

# URC 2019: Regular Division

## Rulebook

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### Competition Overview

Title: Robot Shooting Contest

Competitors will build robots that can fire rubber bands to knock down targets. When the Olympics come to Tokyo in 2020, we will see the world's best athletes once again gather to compete and display their prowess in sports of all kinds, including shooting. However, in recent years we've also begun to see a new kind of sports competition, where the athletes competing are not humans, but robots. In the Regular Division, competitors will take a shot at a new kind of sport with a robot shooting competition.

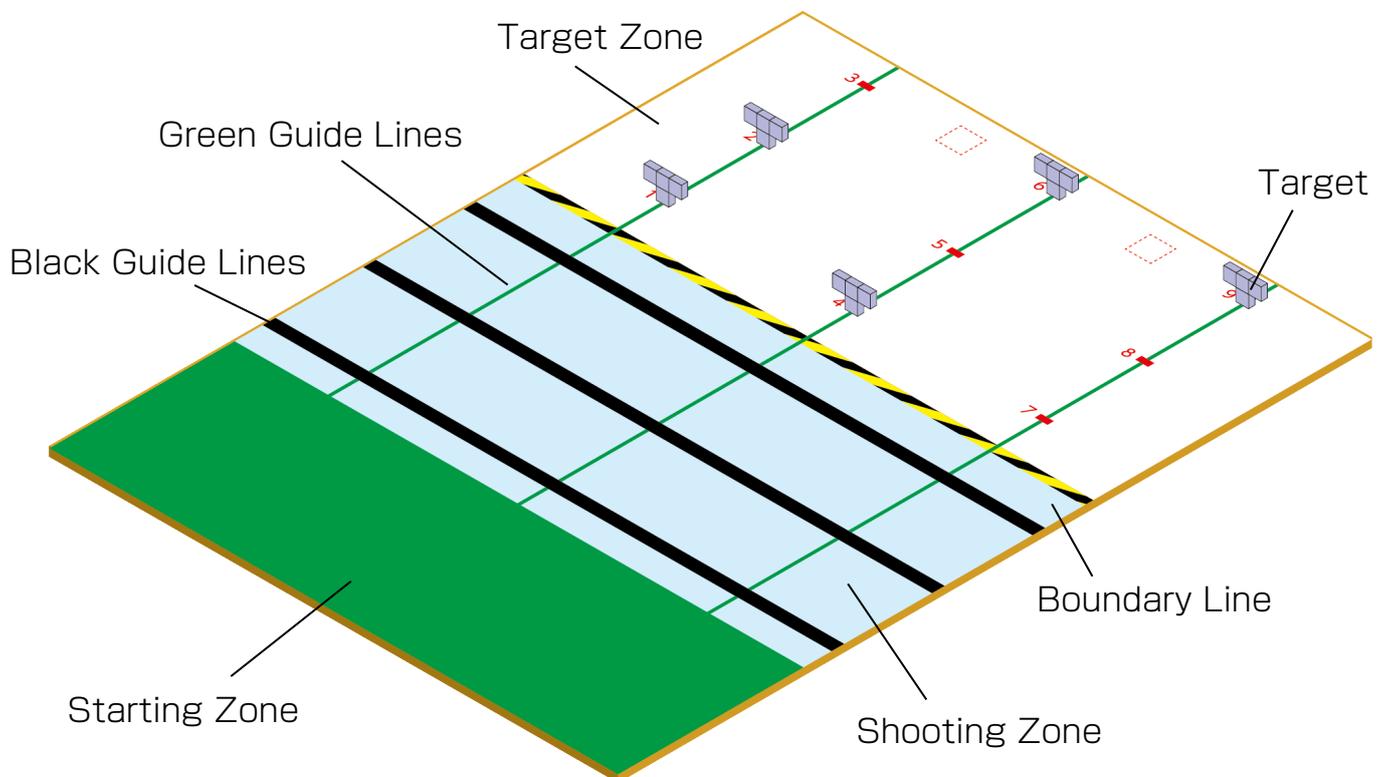


Figure 1. Regular Division Course

# 1. The Competition

## ○ Competition Guidelines

### ◇ Basic Rules

Robots will set off from the Starting Zone with rubber band(s) attached, and fire their rubber band(s) to knock down the targets. Robots will repeat this sequence until all the targets have been knocked down, and the competitors raise the flag they have been given to signal "stop," ending the round.

### ◇ Special Challenge

The special challenge will be held during finals. The content of the challenge will be announced on the day of the competition.

### ◇ Competition Objectives

- > Knock down as many targets as possible using 10 or fewer rubber bands.
- > Complete the game in the shortest possible time.

## ○ Guide to the Course

### ◇ Starting Zone

The Starting Zone is the green area in front of the course.

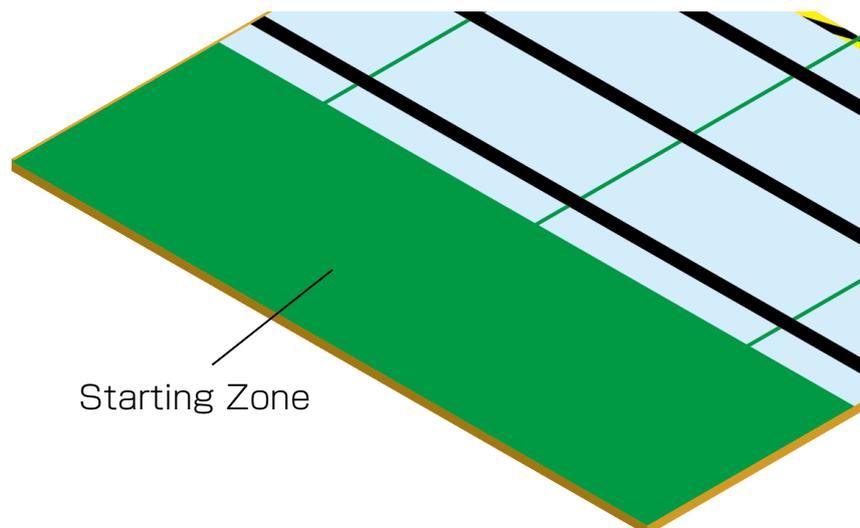


Figure 2. Starting Zone

◇ Shooting Zone

The Shooting Zone is the light blue area in the middle of the course. Robots can fire their rubber band(s) when they are within the Shooting Zone. Robots may not cross the Boundary Line.

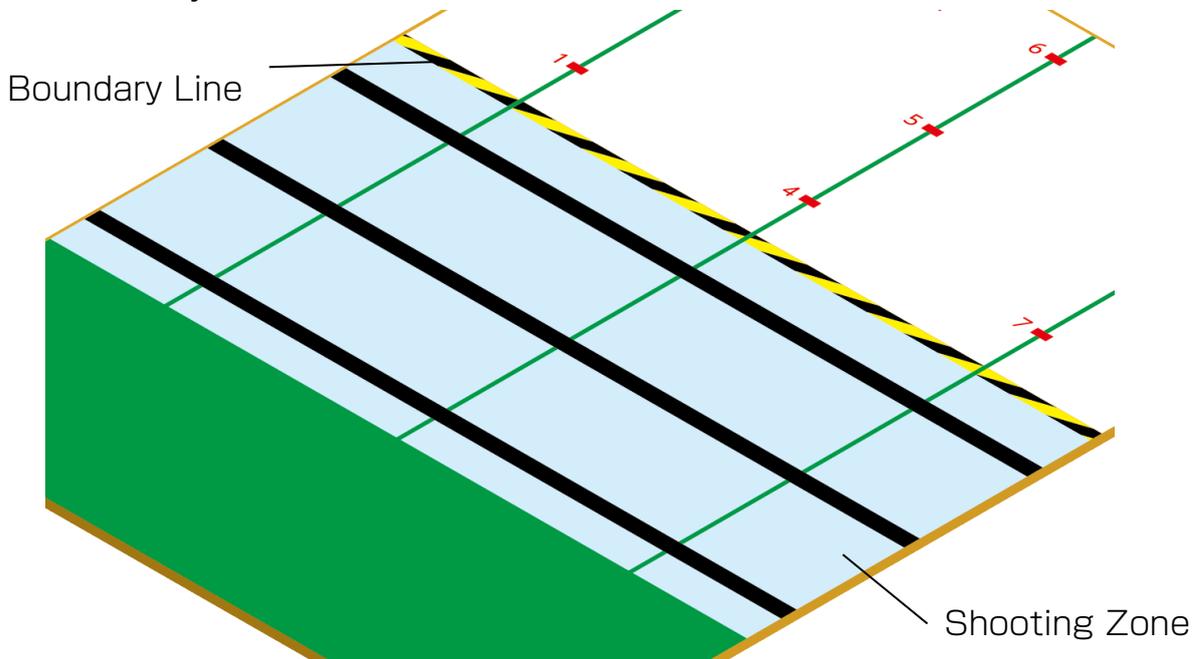


Figure 3. Shooting Zone

◇ Target Zone

The Target Zone is the white area at the back of the course.

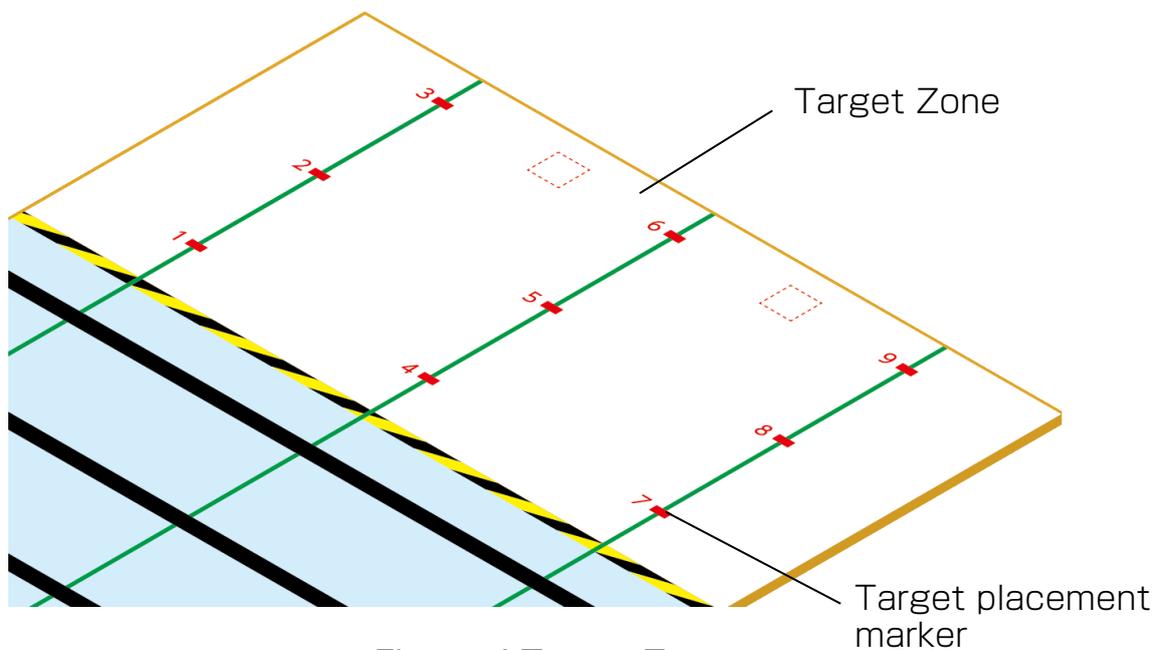


Figure 4. Target Zone

◇ Targets

Targets will be made with Artec Blocks as shown in Figure 5.

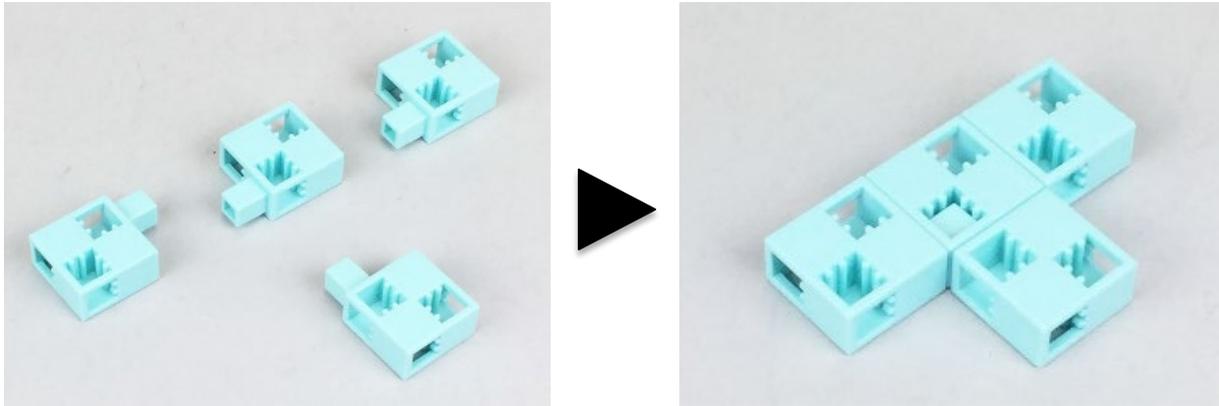


Figure 5. Assembling a Target

Targets will be placed (see Figure 6) on the red squares corresponding to the numbers picked on the day of the competition.

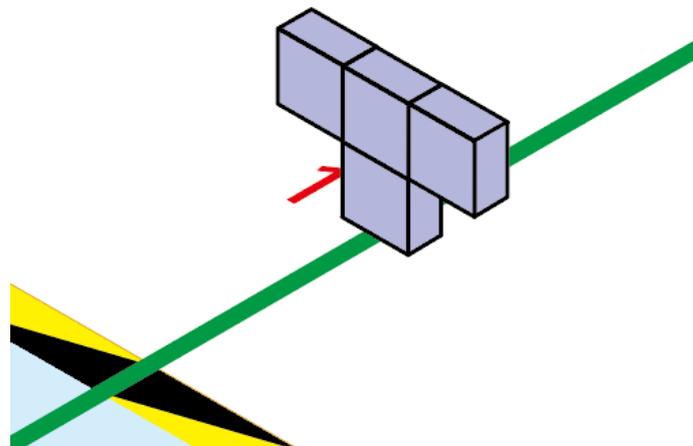


Figure 6. Target Placement

## 2. Competition Rules

- 1) Each round of the competition is 180 seconds (three minutes).
- 2) Competitors will be provided with rubber bands when they check in on the day of the competition. These are to be used both for the competition and for practice. If rubber bands break or get lost, competitors may acquire new rubber bands from the referees before the start of a round.
- 3) The flag used to signal the end of the round will be given to competitors by the referee before the start of the round.
- 4) Robots are placed in the Starting Zone and start at the sound of the referee's whistle.
- 5) Robots must be fully within the Starting Zone at the start of the round, including any parts of the robot that do not touch the ground.
- 6) Before the round starts, all 10 rubber bands used in the game must be in place on the rubber band rack (Figure 7) beside the course, and may not be set on the robot.

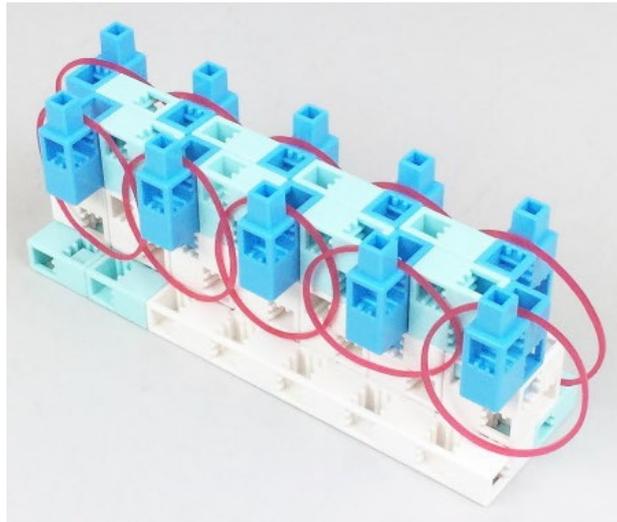
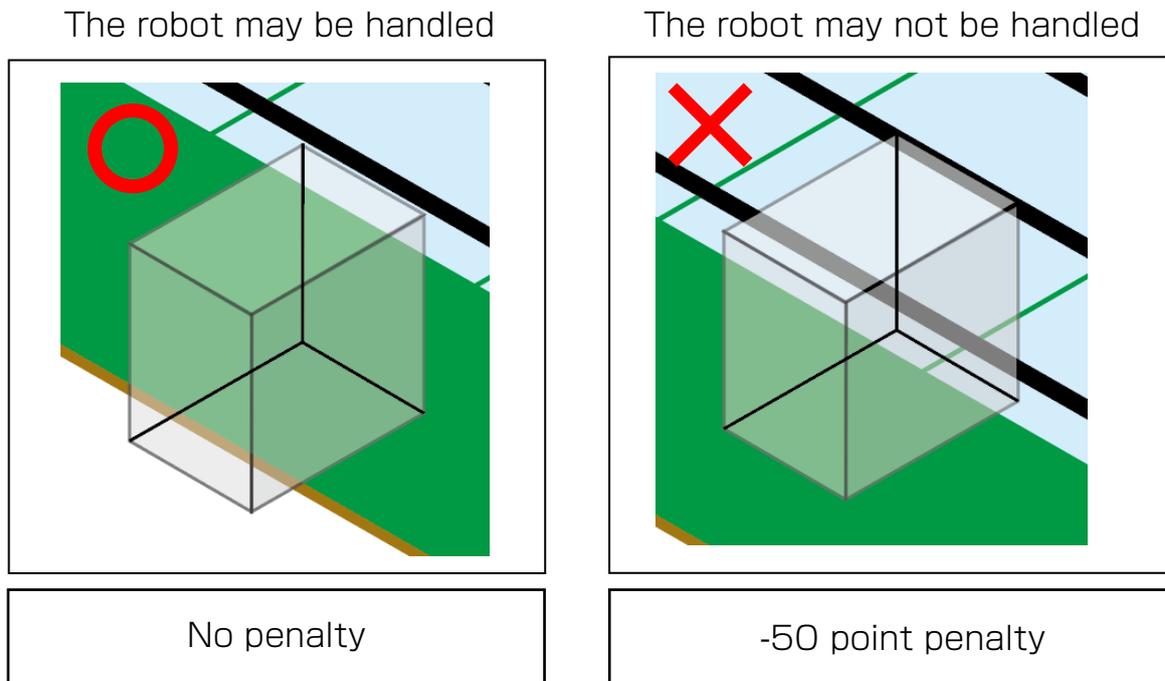


Figure 7. Rubber Band Rack and Rubber Band Placement

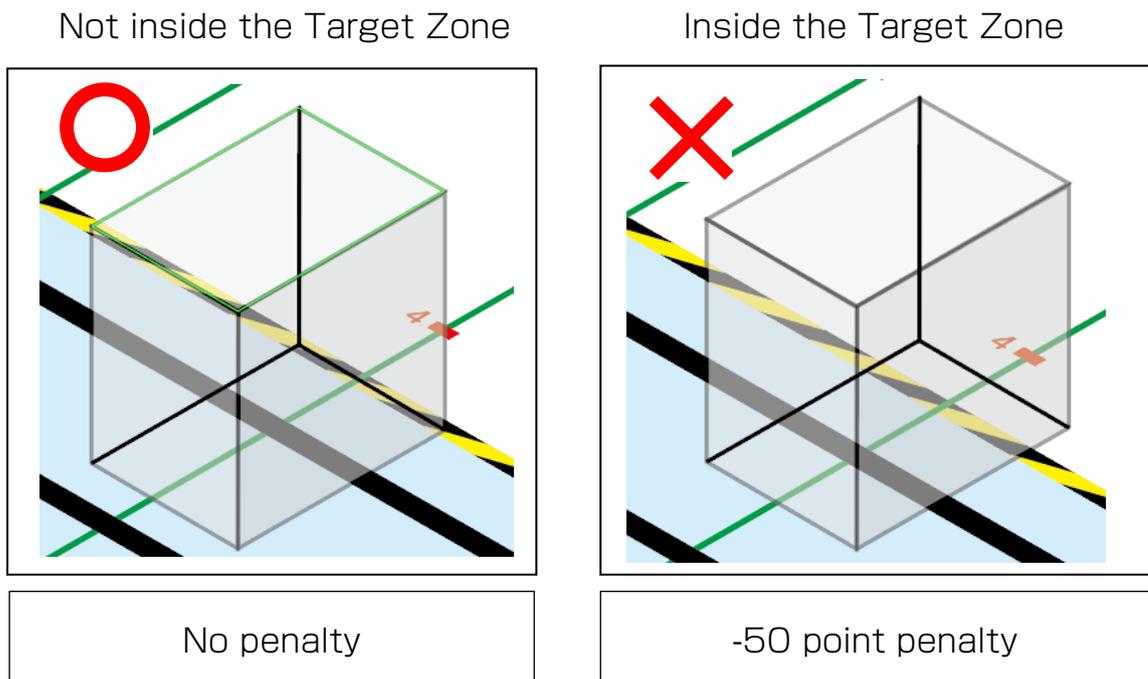
- 7) No retries are allowed during the round.

- 8) Targets will be placed on 5 of the red square markers numbered 1-9. (See Figure 7 on page 13 to confirm the location of the markers.) Which numbered markers the targets will be placed on will not be revealed until the day of competition, and will be decided fairly by a referee's lottery at each venue.
- 9) During the round, competitors are allowed to touch their robot in order to change its position, set rubber bands on it, or use buttons to control it, provided the robot is inside or on the competitors' side of the Starting Zone. However, if competitors touch the robot while part of it is still inside the Shooting Zone, 50 points will be deducted from their score at the end of the round. Controllers that use parts like the Touch Sensor are considered to be part of the robot.



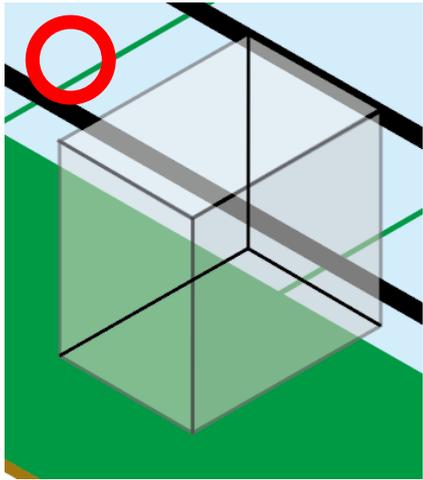
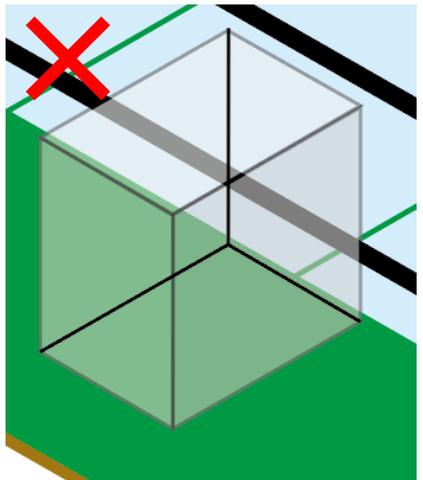
- 10) If a rubber band is accidentally fired while being set on the robot, competitors will not be allowed to reset that rubber band, and it will be collected by the referee. If such a rubber band moves or knocks down any currently standing targets, those targets will be returned to their original position by the referee. Competitors may not touch their robot during this time.
- 11) If a rubber band breaks during the round, competitors may acquire a replacement from the referee.

- 12) Rubber bands other than those designated for the competition may not be used. If such a rubber band moves or knocks down any targets, those targets will be returned to their original position by the referee. Competitors may not touch their robot during this time.
- 13) Robots may not cross the boundary line and enter the Target Zone. Any time a robot enters the Target Zone, 50 points will be deducted from the competitors' score, and they must return the robot to the Starting Zone. If any targets are moved or knocked over by the robot or a rubber band while the robot is in the Target Zone, those targets will be returned to their original position by the referee after the competitors have moved their robot to the Starting Zone. Competitors may not touch their robot during this time.

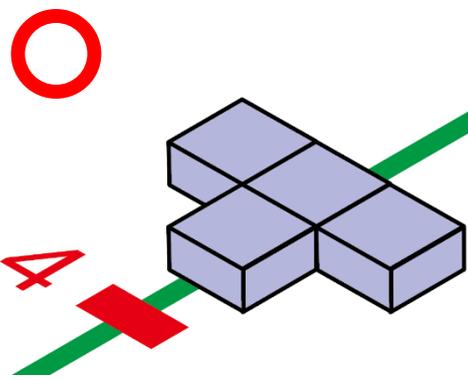
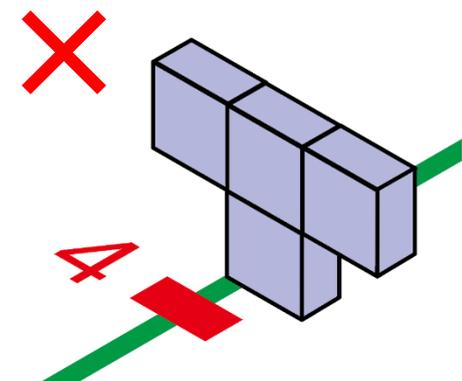


- 14) In the event the robot can't make it back to the Starting Zone and thus can't continue the round, competitors are allowed to handle the robot in order to bring it back to the Starting Zone. Each time this happens, 50 points will be deducted from the competitors' score.

15) When a robot fires a rubber band, part of the robot must be inside the Shooting Zone. If a robot fires a rubber band from outside the Shooting Zone, that rubber band will be collected by the referee. If such a rubber band moves or knocks down any currently standing targets, those targets will be returned to their original position by the referee. Competitors may not touch their robot during this time.

Inside the Shooting Zone	Outside the Shooting Zone
	
<p data-bbox="363 1099 671 1137">The robot may fire</p>	<p data-bbox="927 1099 1299 1137">The robot may not fire</p>

16) Each target a robot knocks down by shooting a rubber band is worth 50 points. Targets that are moved out of place without being knocked down will not be counted. Targets knocked down by the motion of other targets instead of by rubber bands will be counted.

If the target is knocked down	If the target is only moved
	
<p data-bbox="416 1980 584 2018">50 points</p>	<p data-bbox="1050 1980 1217 2018">No points</p>

- 17) If all the targets are knocked down, each rubber band the competitor has remaining at the end of the round will be worth 10 points.
- 18) Bonus points are awarded for completing the special challenge in the finals. No points are deducted for failing the special challenge or not attempting it at all.
- 19) In the event of any of the following, the round will be over:
  - Competitors raise their flag to signal "Stop!", and end the round. The time recorded at this point will be the completion time for the round.
  - The round has reached 180 seconds.
  - The referee determines that a major rules violation has occurred.

### 3. Competition Flow

- 1) Each team gets one round during the preliminaries, and two rounds during the finals. In the finals, only the round with the highest score of the two will count towards the team's rank.
- 2) Teams are given time for a trial run on the actual course before each round. Each team can use this time to adjust their robots and programs. The order of these trial runs is decided by a lottery held by the hosts of the competition.
- 3) Competitors can also freely adjust their robots and programs on the practice course while other teams are practicing on the actual course.
- 4) Teams will also use their time in 2) and 3) to prepare for special challenges.
- 5) Robots will be checked by inspectors once all teams have finished their trial runs. All robots which have passed inspection will be placed in a designated location and can't be touched until the round starts. Programs should be transferred prior to inspection, as no changes can be made to any robot after it's been inspected (this includes during the round).
- 6) Teams will compete in the first round in an order which the hosts of the competition will decide by lottery. After being called, competitors will retrieve their robot and wait in the designated location until the round starts. Robots and programs can't be adjusted during this waiting period.
- 7) Once the round ends, competitors will immediately move their robots to the designated location to wait.
- 8) In the finals, there will be an adjustment period between the first and second rounds. Teams will be allowed to use this period to adjust their robots and programs on the designated course.
- 9) Once the adjustment period is over, robots will be inspected again as they were in 5).
- 10) The second round will be held in an identical way to the first round in 6). Once the round ends, competitors will immediately move their robot to the designated location and wait until all teams have finished.
- 11) Ranks are calculated using the results of each team's rounds.
- 12) In the event different teams have the same score, the team with the shorter completion time gets the higher rank.

## 4. Robot Specifications

- 1) Only one robot is allowed per team.
- 2) See Appendix 1 on page 14 and Appendix 2 on page 15 for the ArtecRobo parts and Artec Blocks competitors can use to build their robots.
- 3) Each robot can only use one Studuino. There are no restrictions on the number of other parts.
- 4) Any parts from 2) can't be modified.
- 5) Competitors are not allowed to reinforce their robots using parts (such as screws, adhesive tape, etc.) other than those listed in 2). However, bundling cables together with rubber bands or cable ties will be permitted.
- 6) Robots must not exceed 30 cm in width, 25 cm in length, and 30 cm in height at the start of the round.
- 7) There are no weight restrictions on robots.
- 8) While robots are allowed to transform at the start of the round, they must stay in one piece.
- 9) Any programs for the robots must be made using one of the following pieces of software.
  - Studuino Icon Programming Environment
  - Studuino Block Programming Environment
  - Arduino IDE
  - Dolittle
- 10) Robots must use three AA batteries.
- 11) Competitors may only use parts and PCs that they've brought themselves to adjust their robots and programs during the trial run before the start of the round. The hosts of the competition will not provide these.
- 12) Robots and programs can only be built by team members registered to participate in the competition. Any competitors who violate the rules of the competition will be banned from competing for three years (starting with this year's competition).

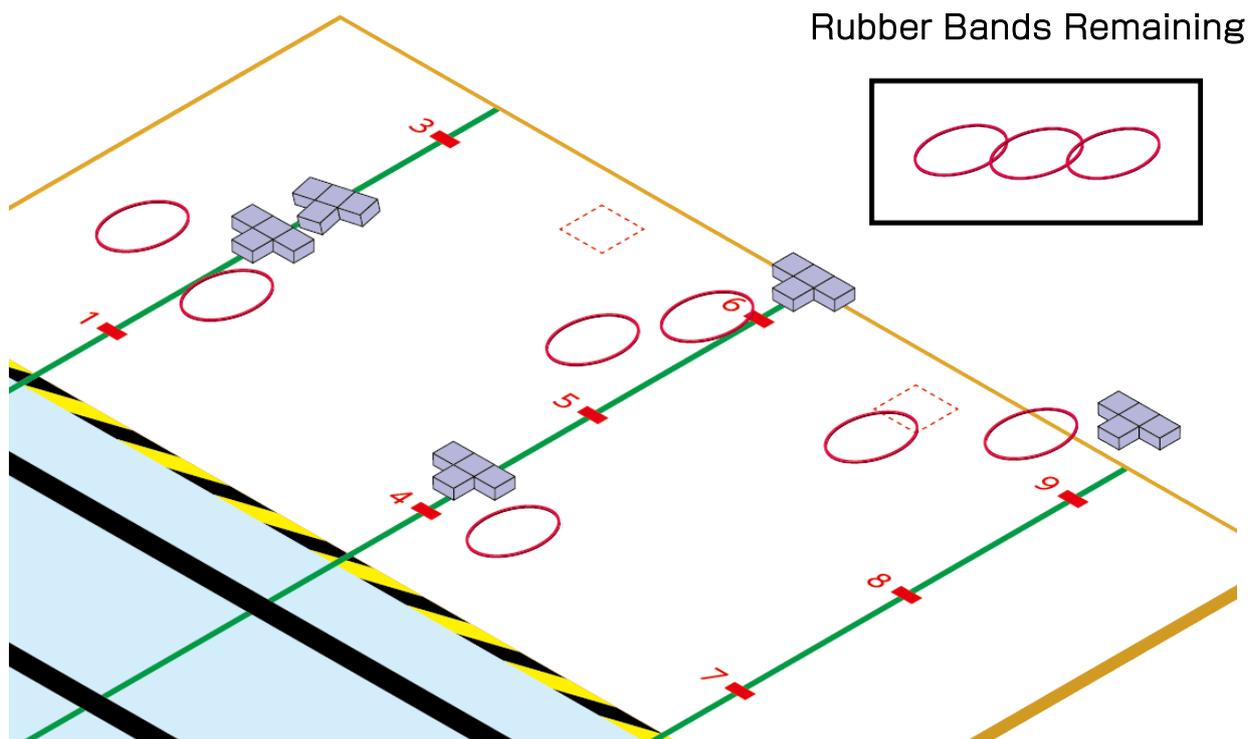
## 5. Scoring

Scores are calculated based on the number of targets knocked down and the number of rubber bands remaining at the end of the round.

- ① Knocked down targets are worth 50 points each.
- ② If all the targets have been knocked down, any remaining rubber bands are worth 10 points each.
- ③ Any time a robot enters the Target Zone or must be manually moved back to the Starting Zone will result in a 50 point deduction.
- ④ Completing the special challenge during finals is worth a maximum of 160 points.
- ⑤ The final score is the sum of items ① to ④.

(Scoring Example)

The targets have been placed on markers 1, 2, 4, 6, and 9.



○ Knocked Down Targets

5 targets  $\Rightarrow$  50 points  $\times$  5 = 250 points

○ Rubber Bands Remaining

3 rubber bands  $\Rightarrow$  10 points  $\times$  3 = 30 points

**Final Score: 280 points**

## 6. The Competition Course

A set including the same competition course, rubber bands, and blocks (for the targets) used for the competition can be purchased from the official competition website.

★The width of black lines are all 20 mm.    ★All units are in mm.

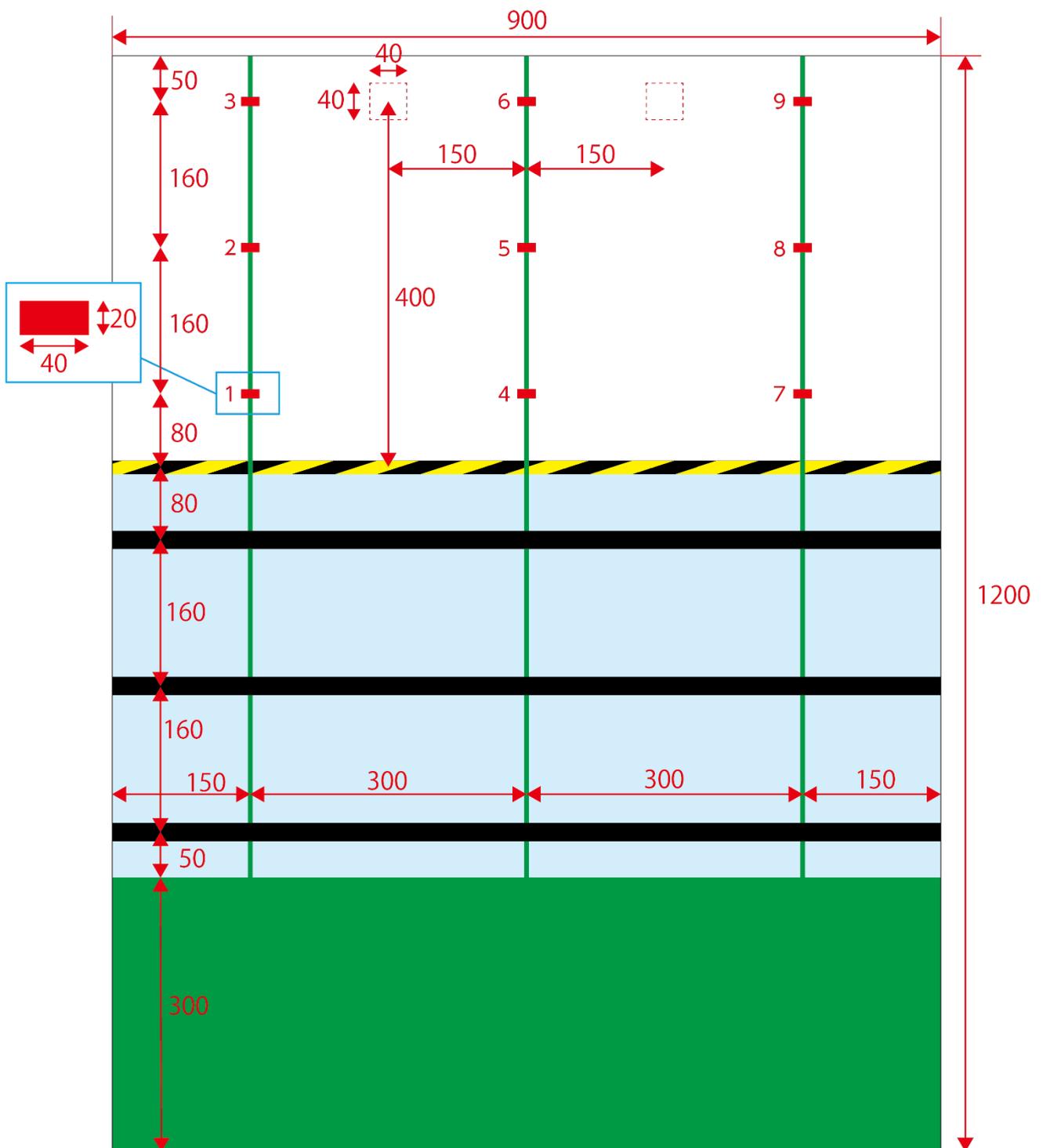
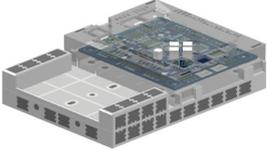
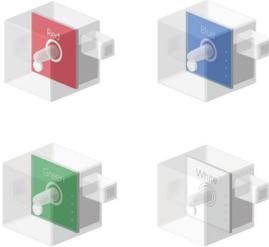
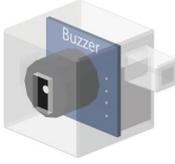
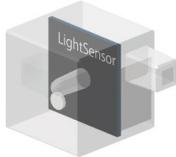
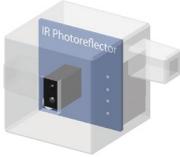
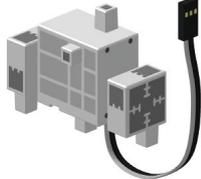
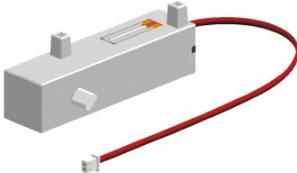
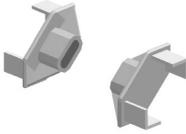


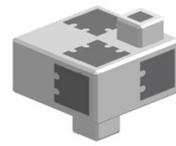
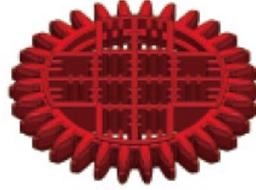
Figure 7. Course Dimensions

## Appendix 1. Permitted ArtecRobo Parts

<p>Studuino</p>	<p>Battery Box</p>	<p>LED (Red, Blue, Green, White)</p>	<p>Buzzer</p>
 <p>*The Studuino may have a face plate sticker attached.</p>			
<p>Touch Sensor</p>	<p>Light Sensor</p>	<p>IR Photoreflector</p>	<p>Servomotor</p>
			
<p>DC Motor</p>	<p>DC Motor Connector</p>	<p>Sensor Connecting Cable (S) 3-wire, 15 cm</p>	<p>Sensor Connecting Cable (M) 3-wire, 30 cm</p>
			
<p>Extension Cable for Servomotors</p>			
			

## Appendix 2. Permitted Artec Blocks

\*There are no restrictions on the color of the blocks.

Basic Cube	Triangle	Half A	Half B
			
Half C	Half C	Axle	Wheel
			
Beam	Disk	Gear (L)	Gear (S)
			
Gear Rack	O-ring		
