



2019 Line Following Challenge

This challenge concludes in a **single elimination tournament** **Top 8 teams** from each division, based on scores, will compete for awards

Goal

To design, build, and program a line following robot that can follow a black line on a white background to a tower and deliver at least one (1) ball and then return to its starting point. Then, in the remaining time (of 3 minutes), to return to the tower (as many times as needed) to deliver a **set number** (not over, not under) of balls as per their division's requirements.

Who Can Play

Teams in this challenge compete in **separate divisions**, typically:

- Elementary School
- Middle School
- High School + Big Kids

Requirements

Autonomous robot, any platform, costing \$1,500 USD or less, and meets the following design constraints, which will be **verified during Check-In**:

- Robot can demonstrate it is running a line following program by negotiating the final 60 cm of the current year's line following track; if an intersection is present within the last 60 cm, robot will start just past the intersection.
- Robot can demonstrate it will stop upon reaching the tower; you do not have to prove the ability to deliver a ball, or turn around.
- Multiple sensors and processors are allowed.
- Volume of the robot must **not** exceed 65030cm^3 .

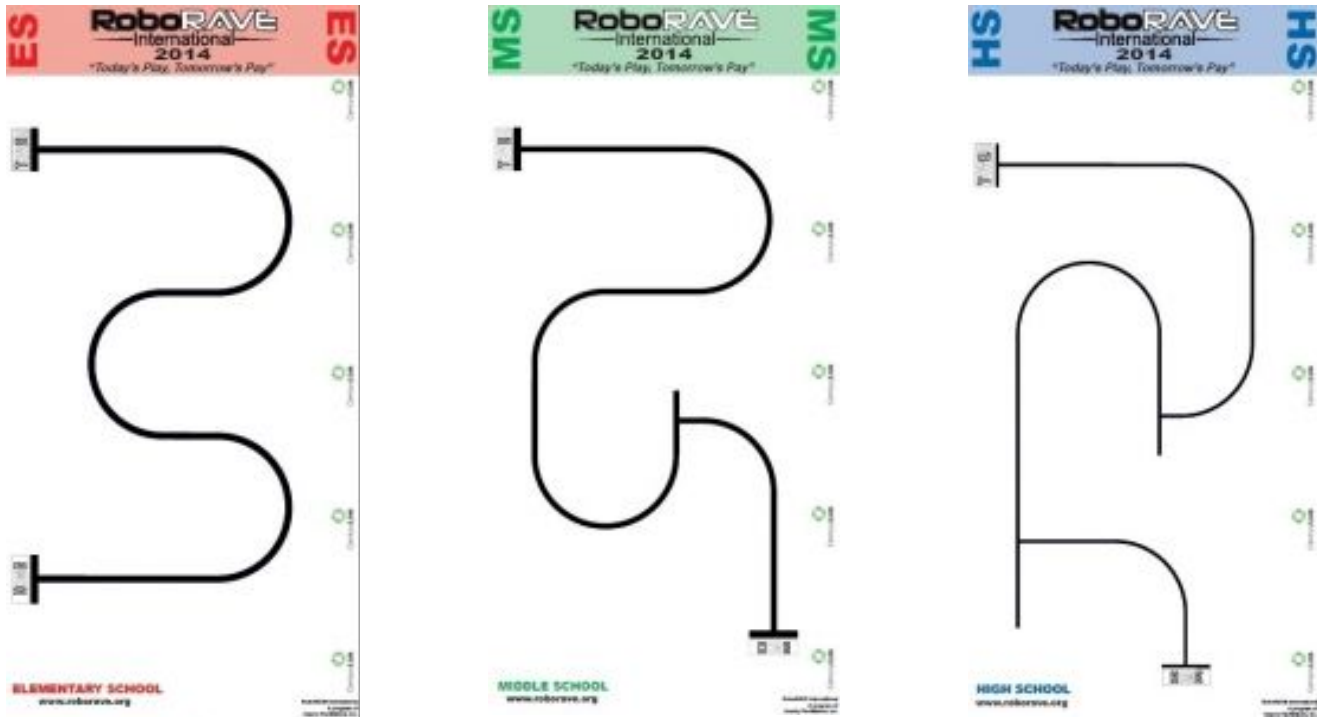
General Rules of Play

- A line following program must control your robot's motion at all times.
- The robot has 3 minutes to complete the tasks.
- Only players can operate and manipulate the robot during the heat. Remember: "*Players Play, Coaches Coach, Parents Cheer*".
- The **tower** cannot be touched by any person during payload delivery.
- **No scooping** of balls out of the tower by any person during payload delivery.
- Touching the robot at any time requires it to be picked up and returned to **home**.
- You will get **10 official scored runs** during the challenge scoring period.
- The **total of your 5 highest official scores** are used to determine tournament selection.

Challenge Specifications

The Track

- White PVC Vinyl Background
- Elementary Division - No intersections, 1.25cm black line
- Middle School Division - One intersection, 1.25cm black line
- High School & Big Kid Division - Two intersections, 0.75cm black line



Tracks shown are an **example**. The design changes every year **and** are revealed on the first day of the event.

The Tower

- All divisions use the same 20cm tall x 10cm wide x 35cm long tower with a 10cm x 10cm opening at the top and an open back to allow the balls to roll out during delivery. The tower is held firm to the track by a strip of Velcro tape. (dimensions are approximate)
- Using the same cardboard box tower/opening, we may attach or include a ramp or other structure designed to count balls automatically as they flow through the tower. The design will be such that it doesn't impede the flow of balls through the tower, and may actually improve the flow of balls.
- -Touching the tower
- If a track monitor sees that a team touches or reaches INTO the tower, the bonus (i.e., 50 points) is forfeited.

All Challenge Dimensions are Approximate

The challenge may be held in areas with natural light present which may change the lighting conditions of the track. **Be prepared** to engineer around this natural condition.

Scoring

The overall score is a combination of points earned from:

- Running the track to the tower
- Delivering at least one ball
- Returning back home
- Delivering the required number of balls

Each division will have a set number of balls to deliver:

- Elementary School - 168
- Middle School - 257
- High School / Big Kids - 346

See the Scoring Matrix for your division below for details on the scores assigned during your first trip to the tower and back.

A successful run is defined as:

- The robot traversing the track from Home to the Tower, delivering **at least 1 ball** and traversing the track back home. These balls must then be discarded.

After a successful run, on additional runs:

- The robot traverses the track from Home to the Tower and delivers the required number of balls. The robot **does not** have to traverse the track back home.

If the number of balls is **under** the required number of balls, then **that number is your ball score**.

If the number of balls is **over** the required number of balls, then the extra will be **subtracted** from the required number resulting in your ball score.

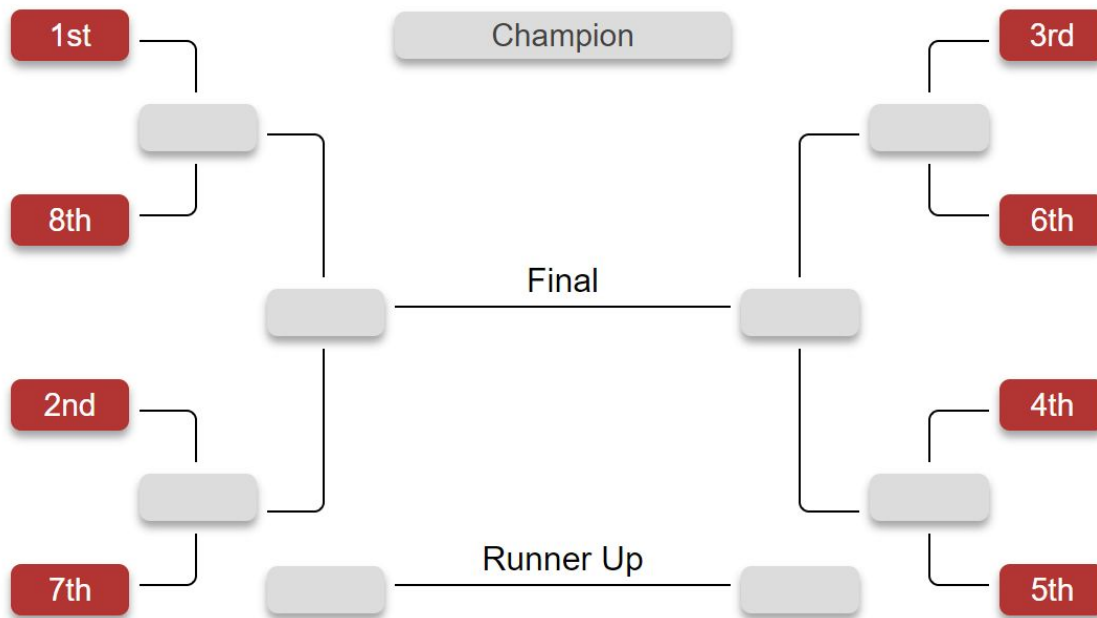
Scoring Matrix

	Leaves Home	Turns at 1 st "T"	Turns at 2 nd "T"	Stops at Tower	Delivers a Ball
ES	50	N/A	N/A	100	100
MS	25	25	N/A	100	100
HS/BK	25	25	25	50	100

	Starts Back Home	Turns at 1 st "T"	Turns at 2 nd "T"	Returns Home	Total
ES	50	N/A	N/A	100	400
MS	25	25	N/A	100	400
HS/BK	25	25	25	100	400

Tournament Scoring

- The top eight teams from each division will compete in the final tournament.
- Advancing teams will be seeded into the tournament bracket according to their aggregate score (see bracket below).



- Runner Up is used to determine 3rd place based on outcome of semi-finals.