MASLAB 2020 Official Game Rules

Revision 8

Table of Contents

Overview

Welcome to MASLAB 2020! This game manual provides the official, single-source-of-truth for the game your robots will be playing this year. If anything is unclear, please let the course staff know! We will answer any questions you have, and, if necessary, update the game manual to clarify or solidify certain aspects of the game rules.

Gameplay

Each year, MASLAB is played on a game field featuring a variety of elements your robot must autonomously manipulate to score points. At the start of the game, your robot may be placed anywhere you choose on the field, as long as it is touching an arena wall. Every team will be connected to their robot's main computer via SSH and have a terminal open to the robot. You will have a chance to set up your robot before the match begins, and during this time you may run as many commands as you'd like, as long as the robot does not move.

Once you're ready to begin the game, notify the referee. You will be given a countdown, and at the end of this countdown you will be allowed to execute a single command on your terminal that should start your robot moving. After this point, you will no longer be allowed to touch your robot or input commands via your computer.

Your robot will have 2.5 minutes (150 seconds) to autonomously score as many points as possible. At the end of this time, your robot should either stop moving automatically, or you should somehow command your robot to stop via your terminal.

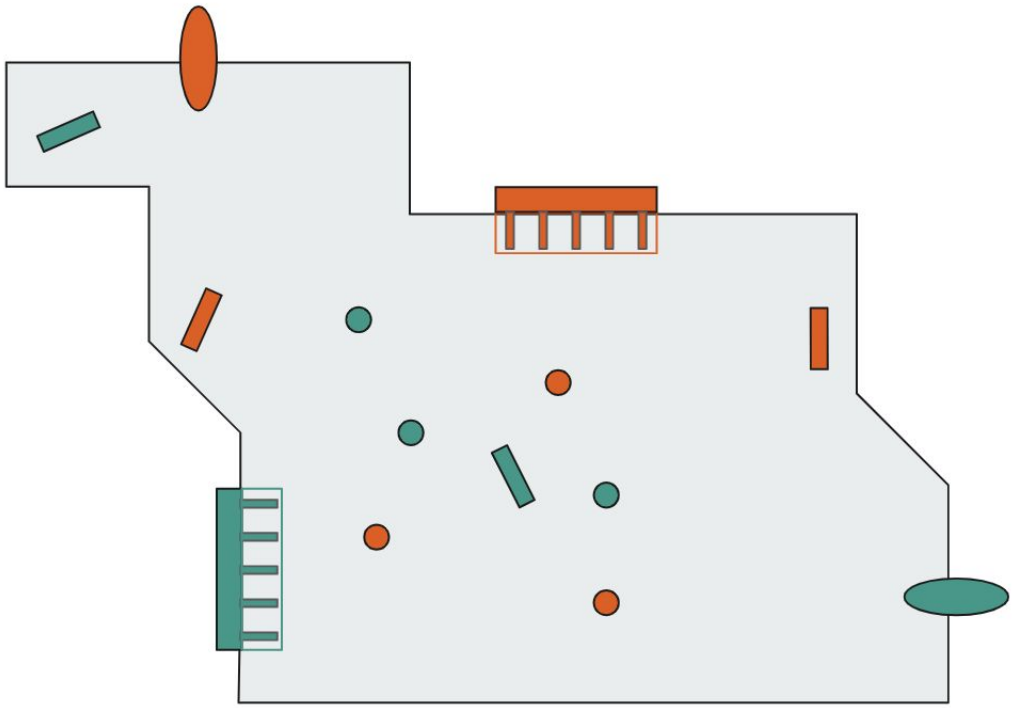
You will have one chance to restart your robot during the match. If you would like to do so, notify a referee. We will stop the match timer, and you may return your robot back to any legal starting position and start it again. However, referees will remove any game elements the robot is holding and drop them in its place (exact placement/orientation at their discretion), and you will be assessed a 20 point penalty (scores will be clamped at zero, however). We will start the match timer running again after 30 seconds if you do not get the robot running within this timeframe. If the robot is not running again after the match timer expires, the match will be over, but no point penalty will be assessed.

If at any point you think your robot is stuck or likely to damage itself, you may stop it prematurely or physically recover it from the field. If you have already used your restart, you will be unable to continue running in that match and your final score will be based on the state of the field at the point when you decided to intervene with your robot.

The Arena

The game will be played in a closed arena. The arena is constructed out of foam floor tiles for your robot to drive on, and surrounded by white walls 12 inches high. The walls also have a blue, 2 inch wide stripe around the top edge. The walls can interlock with each other at either 45° or 90° angles, and the actual configuration of the final arena will be unknown prior to competition day. We will set up a representative practice arena in the lab space, and periodically change its layout if teams wish to facilitate testing. In addition, we will guarantee that the entire arena itself does not exceed the size of a 12 x 12 foot square, and it will have no choke-points smaller than 19” (one max robot width + some breathing room).

Here is an example of a possible arena configuration, viewed from the top down:



The Robot

In MASLAB, you have a lot of freedom to design your robot as you choose, but there are some restrictions to ensure fairness and reasonable designs.

All robots must fit *initially* within an 18” wide, 18” long, and 16” tall bounding box. However, at the start of a match, your robot can automatically expand to dimensions beyond this bounding box.

We will provide all the materials required to build a competitive MASLAB robot. However, if you’d like to get creative, teams can request up to $100 of extra materials as long as the staff deems the request fair.

Teams are also free to use outside materials, but this will also be left to staff discretion to ensure fairness. For example, if you have a particular sensor laying around that’s similar in capability to ones we have stocked, but you’d prefer to use yours, that’s fine. However, if you have a relative who works for a LIDAR company and loans you a $20,000 3D LIDAR module, we probably wouldn’t let you put that on your robot.

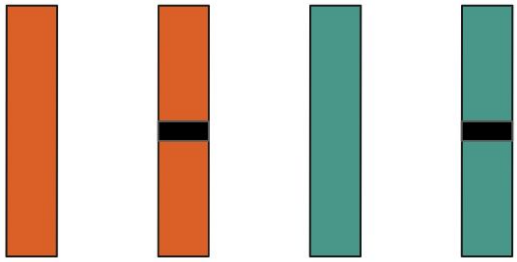
We don’t expect teams to spend out of pocket on their robot, especially not to gain a competitive advantage. *It is possible to create a competitive robot solely using the materials provided*.

Game Elements

Cylinders

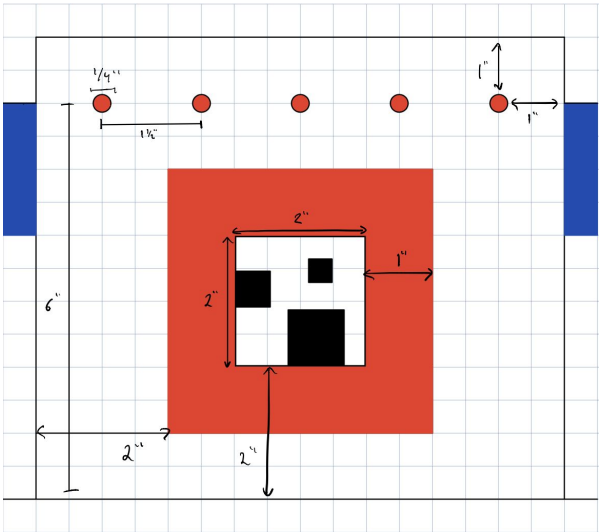
The main game pieces used for scoring are plastic cylinders. The cylinders will be 5 inches long, with a 1 inch diameter hollow opening.

Each cylinder will be painted a certain color, either red or green. This color affects how many points you get for scoring the cylinder in a specific goal.

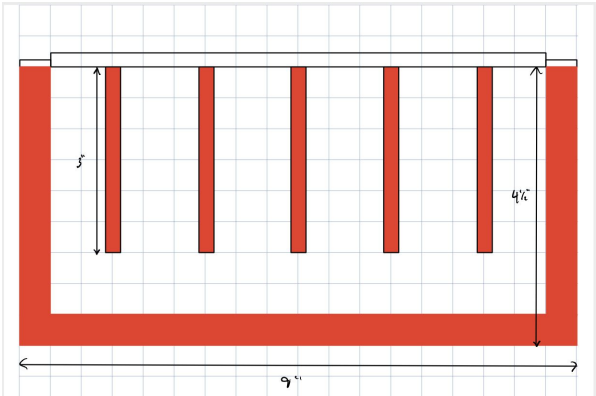


Some cylinders will begin loaded in dispensers, and some on the floor of the field (in any orientation, at the discretion of the staff). There will be 5 cylinders of each color on the field, and 5 of each in the dispensers. Field cylinders will be marked with a single black stripe around the middle. These cylinders have a score multiplier (see Scoring section) that makes them more valuable than the dispenser cylinders.

Goals



Front-on view



Top-down view

There will be two goals placed inline with the arena walls, one associated with each color.

The goals will consist of two parts:

1) A row of five pegs mounted 6” up the arena wall, painted with the goal’s associated color
2) A taped-off floor scoring area underneath each set of pegs

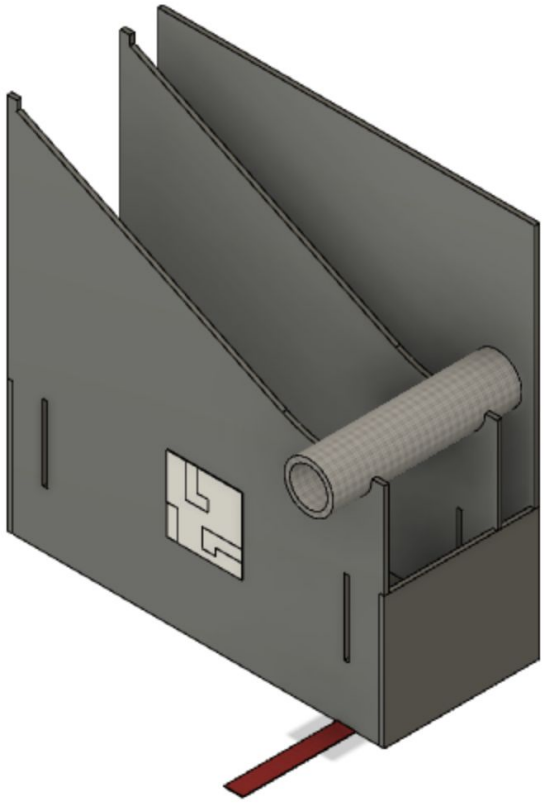
The size of each peg is ¼” in diameter and 3” long, and the floor scoring area will be 4½” deep and 9” wide. Robots will be able to score either by sliding cylinders over pegs, or placing cylinders in the scoring area. Extra points will be assigned for scoring cylinders on the goal associated with their same color (see Scoring for details).

For assistance localizing the goal, there will be an AprilTag installed on the wall, centered underneath the goal.

Each goal will be colored with its associated color on its pegs, on the area around its AprilTag, and the tape around the floor scoring area (see images for reference).

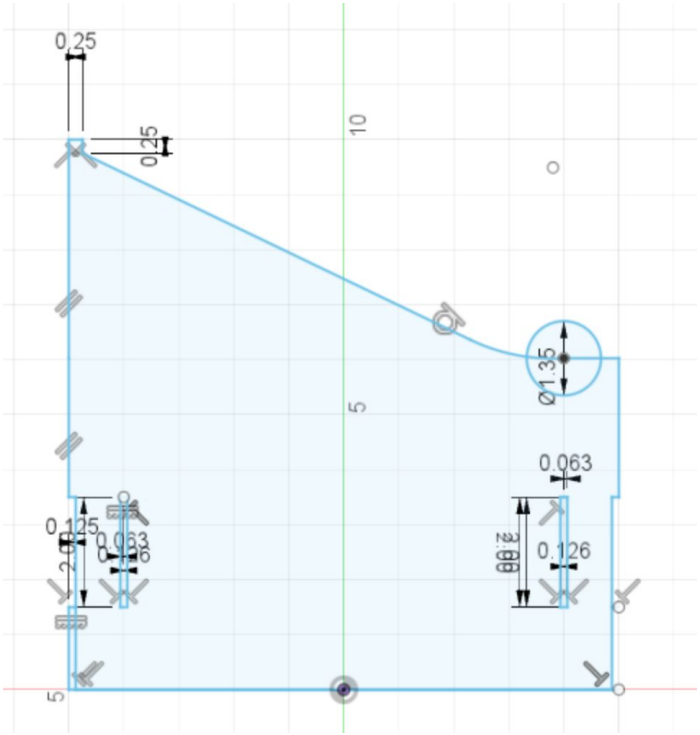
Dispensers

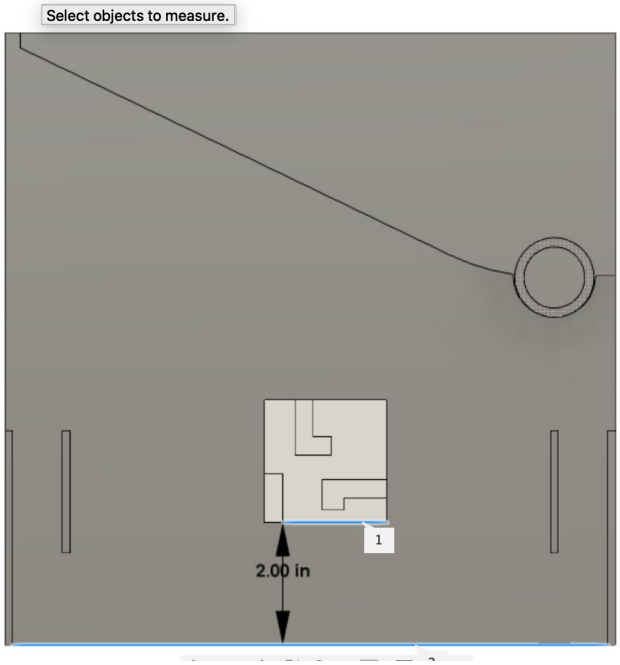
There will be 2 dispensers that teams can collect cylinders from. These dispensers will be mounted to the arena walls. Each dispenser will hold 5 cylinders of mixed colors. The actual order of cylinder colors in each will be unknown to teams before competition. Cylinders will be in random color order.



The dispensers are wooden holders for the game pieces that hold the pieces such that the dispensed piece is centered 6” above the ground. When a robot takes a cylinder from the dispenser then the dispenser automatically dispenses another cylinder into the spot shown above. There is a strip of targeting tape, the color will be white. The system is *passively gravity*

fed. There is no rule that says you cannot take more than one cylinder at a time. It is DESIGNED, however, to take one cylinder at a time.





LINK TO VIDEO:
https://drive.google.com/file/d/13hyThhtvxdix5m53h5mu-CDd6Ld1VdNR/view?usp=sharing

Scoring

The score of each round will be calculated based on the state of the field at the end of the round. Points are scored for each cylinder, according to which category it falls into:

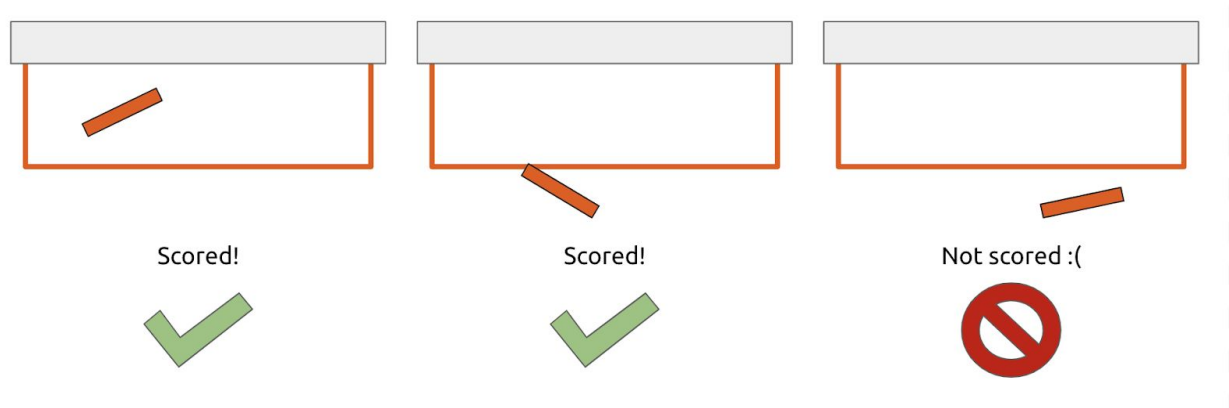
- +100 pts if the cylinder is scored on the correct color of peg
- +50 pts if the cylinder is scored on the other color of peg
- +20 pts if the cylinder is scored in the correct color floor area
- +10 pts if the cylinder is scored in the other floor area
- +5 pts for each cylinder your robot possesses at end of game

There is a 1.5x score multiplier for any floor cylinders scored *on pegs* (marked with black stripe).

Ties will be broken by robot speed. Staff will keep track of when robots finish scoring all their points for a match, and record that along with the score.

In order for a cylinder to count as “scored” on a peg, the peg must be at least partially inserted into the cylinder’s hollow opening, and the cylinder must be fully supported by the peg. If the robot is still touching a cylinder on the goal at the end of the match, this will be verified by pulling the robot away from the goal.

A cylinder does not have to be fully enclosed by the area to count as “scored” in the floor area. Rather, it just needs to be at least partially within the outside edge of the tape.



Revisions

November 16, 2019:

- edits to game manual
- bin to taped area
- decided on some dimensions

December 21, 2019:

- various rule edits
- add dimensioned sketch of goal

December 28, 2019:

- Added 150 seconds to 2.5 minutes
- Changed electrical tape to paint
- Added scoring section references where needed

January 6, 2020:

- Adi made the first dispenser design
- Verified white walls are 6 inches tall
- Removed the gravity fed about the dispenser

January 7, 2020

- New gravity fed dispenser design

January 12, 2020

- Walls are now 12 inches

Appendices

In addition, we will provide a computer-readable map representing the layout of the arena, including locations of all game elements, the morning of the competition. We will also provide map files for each practice arena we set up. The map file specification can be found here.