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| Robotic Athletics | Participation Category | Team                  | How to Create      |
|-------------------|------------------------|-----------------------|--------------------|
|                   | Junior / Senior        | 1 person (individual) | On-site production |

## 1. Description

Robotics is a sport that uses wheeled robots to perform missions in a variety of sports, including curling, pushball, and more. It is a record game in which teams follow a black line to reach a specific event, perform a mission, and move to a destination. The main objective is to evaluate technical skills such as sensor control, programming, and kinematic principles, as well as problem-solving skills for mission execution.

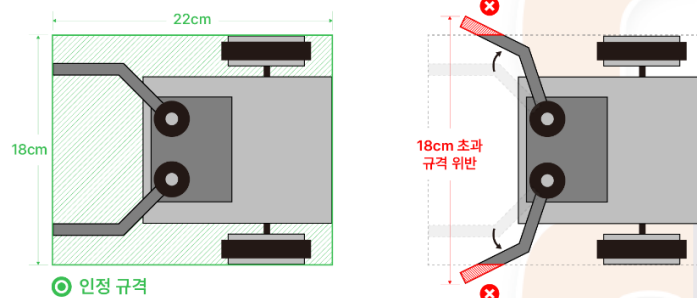
## 2. Robotics

**2.1. Robots** Wheeled robots that can play a variety of sports

**2.2. Robot Manufacture** All mechanical parts of the robot must be fabricated on site and conform to the specifications.

### 2.2.1. Dimensions of the robot

**2.2.1.1. The robot is no larger than 18 cm x 22 cm (width x height)**



<Figure 1> Standards and violations of robots

### 2.2.1.2. Measuring size

- 1) Participants can autonomously measure the size of their robot during build and practice time.
- 2) The referee will personally measure the size of the robot before the match starts.

**2-1) Measurement method:** The contestant shall measure the size of the robot with a measuring tool after powering on the robot under the observation of the referee, and may not dispute the referee's judgment.

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**2-2) Correction time:** If the size of the robot exceeds the standard, the robot will be given one minute to correct the problem and must be corrected at the scoreboard of the venue. If the correction is not made within the allotted time, the record will not be recognized as a violation of the standard. However, only hardware modifications are allowed, not software modifications.

**3)** If the size of the robot is different from the size at the time of measurement and the size changes before crossing the starting line during the competition, the robot shall be disqualified for violation of the specifications.

#### **2.2.2. Sensor No sensor limitations on the robot**

#### **2.2.3. Powering**

**2.2.3.1. Power source configuration** Must use an autonomous, mobile, off-grid power source, no combustion engines.

**2.2.3.2. Power Capacity** There are no usage restrictions on the capacity current and voltage of the power source.

**2.2.4. Drive** No drive restrictions for robots

**2.3. The program and Control** Robot must be capable of autonomous driving by the program and must not be externally manipulated except when departing (the robot may be held in the departure position).

**2.4. Disassembling the motor horn and wheels** The wheels and tires do not need to be removed, and the wheels and motor horn cannot be pre-attached.

### **3. Stadiums**

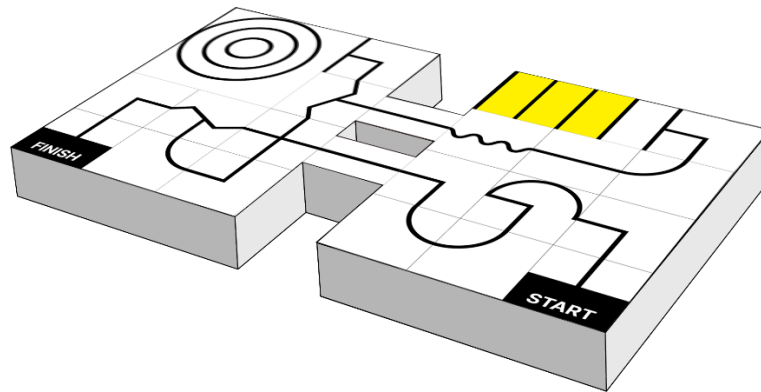
**3.1. Authorized venues** You must use authorized venues as defined by the International Robotics Olympiad Committee.

**3.2. Arena** The arena is a 160cm x 120cm ( $\pm 10\%$  tolerance) arena, and the mission map inside the arena consists of two or more blocks connected together, and the mission map will be revealed on the day of the match.

**3.2.1. Connecting Arenas** Arenas are connected by straight or curved bridges with a width of 25 cm ( $\pm 10\%$  tolerance).

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<Figure 2> Example Arena and Mission

**3.2.2. Stadium tolerances** Stadiums can have tilts of no more than  $2^\circ$  ( $\pm 10\%$  tolerance) and bumps or gaps of no more than 3 mm ( $\pm 10\%$  tolerance).

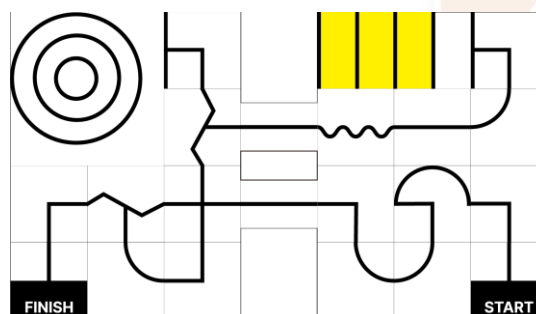
**3.2.3. Robot Fall Protection Structure** No separate structure is installed to prevent the robot from falling.

**3.3. Stadium Field** The stadium field is made of white matte-coated padded paper and can have advertising or the organizer's logo.

**3.3.1. Path** A path is created with a black line with a width of  $20 \pm 3$  mm.

**3.3.2. Gap** The spacing between paths is up to 10 centimeters, with at least 10 centimeters of straight lines before and after each gap.

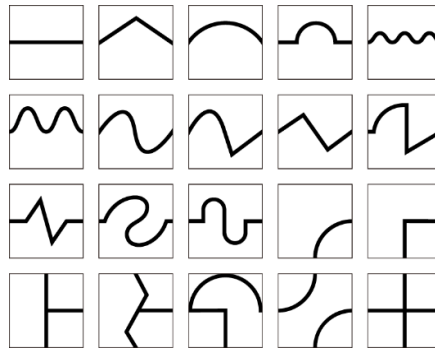
**3.3.3. The mission map** consists of a combination of straight lines, curved lines, curved lines, curved lines, and intersecting blocks. The blocks measure 40 cm x 40 cm ( $\pm 10\%$  tolerance) and are fixed to the playing field with sheet paper and tape. The same blocks can be laid out multiple times, as shown in Figure 4.



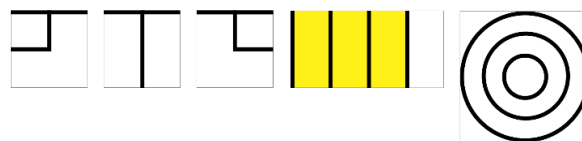
<Figure 3> Mission map example

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<Figure 4> Example of a mission map block



<Figure 5> MissionGate and missions included in the sample file

A sample Mission Map block can be downloaded from the [IROC official website documentation](#).

(File name: R\_Athletics\_Block(2024).zip)

**3.3.4. Starting and ending points** The starting and ending points can vary in location and direction depending on the mission.

## 4. Match progression

- 4.1. The competition** is a timed event, combining mission and driving scores, with a total of two rounds, with time to correct between each round.
- 4.2. Line Out** This is a line sport, so you must not leave the line while driving. If you step out of line, you will be declared TKO and the match will end on the spot. However, line out rule does not apply when entering the curling and pushball mission areas.
- 4.3. Robot building and practice time** Robot building and practice time will be a minimum of 2 hours and will be announced on the day of the competition.
- 4.4. Match Points** robot must pass through an "┆" shaped mission gate to execute a curling or pushball mission. The target is located at the mission gate or in the empty space in front of it.

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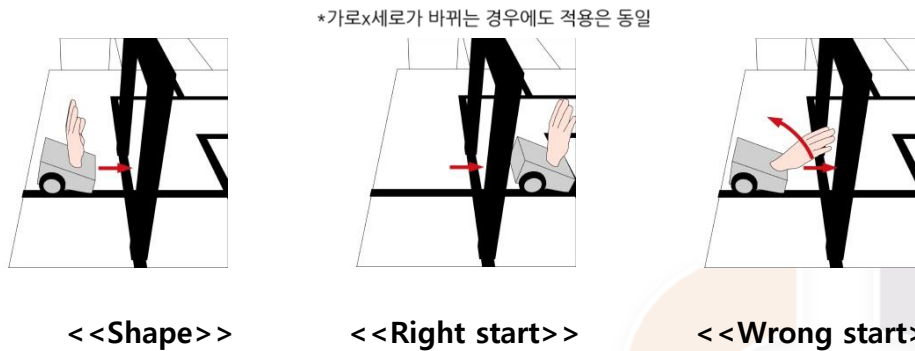
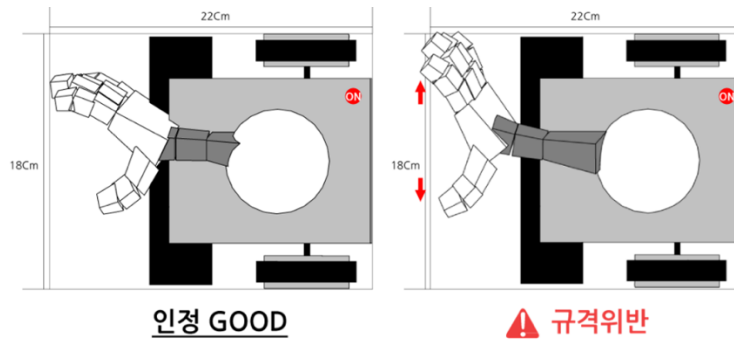
- 4.5. Venue assignments** Adjust the number and assignment of arenas based on the number of participants and difficulty level of the competition, which is the sole prerogative of the organizer.
- 4.6. Production and practice** participants may practice in their assigned arena until the end of the announced production and practice time, and may not practice in the arena before their assignment.
- 4.7. Round 1 The first round will be** held after the robot build and practice periods have ended. Lunch break may be adjusted depending on time.
  - 4.7.1. Preparation** All competitors must come out with their robots and wait as directed by the referees and officials at each venue.
  - 4.7.2. After a match,** all participants wait in a queue until they have finished their match and other participants have finished their matches, and then move to their seats after all participants have finished their matches.
- 4.8. Modification Time** After the first round of competition, all competitors will have the same amount of time to modify or practice their robot. The modification time will be announced on the day of the match.
- 4.9. Round 2** begins immediately after the correction time.
  - 4.9.1. Match Preparation** Same as in Section 4.6.1
  - 4.9.2. Post-match waiting** Same as section 4.6.2,.

## 5. Match

- 5.1. Mission Opening** The shape of the arena and bridges, the line structure, and the missions to be performed are revealed in the form of a mission map on site before the start of the match.
- 5.2. Time limit for starting a match is** 2 minutes.
  - 5.2.1 Start** The robot will start on the signal of the judge and will be timed. If the shape of the robot when measuring the size of the robot is different from the shape before passing through the device and the size changes, the robot will be disqualified as a violation of the standard.

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**5.2.1.1 Starting point** robot must be fully positioned in the black portion of the starting point and must follow the straight line from the starting point. Taking shortcuts or moving in the opposite direction will be recognized as an incorrect start and will require a restart.



<Figure 6> Starting point

**5.2.1.2 Miss Start** Failure to start Failure to start within 5 counts of the start signal will be declared a failure to start and the player will be given a maximum of 3 chances to restart (2 restarts).

**5.2.1.3 False Start** The following are recognized as false start

- 1) If the robot was activated before the referee's start signal
- 2) If you took a shortcut from your starting point
- 3) If you're moving in the opposite direction from your starting point

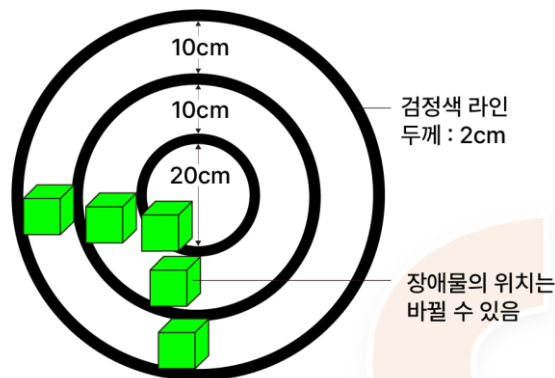
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**5.2.1.4 Restarts** Players get a maximum of 2 restarts for a missed start and 1 restart for a false start.

However, only one restart is granted after a false start.

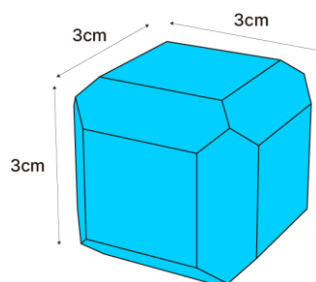
**5.3. Curling** given a circular target as shown below. You have to place the target between the obstacles. Each destination is worth a point. The target can only be pushed (not shot) to score points.



<Figure 7> Example of bull's-eye dimensions and obstacle placement

**5.3.1. Size and shape of the target** Polyhedron with dimensions 3 cm x 3 cm x 3 cm (width x length x height,  $\pm 10\%$  tolerance)

**5.3.2. Target weighs** 30 grams or less ( $\pm 10\%$  error)



<Figure 8> Example of a target

**5.3.3. Movement of a target** You cannot move a target to a location that is not its destination.

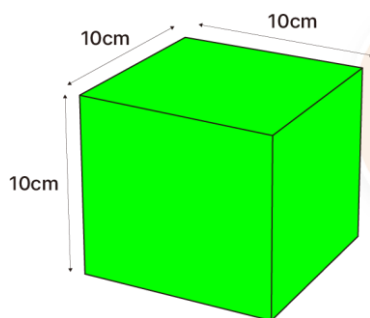
**5.3.4. Target moving number** You can move more than one **objective** at a time, but each objective is worth one point.



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- 5.3.4.1. If a target is moved to a higher point space due to contact between the target and a target that is already at its destination during the movement of the target, this is counted as a point.
- 5.3.4.2. Contact with anything other than the target, such as the robot's wheels, the robot's grippers, etc. is not considered a move.
- 5.3.5. **Destroyed Targets** Destroyed targets that fall outside of the arena cannot be brought back in.
- 5.3.6. **The color of the target** can be any color.
- 5.3.7. **The objective's placement** on the mission map.
- 5.3.8. **Dimensions of** 10 cm x 10 cm x 10 cm (width x length x height, with a tolerance of  $\pm 10\%$ ) for the obstacle.



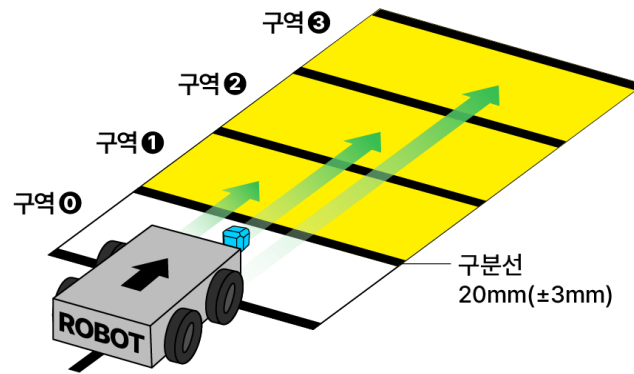
<Figure 9> Example of an obstacle

- 5.3.9. **Obstacles** The number and location of obstacles placed in the arena will be revealed on the day of the match and will be fixed in the arena.
  - 5.3.9.1. **Touching Obstacles** If a robot or target touches an obstacle, that moving target will not be scored.
- 5.4. **Pushball** The objective is to move the target into the designated area. You can only score points by pushing the target, not shooting it.
  - 5.4.1. **Size and shape of the target** Same as in Section 5.3.1.
  - 5.4.2. **The weight of the target is the** same as in Section 5.3.2.
  - 5.4.3. **Initial location of the target** The target is located on the horizontal line of the 'T' shaped mission gate, or Zone 0.
  - 5.4.4. **Number of targets** Targets are located at specific locations on the map and can range from 1 to 10 in number.



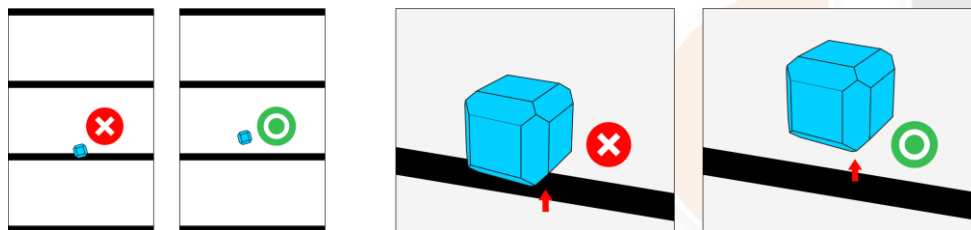
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<Figure 10> Initial location and zoning of the target

5.4.4.1. The target must cross the dividing line completely and no points are awarded if it touches the line.



<Figure 11> Correct position when moving the target

## 5.5. End of match

5.5.1. **The destination** robot must stop exactly at the destination and stay there for at least 3 counts to be considered successful.



<Figure 12> Destination Point

5.5.2. **Arrival** If the robot arrives at the arrival point before the time limit, the match is over and the mission score and time record at the end of the match will be recognized.

5.5.3. **End** If you do not pass the destination within **the time limit, the time at** the end of the time limit will be recognized as your time.

5.5.4. **Robot Stop** If the robot does not operate during the match, the referee will give a 10-second count, and if the robot does not operate normally within the count, the

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referee will declare the robot stop and only the mission score at the time of the stop will be awarded.

**5.5.5. Technical Knock out (TKO)** If the robot is unable to run normally, the referee can give a 10 second count and declare a TKO, which is equivalent to stopping the robot without the 10 second count. The following situations qualify as a TKO

- 1) Repeatedly moving a region
- 2) You've stopped progressing at a point because you're stuck or blocked by a structure, obstacle, etc.
- 3) Leaving the arena (falling robots), etc.
- 4) Line out

**5.6. Disqualification** In the event of any violation of the Rules of the Game or interference with the progress of the match, the match shall be terminated immediately, and all records of the match shall be disregarded and no remedy shall be granted. (However, Articles 5.5.4/5.5.5 shall apply only to the next match).

**5.6.1. Robot repair** During the competition No addition/removal/exchange/alteration of robot parts is allowed during the competition, and any robot found with spare parts, tools, batteries, etc. for the purpose of repairing the robot waiting for the competition will be disqualified.

**5.6.2. Sensor Tuning** Attempting or being caught tuning sensors in the arena before the start of a match will result in disqualification.

**5.6.3. Failure to honor venue assignment** Any participant found practicing or competing in a venue other than the assigned venue will be disqualified.

**5.6.4. Falso Start** Any competitor with two or more false starts in a given race will be disqualified.

**5.6.5. Miss Start** If a competitor fails to start three times in a given race, the competitor will be disqualified.

**5.7. Rematch In the event** of a natural disaster, such as a power outage, or an unreasonable accident at the venue, a rematch may be made at the discretion of the referee and supervisor.

International Robot Olympiad Committee

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- 5.8. Referee's Decision** The referee has the authority to preside over all situations and control the participants from the beginning to the end of the match. Deciding the outcome of a match is the sole authority of the referee and his/her declaration is final.

## 6. Match History

- 6.1. Scorekeeping Items** Mission Performance Scores, Timekeeping, Destination Stop Missions
- 6.2. Mission Record** For each mission, the mission score is calculated after the end of the match is declared, and the status of the target is reported at the destination.
- 6.3. Time record** Time record is recognized when the robot passes the start and finish points. (Stops, falls, and TKOs will not be recognized.)
- 6.4. Final Score** The best of the first and second times is the final time.
- 6.5. Decision making** Groups are divided into prioritized mission scores and the driving records of each group are compared and summed to determine the ranking.

Mission Score > Timeloggged or Not Timeloggged > Compare Timeloggged (Timeline Score)

- 6.5.1. Prioritization by time period** If the driving results are the same in the same time period, the ranking is determined by comparing the records of different time periods.
- 6.5.2. In the event of a tie, the** better of the first and second rounds will be counted, but in the event of a tie, the better of the first and second rounds will be prioritized.