



## Line Following

### *Objective:*

The Line Follower is a classic introductory robot design and requires a minimal amount of resources (go to your search engine on the Internet and enter "line following robot"). These Line Follower robots can use microprocessor control or simple digital or analog control systems and are highly visual and entertaining to watch! A great event for reprogrammed Mini-Sumos.

### *Description:*

This event is intended to showcase basic sensor design and robot control systems in the form of a small autonomous robot which must follow a black line over a white surface. Points are awarded based upon the distance covered and the overall speed of the robot.

### *Robot Specifications:*

The robot must be able to operate without cues or input from the operator. The robot must be less than 23 cm (9 inches) long and less than 23 cm (9 inches) wide. The robot may be an unmodified kit, built from a construction set such as LEGO or Meccano, built from scratch, or any combination. Bonus points will be awarded to a robot based upon the originality of its design.

### *The Arena:*

The arena consists of four separate stages. Each stage is a flat, smooth, square white surface approximately 1.2 m (48 inches) on each side, with a black line made from standard electrical tape (18 or 19 mm or  $\frac{3}{4}$  inch wide).

Each stage will be more complex than the one before. The robot may encounter:

- Gently rounded corners (radius greater than 20 cm)
- Tightly rounded corners (radius less than 10 cm)

- Sharp obtuse corners (greater than 90 degrees)
- The line crossing over itself
- Sharp acute corners (less than 90 degrees)
- Gaps in the tape of up to 5 cm

Lighting levels are unpredictable and may include camera flashes. The robot must be able to operate over a wide range of indoor lighting conditions. Auto-focus cameras are likely to be in use during the competition. The robot must be able to operate while exposed to infrared auto-focusing devices.

## *The Rules:*

Follow the line as far as you can as fast as you can! The robot will be placed by the operator at a pre-assigned starting point and may be started by hand as directed by the judge. The judge starts a timer once the robot begins to move.

If the robot leaves the line and cannot find it again, the operator may reset the robot on the line. No penalty is given when a robot is reset on the line, but the timer continues to run. The robot must be reset at a point before the point at which it left the line. A robot is allowed to leave the line and be reset up to five times on each stage.

The judge stops the timer and notes the elapsed time when the robot completes the stage, or after the robot loses track of the line for the sixth time. The judge does not stop the timer during resets.

Each robot is allowed a maximum of two minutes per stage. If the robot has not completed the stage in two minutes, the judge stops the timer.

The judge notes how far along the line a robot has traveled when the timer is stopped.

Each stage must be attempted before the next one is started.

The course layout will not be made available until the day of the event.

Each robot is also examined and judged on the creativity of its design.

## Scoring Method:

Each stage consists of approximately 2 m to 6 m length of black tape.

<b>Description</b>	<b>Points Awarded</b>	<b>Example</b>
<u>Distance travelled.</u> Points are awarded based upon the percentage of the stage completed.	10 points for each 10% of the stage travelled, maximum 100 points for 100%	Robot travels 30% of stage : 30 points awarded
<u>Elapsed time.</u> Points are awarded based upon robot speed.	500 points / (calculated elapsed time for 100% of the stage, in seconds)	Robot travels 30% of stage in 10 seconds, so calculated elapsed time for 100% of stage is $10/0.3 = 33.3$ seconds. Robot is awarded $500/33.3 = 15$ points
<u>Completion bonus.</u> Points are awarded for completing 100% of a stage with no resets.	50 points for each stage	Robot completes 2 stages with no resets : 100 points awarded
<u>Creativity bonus.</u> Points are awarded at the judge's discretion based on originality of robot design.	Up to 50 points for each stage attempted.	1. Scratch-built robot hardware and software : 50 points awarded 2. Unmodified robot kit : 0 points awarded