Robo-Rat Competition Rules, Winter 2009

Competition will be on Tuesday 3/10
Lab check in on Thursday 3/12
Written report due Monday 3/16 by midnight

The competition takes place on the robo rat table (the large white table in the rear corner of the lab) with layout as follows:

Groups will compete one-on-one, and the group with the most points at the end of the round wins. Each competition is two minutes long and the groups are not allowed to touch their rat during the competition. This means that the rat has to be pre-programmed on what to do for the entire two minutes, taking into account obstacles, collision and gaining points. The way that the rats earn points is by collecting "cheese." The cheese consist of 2" x 2" foam cubes with a hole through each face. The rats can either collect the cheese and store it on the robot, or place their cheese on their home wall. Different cheese cubes are worth different values, and where the rat stores the cheese makes a difference. If your opponent knocks off the cheese you placed on your wall, too bad! Sabotage is part of the game. The point breakdown is as follows:

<table>
<thead>
<tr>
<th>Cube Type</th>
<th>Ground Cheese On Your Robot</th>
<th>Ground Cheese On Your Wall</th>
<th>Hanging Cheese On Your Robot</th>
<th>Hanging Cheese On Your Wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yours</td>
<td>2</td>
<td>8</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Center</td>
<td>3</td>
<td>12</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>Opponent's</td>
<td>4</td>
<td>16</td>
<td>10</td>
<td>40</td>
</tr>
</tbody>
</table>

Your cheese is the cheese on your side of the table (green in the figure). Your opponent's cheese is at the other end of the table (blue in the figure). There are also 9 center cheese located on platforms in the center of the table (pink in the figure). As you can see from the point breakdown, placing your opponent's cheese on your wall is the most lucrative way to earn points. However, this task is rather challenging when you consider that for two minutes the cheese is being scattered everywhere by the robots.
In addition to the cheese shown above, there will be 4 additional center cheese on the ground (3 points on your robot, 12 points on your wall) placed randomly on the board. There will be a 25% chance all 4 random cheese will be located on the left wall between the standard center cheese, a 25% chance all 4 random cheese will be located on the right wall between the standard center cheese, a 25% chance 2 random cheese will be located on the left wall and 2 random cheese located on the right wall and there is a 25% chance that all 4 random cheese will be located on the edges of the center ramp between the standard center cheese.

In addition to the configuration above, there are 9 hanging cheese located in a grid that has the 3” black squares as the corners. From the points breakdown the hanging cheese are very high value. The hanging cheese are located 18” above the playing field. Details of how many of the 9 slots will be populated and if the hanging cheese will be instrumented with beacons will be forthcoming.

The Rules:

1) The robot must be no larger than one cubic foot at the beginning of each match (1 foot on each dimension maximum)

2) Contestants must place their Robo-Rats facing left, as referenced from the contestant’s end of the table. The referee will turn on the start lamp under each starting circle when both contestants are ready.

3) At the beginning of the round the entire robot must fit within the inside of the large black line that goes around the start area.

4) The location of the 4 randomly placed ground cheeses will determined each round by the TAs. The teams may interact with their robot for up to 20 seconds after the cheese has been placed. Note, this is not enough time to download new firmware.

5) There will be no touching the robots, except as outlined in rule 6 below.

6) In the event that the referee determines that a collision is about to occur, each contestant must quickly activated a micro switch mounted on top of their robot. When the switch is activated, the robot must go into a pause state. This switch will tell your software that a collision-avoidance relocation was necessary and that the robot is at the starting area again. Upon restart with the starting lamp you may allow your robot to face any direction in multiples of 90 degrees, instead of only left.

7) The contest will go on for 2 minutes, and this time will not include any collision avoidance time outs.

8) If a hanging cheese is dropped on the ground before being collected its value will be cut in half.

9) From here on out the term robot will be defined as the Handy Board and all of the parts directly connected to it.
10) In order for the cheese to be counted as being on top of the wall it must be at rest above the team’s home wall, without support from the robot and without touching the floor of the competition board or either of the side walls.

11) At the end of each round both of the robots will be paused by their touch switches. The TA’s or Professor will then pick the robot up perfectly vertical, any cheese that remains connected to the robot while in the air will be considered to be cheese on the robot and will receive points.

12) All structural elements (i.e. not related to electronics) must be built of Legos.

13) There is **ABSOLUTELY NO GLUE ALLOWED** on the robot.

14) Zip ties and tape should be used minimally and only for attachment of sensors. They may not be used as active parts of the robot (i.e. cages, nets, spears, supporting structure or anything else).

15) There is a restriction of three motors and two servos per robot, but note that having 2 servos on the Handy Board often draws a large amount of current and may cause it to reset.

16) Robustness should be a high priority in your design. This includes mechanical stability so your robot stays together and adaptive algorithms so your robot can get itself out of undesirable (typically endless loop) situations.

17) During the actual competition you are allowed to load different programs to your robot in between rounds (but not in between a round and a tie breaker, see below). You are also allowed to repair a damaged robot, however you are not allowed to significantly modify the robot. You may only make changes to your robot after TA or professor approval in the case that it is not functioning correctly or if it has broken while in competition.

18) In the result of a tie at the end of the 2 minute round each robot will be allowed a 1 minute tiebreaker round. In this round all of the cheese on the board will be reset to the normal positions and one robot will try to collect the most cheese, where points are the same as for a normal round. It only matters how much cheese you collect, knocking the opponent’s cheese off will not help you! As stated above, you are not allowed to load a new program into the rat. You must take into account the possibility of a tie and include it into your standard Robo-Rat program.

19) If you have any question or need clarification please ask the TAs or Professor. Final interpretation of the rules lies with the teaching team.

20) You are encouraged to customize or augment your components. These additional components cannot be complete systems (RC controllers, drive trains, …) or motors. Examples of acceptable additional components include sensors, relays, electronic components and batteries. The total cost of all brand new additional components cannot exceed $20.
The written report is due after the final competition. This report is due via email to the TAs and instructor preferably in PDF format. The report should include a detailed discussion of your design path, what worked and what didn’t, a detailed description of your robot (including mechanical, electrical and software elements), a discussion of what tools and fixtures you built, an analysis of what worked well and what didn’t, your improvements to your robot if we were to conduct the competition again, improvements to your overall design process and notes to future teams. Please be thorough and complete as this report is the most significant output of your quarter’s work.