in any way.

### **Evaluation:**

Performance testing procedures: All machines will be operated by one of the team members. There will be one round for grading purposes, and one round for entertainment purposes.

**Level 1:** Grading evaluation. Each machine will be graded based on its performance in the testing before the class competition at the end of the quarter. Each machine will have up to 2 minutes to make the required two baskets. Grading is not based on point value, but is simply a measure of successfully making two baskets.

**Level 2:** Class Competition. After a few trial runs, each group and machine will be entered into a single-elimination tournament. Each machine will receive points as outlined above for successful shots delivered within the 2 minutes. Note that the tournament is a public demo, and be sure to invite all of your friends and family.

**Grading Criteria:**

1. Concept (20%) This will be based on the technical merit of the design and coding for the machine. Included in this grade will be evaluation of the appropriateness of the solution, as well as innovative hardware and software and use of physical principles in the solution.
2. Implementation (20%) This will be based on the prototype displayed at the evaluation session. Included in this grade will be an evaluation of the physical appearance of the prototype and the quality of construction. We will not presume to judge true aesthetics, but will concentrate on craftsmanship and finished appearance.
3. Report (10%) This will be based on an evaluation of the written report. It will be judged on clarity of explanations, completeness and appropriateness of the documentation.
4. Performance (20%) Based on the results of the performance during the evaluation session.
5. Design Evaluations (30%) Based on checkoff completion.

**Project Milestones:**

**First Review:** Thursday, 14-February-2008, Presented in Class (using overhead projector or tablet). Note that this is done by each person in the class individually.

Generate 5 concepts of how you are going to build a droid that will successfully play the game of S-L-U-G. Sketch them all out, and deliver a sketch of your best concept to the professor at least 1 hour before class begins, include:

- Sketches
- Details where you have them
- Plan-B in case things don't work out the way you expect

**Check-off 1:** Tuesday, 19-February-2008, Presented to TAs or Instructor

Deliverables are:

- Time schedules
- Personnel assignments
- System Block Diagram
- Mechanical Design Sketches

**Check-off 2:** Thursday, 21-February-2008, Presented to TAs or Instructor

Deliverables are:

- State Machine(s)

- Final Mechanical Design (Solidworks/Sketchup)

**Check-off 3:** Tuesday, 26-February-2008, Presented to TAs or Instructor

Deliverables are:

- Working sensors (breadboard is ok) and schematics
- Actuators (breadboard is ok) and schematics

**Check-off 4:** Thursday, 28-February-2008, Presented to TAs or Instructor

Deliverables are:

- Final sensors and final schematics
- Final actuators and final schematics

**Check-off 5:** Tuesday, 4-March-2008, Presented to TAs or Instructor

Deliverables are:

- Autonomous platform that can move and sense

**Check-off 6:** Thursday, 6-March-2008, Presented to TAs or Instructor

Deliverables are:

- Robot that can autonomously locate baskets and fire balls

**Specifications Check-Off:** Tuesday, 11-March-2008, Presented to TAs or Instructor

Deliverables are:

- Robot that meets minimum specifications

**Final Presentations: Wednesday 12-March-2008,** Finished, operational machines, fun performance for SOE audience. Public Demo will be held in Humanities Lecture #206, starting at 6:30 PM.

**PS:** With this many people in the lab, it is going to be very important that you keep the lab clean, and not leave your things out. We will be assigning I/O boards and batteries to each team, and they will be yours until the project is over. An early trip over the hill to Halted will probably be very useful, and if you are going to order things from McMaster-Carr or Digikey/Jameco, gang your orders together to save on the shipping. We will be bringing down our “box o’ freedom” that has random parts that people have donated over the years, and if you happen to find surplus printers, or other random electronics that people no longer want, feel free to dismantle and put parts in.