PDXBOT
Line Following Tournament Rules
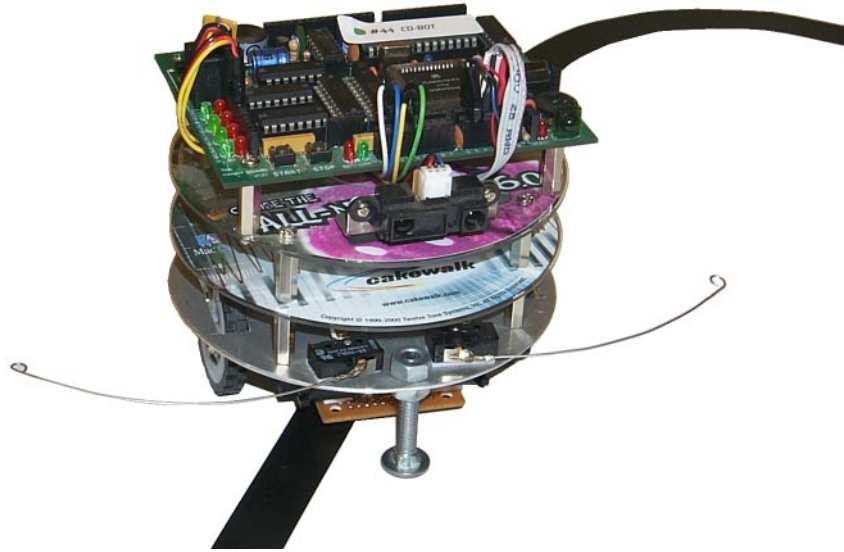
CD-Bot by Dan Gates

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http://www.portlandrobotics.org

Race Categories

There will be two levels of competition: beginner and advanced. See figures 1 and 2 for example courses. The beginner course is a 3/4" non-crossing line with curves no tighter than 6" in radius, whereas the advanced course is a 1/4" wide line and has a number of hazards including breaks in the line, line crossings, gates to be avoided, and bridges/tunnels to cross.
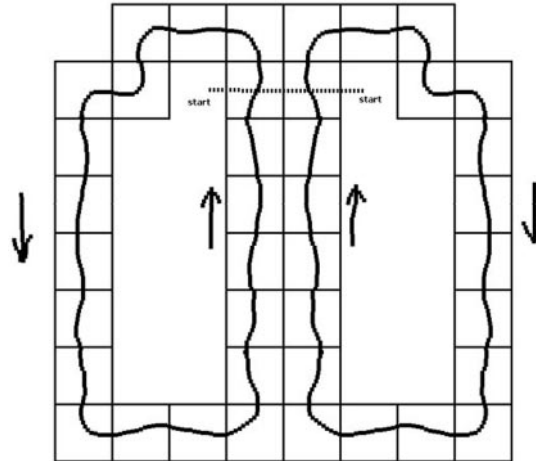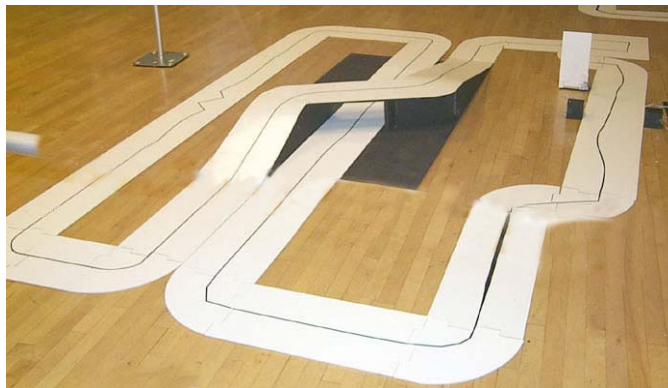
Figure 1 - Beginner course

Figure 2 - Advanced course

Robot Specifications

1. Robots must be autonomous. Data links to off-board computers are allowed, but no wetware (human) operated remote controls will be permitted.

2. The length, width, and weight of a robot are not specified in this contest. The only requirement is that the robot must remain on the course during the event. It is the designers' responsibility to design the robot to accomplish its task.

3. The maximum robot height is not applicable for the beginner's course, but is limited to 6" for the advanced course to allow for underpasses.

4. No robot that is deemed by race officials to be harmful or damaging to either people or the course will be permitted.

Track Specifications

1. The track surface is 11.5 inches (292 mm) wide, + 1/10 in.

2. The rack surface is white. This years' course will be cut from Collegewood brand "polar white" melamine coated hardboard, available in 3'x7'x1/8" sheets from Home Depot and other sources.

3. The track surface is assembled from 11.5-inch (292-mm) wide sections.

4. The track surface may have discontinuities, not to exceed 1/10 inch at segment joints.

5. The course line is 3/4 inch wide for beginner course; 1/4 inch wide for advanced; + 1/16 inch. It will be made of standard 3M vinyl electrical tape, 3M splice tape (thicker and stretchier for curves) and/or 2" Pro-Pak plumbers tape on curved sections (tests show little or no difference in reflectance between these tapes). Plumbers' tape usually has white writing on its surface. This can be easily removed by wiping the tape with a rag dampened with acetone.

6. The course line may have discontinuities, not to exceed 1/10 inch.

7. The course line may be curved, with a minimum centerline radius of 6 inches for the beginner course. Right angle turns may be expected in the advances course.

8. The robot must deal with the lighting conditions as they appear. That is, room lighting and window drapes will be set as desired by the judges and will not be modified for individual contestants. Also, flash photography and IR focusing cameras will be allowed, unless the judges deem such activities as interfering with the ability to hold the event in general.

Note: figures 1 and 2 are just examples – the courses will be different the day of the event.

The Course

1. The size will be approximately 4 feet by 8 feet overall size for the beginners' course. The length is such that a MarkIII with standard servos can traverse the course two times in under 5 minutes total (0.18 sec / 60 degree transit time = 55 RPM. 3" wheel = 9" diameter => 41 feet per minute).

2. The length of the advanced course is to be determined.

The Tiers

Beginner - Simple, Continuous Oval Line Course- intended for beginners and school groups.

The beginner course requires no special hardware to be added to the MarkIII kit other than a device to prevent the scoop from catching on track joints. Lego and other kit robots, such as the Parallax BoeBot or Sumo Bot will work well also. The course is a circular or oval course with some waviness.

Advanced - Obstacles!

The advanced course will have obstacles including:

1. Tight turns: Robots will be expected to navigate turns of up to 90 degrees.

3. Breaks in line: There may exist missing line segments approx. 0.25" to 1" long. If the robot drives straight, it will reach the next segment. This will only be in a straight section of the course.

4. Thickening of line: A line can vary from 0.25" to 0.75"

5. Line crossings: Robots may have to cross lines at right angle to robot motion. The line forms a loop that robot must follow.

6. Ramp: Robots will be expected to navigate ramps both ascending and descending. The maximum slope of an ascending ramp shall be 1 in 8. The maximum slope for a descending ramp shall be 1 in 6. The radius of vertical transitions shall be no sharper than an 18" radius. The maximum ramp height may be up to 12". A typical transition will be from 0" to 6" to 0" in about 7 linear feet.

7. Bridge/tunnel crossing: Robots must ignore he tunnel underpass while still being able to detect the gate.

8. Gate: There will be an independently controlled gate, which is white. The gate is triggered by passage of robot by a sensor that is placed within 2 feet of the gate. The gate is a white square 6" high x 12" long, driven by a motor to flip down over the line and block the robot's passage, and it does so in less than 1 second. The gate stays down at least 5 seconds. If the robot hits the gate, it gets a penalty of 10 seconds, plus a reset. The gate normally stays up and drops for 5 seconds, then goes back up. The gate is edge triggered, so if the robot stops with its back end blocking the light beam of the sensor, the gate will still go up after 5 seconds. A sensor range of 4" to 9" should work well.

9. Colored line: The course line may be the course of a different color for part of its length.

Race Operations

1. Each machine is allowed one or more opportunities, depending on available time and track availability, to "test drive" on the track (or similar construction official test track) for testing and calibration.

2. Test opportunities are first-come, first-served.

3. Machines will receive an "on deck" call when the match before theirs is ready to run.

4. Machines should be ready to run when their match is called. Machines have five minutes to make ready from the "on deck" call.

5. The contestant starts a match by pressing a start button. The robot must not move for 5 seconds after the starting signal by the official. The starter can delay pressing the start button manually to reach this time limit.

6. Once a match has started, no contestant or official may touch the track or interfere with the machines in any way except to reset a machine as stated above. Resets are done only by the race official.

Race Scoring

1. Races may be run in matches of two machines, on separate tracks of equal length, or they may be solitary timed events.

2. Each race is timed; the machine with the lower total time wins the match.

3. If the track is open-ended, the time is to the end of the line. If the track is a closed loop, the time is to the start/end line after the specified number of laps (usually two, one on each lane).

4. A contestant may not operate a robot. All manipulation of the robot is to be done only by the tournament official.

5. A machine that has no part of its structure over the course line, or is clearly not steering in response to the course line, is no longer tracking the course line.

6. An official may reset a machine that is no longer tracking the course line.

7. Resetting a machine onto the course incurs a 5-second penalty (and how ever much time it takes the official to replace it). Placement is to be at the previous turn or hazard.

8. Decisions regarding whether a machine is tracking the course line are made only by a track official.

9. A match ends when both machines have completed the course, or each machine is deemed by the official to be unable to track the line, or at the end of 3 minutes.

9. Some races may offer time reductions for achieving secondary objectives (for example, lap-counting). These will be posted before the race.

10. Some races may use alternative elimination methods. These will be posted before the race.

Final scoring

Accuracy in completing the event is ranked above speed.

Final scoring shall be as follows:

Entries that have completed the course with no penalties shall be ranked in order of fastest time.

Then:

Entries that have been assessed penalties shall be ranked in the order of lowest combined time and penalty points.

If no robots complete the course, the robots shall be ranked by total distance covered, as determined by the match official. If this cannot be determined, the winner will be chosen in a manner to be decided by the tournament officials.

Hints:

1. Keep your robot wheel base short to avoid problems with vertical transitions. For the same reason, avoid long overhangs to the front and rear of your robot.

2. Keep your line sensors in line with either the front or rear contact patches of the robot. If you don't, your sensors will vary in distance from the track in the transition areas and give false readings in vertical transition areas.

3. Make sure you robot is less than 6" total height. If not, your robot won't make it under the overpass.

4. Make some effort to shield the sensors from camera lights and IR focusing cameras. A flexible skirt around the sensors may help.

5. Get a piece of white Melamine, some tape, and PRACTICE.

6. Use a narrow beam sensor to detect the gate or you may have trouble under the overpass.

7. Make sure you can calibrate your sensors at the event. Lighting conditions are sure to be different than in the Bat Cave.

8. Have a look at Last years' course in the PDXbot.02 archives at
   http://www.portlandrobotics.org/PDXBOT/photos/index.html.
   Pictures there will give you a very good idea of what to expect this year. Course transitions will be smoother this year and the actual course layout will be different, but the course will be largely composed of the same course pieces as last year with some additions.

More Information:

Questions or comments about these rules should be directed to Steve Davee *<pxlkrz@yahoo.com>*, Larry Geib *<LJGeib@aol.com>* or the PARTS list at: *http://groups.yahoo.com/group/PARTS*.