



RoboCup Junior South Australia

Robot Sumo Rules

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RCJSA Robot Sumo Rules

RCJSA Sumo is a competitive sport where two autonomous robots go head-to-head in a competition to try to push or flip the other robot out of a circular ring. The first robot to touch the floor outside of the ring loses. The last robot remaining in the ring wins the round. The robot that wins the most rounds wins the contest. 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.

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 our 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 overall desire of RoboCup Junior 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 science and technology.

Advice vs. Rules

This document includes advice to the competitors and mentors, plus firm rules; this has been done to ensure clarity. A numerical reference indicates rules. Advice is marked as "*Advice*".

The aim is to win and to have fun.

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1. The Playing Field:

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

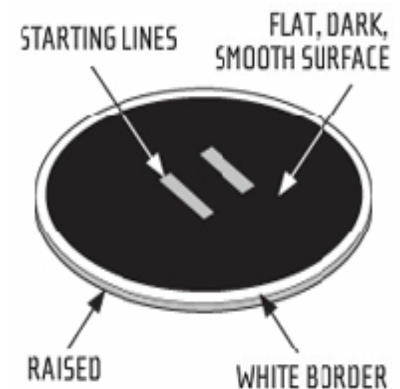
1.1.1 The arena will be a circular ring 1000 to 1200 mm in diameter which must include a 50 mm thick white border around the ring's perimeter (see diagram for details).

1.1.2 The Arena's playing surface can be raised up to 32 mm in height.

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

1.1.4 Open Sumo (section 2) matches are played on a raised field e.g on a table

1.1.5 The Arena could be black with a white border. If black and white is not used, then colours of high contrast must be used e.g., red-green or orange blue



2. Sumo Challenge Divisions

The challenge is broken up into 3 divisions:

- Featherweight Sumo
- Standard Sumo
- Heavyweight Sumo

Students can only compete in Standard / Featherweight for 2 combined years of robocup registration.

They must then go into Heavyweight if they want to continue competing in Sumo for one more year.

This rule does not reset if they compete in another competition and come back to Sumo.

3. Robot Construction:

3.1 Featherweight Sumo

3.1.1 All participants can use a single standard EDUCATION or COMMERCIAL LEGO kit. This may be either NXT, EV3, Spike Prime or Robot Inventor 51515.

Note: Tracks are not permitted

3.1.2 No glue, tape or non-LEGO rubber bands are allowed

3.1.3 Participants can only use the kits proprietary software. The program must be stored and run from the brick.

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

3.1.5 Each robot may only use:

- up to 2 motors for driving
- up to 2 touch sensors for bump sensing
- 1 light/colour sensor
- 1 ultrasonic sensor

3.1.6 4 wheel drive systems are not permitted

3.1.7 All robots must fit within an open-top 210mm (L) x 210mm (W) x 210mm (H) frame, (including all capturing, lifting mechanisms at its full extension).

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

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

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

3.1.11 Robots must be entirely autonomous; they need to work independently from start to finish

3.2 Standard Sumo

3.2.1 All participants can use a single standard EDUCATION or COMMERCIAL LEGO kit. This may be either NXT, EV3, Spike Prime or Robot Inventor 51515.

Note: Tracks are not permitted

3.2.2 No glue, tape or non-LEGO rubber bands are allowed in the construction

3.2.3 Participants shall only use the software provided with those kits. The program must be stored and run from the brick.

3.2.4 The weight of the robot must be between 700 - 900 grams.

3.2.6 Each robot may only use:

- up to 2 motors for driving
- 1 motor for lifting and flipping.
- up to 2 touch sensors for bump sensing
- 1 light/colour sensor
- 2 ultrasonic sensors
- 1 gyro / compass sensor

3.2.7 3D printed lego bars/pieces can be used however they CANNOT form scoops or walls

3.2.8 4 wheel drive system is not permitted

3.2.9 All robots must fit within an open-top 210mm (L) x 210mm (W) x 210mm (H) frame, (including all capturing, lifting mechanisms at its full extension).

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

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

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

3.2.13 Robots must be entirely autonomous; they need to work independently from start to finish

3.2 Heavyweight Sumo

3.2.1 The robot can be made from any kit or material. The robot can only have one controller (brain) controlling it.

3.2.2 **Each robot may only use:**

- up to 3 motors for driving
- 1 motor or actuator for lifting and flipping
- up to 2 touch sensors for bump sensing
- up to 2 colour/light sensors
- up to 4 ultrasonic or infrared sensors,
- 1 Gyro sensor
- 1 pixy camera

3.2.3 Participants can 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 or PC isn't to be touched unless a restart has been called or instructed by the referee.

3.2.4 Robots must be entirely autonomous; they need to work independently from start to finish.

3.2.5 **The weight of the robot must be 1000g or greater**

3.2.6 The use of 3D printed, and laser cut pieces are permissible. These CAN form scoops or walls

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.

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 can still have their robot checked before competing.

4.2 Team Interview

Teams that make it into the final rounds of the competition will be interviewed (if time permitting).

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 at the event must present for the interview. The Team Mentor isn't included in the interview.

4.2.2 The robot(s) must be present at the interview 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 (while still complying with 5.2.4); active searching is enforced in this way. The judge of the round will verify with the current contestants that their sumo-bots are positioned on the arena in a way which will result in them initially travelling in opposite directions.

5.2 Start of Game

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.

5.2.3 Robots will be started manually (with an exception in Heavyweight where programs may be stored on a PC or device). Please design and program your sumo-bot(s) to be activated upon the press of bumper or switch.

5.2.3 The robot must wait 3 seconds after the contestant presses a start button before it moves. This pause allows the teams to move out of the way, so the referee has a clear view.

5.2.4 Robots are not allowed to have random start-up directions. Please program your sumo-bot to begin a round by travelling forward **10cm after the waiting 3 seconds**.

All actions must be pre-programmed. The use of any form of remote control is prohibited.

5.2.5 The robot must not intentionally obstruct the control of the opponent's operation or intentionally damage the opponent's robot or the playing field.

5.3 Length of Game

5.3.1 A match consists of three rounds with a total time limit of 5-minutes allowed (best of three).

- Once the time limit has been reached the current standing result will be final.
- 3 points will be awarded for winning a match and one point each for a draw.

Bouts within a round are over when the following happens:

5.3.1.1 A robot is either pushed out or falls off the arena. A robot 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 your robot is knocked over and fails to become upright and continue normal movement within a count of 10 seconds it is eliminated.

5.3.1.3 The 5-minute time permitted for a round has run out, and there have been no victories.

5.3.1.4 One of the sumo-bots becomes disabled for any reason. The other sumo-bot will be declared winner. This includes a robot that hangs or drives around the edge of the ring without being able to re-enter the arena by itself.

5.3.1.5 One robot loses 4 (not including connector pins/friction pegs) or more pieces of LEGO. Motor and sensor cables are not considered connected, so a motor that comes off but remains tethered is still considered as a lost piece towards the count of four or more. Any parts that fall off your robot during the match cannot be replaced.

5.3.1.6 If the robot is badly damaged, then it is eliminated from that round. Refer to section 5.4.2 for rules on in match maintenance.

Note: this includes the loss of a wheel or a track.

5.3.1.7 The game 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 game will be stopped, and a restart or reset, started under the following conditions:

Reset	<ul style="list-style-type: none"> Both robots touch the exterior of the playing field at the same time or if one or both are hanging off the field for a count of 10.
Restarts	<ul style="list-style-type: none"> The robots have not detected opponents (i.e. sumo-bots have rotated in circles for 15 seconds or more). 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.

5.4.4 In the case of finals, if a winner has not been determined, then a Sudden Death match is called (section 5.5).

5.4.5 All decisions by the referee are final.

5.5 Sudden Death (finals)

- A sudden death is a 1-minute round to resolve which robot is the winner from a previous, expired 5-minute regular match.
- In sudden death, both robots are repositioned and started by the judge. If no robot is found to be a winner at the end of 1 minute, the judge(s) shall declare a winner based on action observed within the circle and the design of the selected Robot.
- If they are still unable to make a clear distinction between sumo-bots, then a coin toss is used to determine the winner.
- All sumo-bots declared a winner in sudden death are judged by normal scoring standards, except those determined by flipping a coin.