# RoboCup Junior South Australia

# Robot Sumo Rules

# 2022

Standard and Open Divisions

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# Robocup Junior South Australia Sumo Rules
## Standard and Open Divisions

Robocup Junior South Australia (RCJSA) Sumo is a head to head competition where two autonomous robots try to push or flip the other out of a circular ring. The last robot remaining in the ring, or upright, wins the round. While pushing your opponent out of the ring is the most common way to win a round, disabling your opponent (flipping and lifting) is strongly encouraged. Winning the most rounds, wins the match.

## Code of Conduct

It is expected that all participants, students and mentors, will respect the aims and ideals of RoboCup Junior as set out in mission statement. In turn, the volunteers, referees and officials will act within the spirit of the event to ensure the competition is competitive, fair and most importantly, fun. "It is not whether you win or lose, but how much you learn that counts."

## Sharing

It is the desire of RCJSA competitions that any technological and curricular developments will be shared with other participants, after the competition. Any developments, including new technology and software examples, may be published on the RoboCup Junior website after the event, furthering the mission of RoboCup Junior as an educational initiative. Participants are strongly encouraged to ask questions of their fellow competitors to foster a culture of curiosity and exploration in the fields of maths, science and technology.

## Advice vs. Rules

This document includes advice and the competition rules for the competitors and mentors. A numerical reference indicates rules. Advice is marked as "*Advice*".

The aim is to win and to have fun.

## Table of Contents

# 1. The Playing Field:

1.1 The Arena - is the area where the sumo robots will compete.

**1.1.1** The arena will be a circular ring 1000 to 1200 mm in diameter with a 50 mm white border around the ring's perimeter (Figure 1).

**1.1.2** The Arena's playing surface can be raised up to 30 mm in height for the Open division

1.1.3 Starting Lines may be included, (dimensions are 200 mm long, 20 mm wide and 200 mm apart).
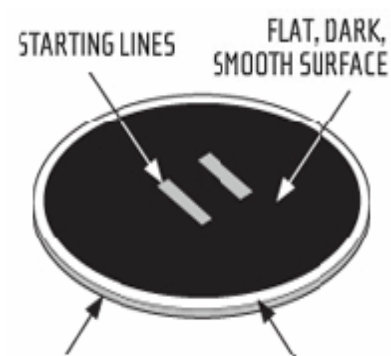

*Figure 1 Example sumo filed with key components labelled*

# 2. Sumo Challenge Divisions
The challenge is broken up into 3 divisions:

- Standard
- Open
- Spike Prime

# 3. Robot Construction:

## 3.1 Standard Sumo
**3.1.1** For RCJSA Sumo Standard Challenge, all participants shall use the standard EDUCATION or COMMERCIAL LEGO Mindstorms EV3, NXT or Spike Kit. The sumo bot can have only 1 EV3, NXT or Spike controlling it.

Note: Tracks are not permitted in Standard League. Omni/rotor caster wheels are permissible. 3D printed parts are also not permitted.

**3.1.2** No glue, tape or non-LEGO rubber bands are allowed in the construction of a robot.

**3.1.3** The program must be stored and run from the brick.

**3.1.4** The weight of the robot **cannot exceed 800 grams.**

**3.1.5** Each robot may only use up to 2 motors for driving and 1 motor for lifting. Robots can have up to 2 touch sensors for bump sensing, 1 colour/light sensor, 1 ultrasonic sensor, and 1 Gyro sensor.

**3.1.6** Standard Sumo robots must fit within an open-top **210mm (L) x 210mm (W) x 210mm (H)** frame, (including all capturing, lifting mechanisms must be fully extended).

**3.1.7** The robot must not include any part that fixes the robot to the playing field surface.

**3.1.8** The robot must not intentionally damage the opponent's robot or the playing field.

**3.1.9** Each robot should have a recognisable tag to link it to that team.

**3.1.10** Robots should be entirely autonomous; they will work independently from start to finish

## 3.2 Open Sumo

**3.2.1** An Open sumo bot can be made from any kit or material. Including LEGO, Makebots, Edisons, BBC Microbits, etc. or homemade (including 3D Parts). The sumo bot can only have one brain controlling it.

**3.2.2** Each robot may only use up to 3 motors for driving, 1 motor or electronic actuator for lifting and flipping. Up to 2 touch sensors for bump sensing, up to 2 colour/light sensors, up to 2 ultrasonic or infrared sensors, 1 Gyro sensor and 1 pixy camera.

**3.2.3** Participants shall only use the software provided with kits or text-based software. Robots may be remotely started if the program is stored on a Device or PC. Once started the device isn't to be touched unless a restart has been called or unless instructed by the referee.

**3.2.4** Open robots are entirely autonomous; they need to work independently from start to finish.

**3.2.5** The weight of an Open sumo robot **cannot exceed 1.5Kg.**

**3.2.6** The use of custom-made 3D printed, and laser cut pieces are permissible.

**3.1.7** All robots must fit within an open-top 250mm (L) by 250mm (W) x 210mm (H) frame, (including all capturing, lifting mechanisms must be fully extended).

**3.2.8** The robot must not intentionally damage the opponent's robot or the playing field.

**3.2.9** The robot must not include any part that fixes the robot to the playing field surface.

**3.2.10** Each robot should have a recognisable tag to link it to that team.

## 3.3 Spike Sumo

**3.3.1**   As a new product we will be allowing students to compete in a stand-alone RCJSA Spike Sumo Challenge, all participants shall use the standard EDUCATION or COMMERCIAL Spike Kit. The Robot Inventor Kit 51515 can also be used in this division.

Note: Tracks are not permitted. Omni/rotor caster wheels are permissible as well as the use of NXT / EV3 wheels. 3D printed parts are also not permitted.

**3.3.2**   No glue, tape or non-LEGO rubber bands are allowed in the construction of a robot.

**3.3.3**   The program must be stored and run from the brick.

**3.3.4**   The weight of the robot **cannot exceed 600 grams.**

**3.3.5**   Each robot may only use up to 2 motors for driving and 1 motor for lifting. Robots can have up to 2 touch sensors for bump sensing, 1 colour/light sensor and 1 ultrasonic sensor.

**3.3.6** Standard Sumo robots must fit within an open-top **210mm (L) x 210mm (W) x 210mm (H)** frame, (including all capturing, lifting mechanisms must be fully extended).

**3.3.7** The robot must not include any part that fixes the robot to the playing field surface.

**3.3.8** The robot must not intentionally damage the opponent's robot or the playing field.

**3.3.9** Each robot should have a recognisable tag to link it to that team.

**3.3.10** Robots should be entirely autonomous; they will work independently from start to finish

# 4. Inspection

## 4.1 Scrutineering
4.1.1 All competing robots need to be presented for scrutineering at the start of the competition. Organisers check each robot to make sure they comply with all rules. If a team arrives late, they must have their robot checked before competing.

## 4.2 Team Interview
Teams that make it into the final rounds of the competition may be interviewed.

*Advice: Students may wish to produce a Journal showing the progress of the team throughout the design, implementation and testing phases of the project. The final project report may include but is not limited to:*

1. *Report cover page;*
2. *Table of contents;*
3. *Robot design considerations and methodologies used;*
4. *Challenges faced and milestones achieved;*
5. *Robot final design with a picture. Pictures of robot construction are advisable;*
6. *Any experimentation conducted and results;*
7. *Documented robot program code, and*
8. *Completeness and overall presentation.*

**4.2.1** All team members in attendance must be present for the interview. The Team Mentor is not included in the interview.

*Advice: The interview may take about 10 minutes (i.e. 5 minutes student-led demonstration / 5 minutes interview questions)*

*Advice: All team members are invited to answer in the interview, not just the Team Leader, though the Team Leader may like to co-ordinate the interview responses. Ideally, teams should be able to provide some form of Learning Journal or Logbook that shows the evolution of their entry and confirms it as being their work. This is good practice and can also be used by teachers as a form of assessment for the classroom learning.*

**4.2.2** The robot(s) must be present at the interview and in a functioning condition.

**4.2.3** The team can bring a clear print-out of the program(s) they are using with their sumo robots. Alternatively, the team may have their computer on and displaying their program(s) in readiness for their interview

# 5. Game Play

## 5.1 Set Up
**5.1.1** At the beginning of a round, the sumo-bots will be placed approximately 200 mm apart from each other in a parallel position. The sumo-bots must begin the round by moving in opposite directions. The referee of the round will verify with the current contestants that their sumo-bots are positioned such that they will initially travelling in opposite directions.

## 5.2 Start of round
**5.2.1** When the referee signals the start of the match, one member of each team will start the robot.

**5.2.2** Once the match has started, only the referee is allowed to touch the robots. Unless a restart is called (5.3.1.4)

**5.2.3** Sumo-bots will be started manually (standard, with an exception in Open when program is stored on the device). Please design and program your sumo-bot(s) to be activated upon the press of bumper or switch.

**5.2.4** The robot must be designed to wait 3 seconds after the contestant presses a start button before it moves.

**5.2.5** Sumo-bots are not allowed to have random start-up directions. A robot must begin a round by travelling forward at least 10cm —away from the other sumo-bot

## 5.3 Length of Match
**5.3.1** A match consists of three rounds, each round lasts up to three minutes (best of three).  The competition will consist of round-robin matches, with the  finals series to determine the Grand Final. **2 points will be awarded for winning a match, one for a no result (determined by the referee).** Bouts within a round are over when the following happens:

**5.3.1.1** A sumo-bot is either pushed or falls off the arena. A sumo-bot is not considered "out" until it has entirely fallen off the arena (touched the floor outside the arena) or voluntarily exits the ring. **Hanging over the edge does not disqualify a sumo-bot.**

**5.3.1.2** If a robot is knocked over and fails to become upright and continue normal movement within 10 seconds it is eliminated.

**5.3.1.3** The 3-minute time permitted for a round has run out, and there have been no victories. A sudden death round will be permitted (5.5).

**5.3.1.3** The robots are entangled for 5 seconds. A reset will follow (**5.3.1.4**).

**5.3.1.5** One of the sumo-bots becomes disabled for any reason. The other sumo-bot will be declared winner.

**5.3.1.6** One robot loses 4 (not including connector pins) or more pieces. Motor and sensor cables are not considered, hence a motor that comes off but remains tethered is still considered as a lost piece. Parts that fall off a robot during the match cannot be replaced.

**5.3.1.7** If the robot is badly damaged, then it is eliminated for that round.

<span style="color:red">Note: this includes the loss of a wheel or a track.</span>

**5.3.1.8** The round ends when the referee calls the winner. Both contestants should thank each other for a fair and competitive match after removing their robots.

## 5.4 Restarts and Resets

**5.4.1** A round will be stopped, and a restart or reset, started under the following conditions:

| Reset | • Both robots touch the exterior of the playing field at the same time or if one or both are hanging off the field for at least 20 seconds. |
|---|---|
| Restarts | • The robots have not detected opponents (i.e. sumo-bots have rotated in circles for 20 seconds or more).<br>• Any other conditions under which the referee judges that no winner can be decided. |

5.4.2 In case of a restart or reset, maintenance of competing robots is prohibited, and the robots must be immediately placed in the designated starting position.

**5.4.3** If neither of the competing robots win, or lose, after a rematch, the referee may reposition both robots to a specified location and restart. If that does not yield a winner, then a Sudden Death match is called (5.5).

**5.4.4** All decisions by the referee are final.

## 5.5 Sudden Death

A sudden death is a 1-minute round called to determine which Robot is the winner when a regular three minute round cant. In sudden death, both Robots are repositioned and started by the referee. If no sumo-bot is found to be a winner at the end of 1 minute, the referee shall declare a winner based on action observed within the circle and on the design of the selected Sumo-bot. If unable to make a clear distinction between sumo-bots, then a coin toss is used to determine the winner. All sudden death competitors will be judged using the same scoring as a regular round, with exemption given to the coin toss.