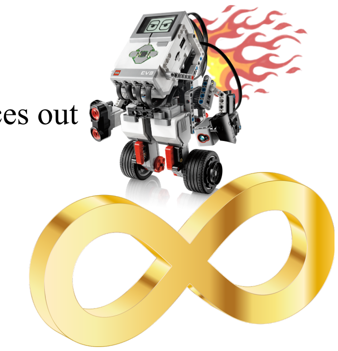
AIRC 2019: Infinity Racer!

4TH Annual Augustana Invitational Robotics Challenge



1. Objective:

To infinity and beyond! The 2019 challenge is to design a racing robot that traces out the infinity symbol (∞, a.k.a. "figure 8 pattern"). Specifically, your robot must complete three figure-8s around 2 vertical poles on a fiberboard race track.

2. Course layout and construction

Raw Materials:

- 2'x4' medium density (¼ inch thick) fiberboard (actual dimensions seem closer to 24"x49")
  - *(we used https://www.homedepot.com/p/202089069)*
- 1" diameter oak dowel, cut into two segments each ~ 9" long (perhaps 8 7/8" after cutting)
  - *(we used https://www.homedepot.com/p/206184686)*
- 2 screws *(we used #8 1-1/2" wood screws - https://www.homedepot.com/p/204587450)*
- 2 washers *(we used 1/8"x1" zinc fender washers - https://www.homedepot.com/p/204276336)*
- Optional: 16 cabinet surface bumpers *(we used https://www.homedepot.com/p/203661150)*
- **Tools:** Saw for cutting the dowel, electric drill for drilling pilot holes and screwing in screws.
- *Total cost of materials: ~ $17* *Time Required for Assembly: 30 mins?*

Step 1: Drill pilot holes 17 inches apart along the center line of the fiberboard, as shown in Figure 1.

Step 2: Drill pilot holes into the center of the ends of each of the two 9" dowel segments.

Step 3: Screw the screw (with washer) through each pilot hole in the fiberboard and into the dowel to secure it. (See Figure 2).

Step 4 (Optional): because the screw heads extend a little below the bottom of the fiberboard floor, to help keep the racing course stable/flatter, you might want to attach some cabinet surface bumpers to the bottom side of the board/floor at regular intervals.

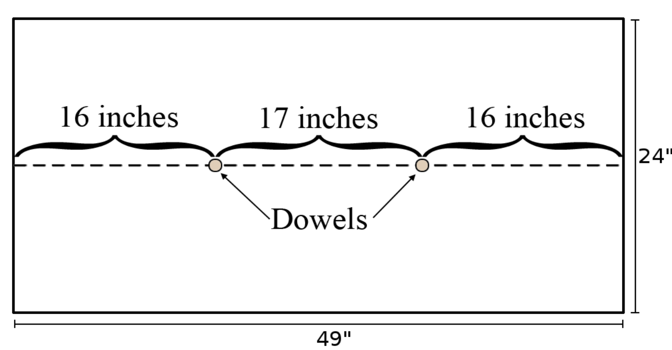


Figure 1: top-down view

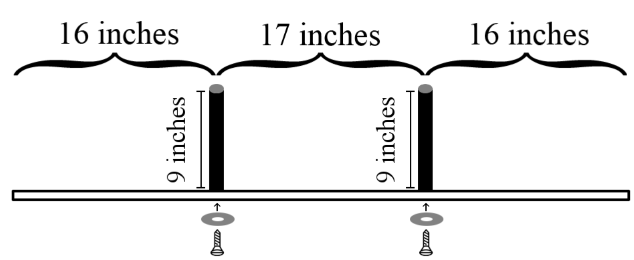


Figure 2: side view

3. Racing Rules

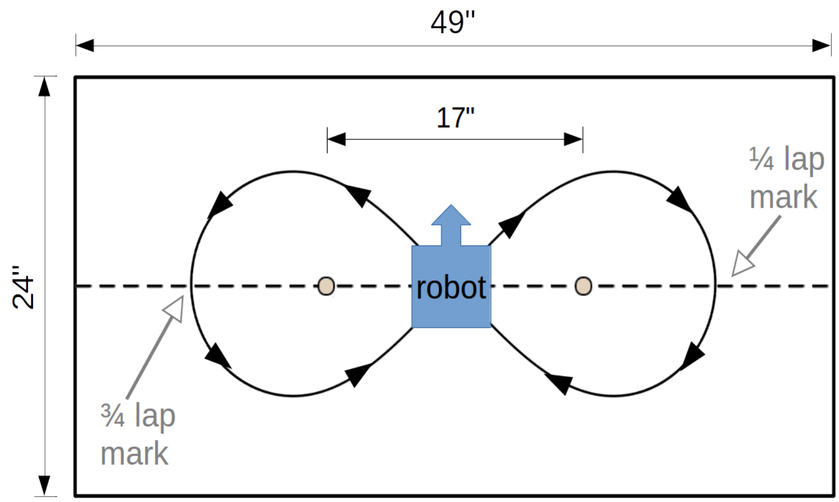


Figure 3: Race Course Diagram

Initially, the robot will be placed halfway between the two poles, facing perpendicular to the line that passes through the poles. (See Figure 3).

Someone from your team will press a button to signal to your robot that it should start racing. The timekeepers will start their stopwatches at the first sign of movement from your robot.

The robot should circle around the pole TO ITS RIGHT first to do one-half lap, and then complete the lap by circling the pole TO ITS LEFT. (Note the ¼ lap and ¾ lap marks in Figure 3).

Your robot **is** allowed to touch (or even grab onto) the poles as it goes around them. However, the robot's center of mass must orbit the pole (the robot cannot merely swing one finger around the pole, and claim that it went around it!).

The timekeepers will stop their stopwatches once your robot completes 5 full figure-8 laps.

If your robot does not complete its 5 laps within 2 minutes, time will be called, and the judges/time-keepers will record its progress based on the number of quarter-laps it fully completed within the time. (e.g. A robot could complete 3.25 laps by making three full figure 8s and then making it halfway around one of the two poles as progress toward the fourth figure-8.)

If a robot misses going around a pole (e.g. circles one pole twice, instead of alternating to the other pole), its trial will be considered over, and its progress before the error will be recorded.

4. Scoring

A robot's "trial score" will be calculated as: `(# of laps) x 100`

IF a robot finishes all 5 laps, a bonus of `(120 – race_time_in_sec)` will be added to its score.

Example 1: a robot who completes 2 and a half figure 8's before going off course scores 250 points.

Example 2: a robot who completes all 5 laps in 114 seconds scores 506 points.

Each robot's *contest score* is the sum of its **best two trials** (out of three). *Ties are broken as follows:*

If multiple robots happen to tie for the top *contest score*, then the sum of all three trials will be considered. If a tie persists, then additional *tie-breaker* race round(s) may be held. If the tying robots do not complete all 5 laps and the robots continually tie in the tie breaker rounds, the time taken to complete fewer laps (4, or 3, etc) may also be considered as a further tie-breaking factor.

5. Robot construction and programming

- This year's contest will allow teams to use any robotics platform, but most teams will likely use LEGO-brand EV3 or NXT kits. *(Augustana teams may check out robots from the Math and CS Department. Other schools will need to provide their own robots – contact your local CS or engineering dept. to see if they have robots or are willing to purchase them for you.)*
- Remote-controlled robots will NOT be allowed. Once the race trial begins, the robot must act autonomously! (Bluetooth/WiFi communication with the robots is prohibited during the race.)
- If a robot is physically damaged during a trial, the team may repair it after that trial is over. However, no changes to the robot design or programming are allowed once the contest starts.
- Teams are free to program their robots using any tools/language that they choose. The free LeJOS platform (to program LEGO robots using Java with a convenient Eclipse plugin) is one possibility, but other choices (e.g. LEGO drag-n-drop, RobotC, LabVIEW, ev3dev) would also be fine.

6. Team composition & registration

Teams must be composed of undergraduate students from an invited institution. Teamwork is highly encouraged, and the recommended team size is 3 members. However, team sizes between 1 and 5 will be allowed to register. Each participant may only serve on one team, and each team is only allowed to enter one robot in the contest. Non-student (e.g. faculty) coaches may offer assistance, but robot construction *and* programming should be done primarily by the students.

Teams should register no later than **April 24**. Register here: http://lovelace.augustana.edu/airc

At least one team member should be present at the actual contest, which will be held **on the evening of Wednesday, May 1, 2019.** Check the website later for exact room/time information.

If any adjustments/clarifications need to be made later regarding the robot challenge rules or logistics, these will be posted on the A.I.R.C. website http://lovelace.augustana.edu/airc, and ***all registered teams*** will receive email updates.

Questions? Contact the AIRC coordinator: Dr. Forrest Stonedahl, forreststonedahl@augustana.edu