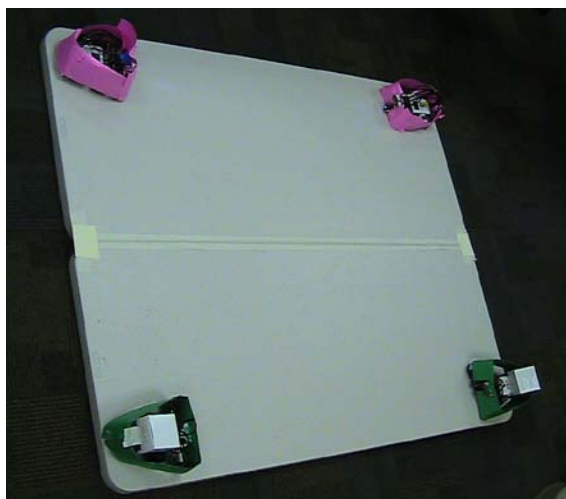


# $n$ V $n$ RoboSumo<sup>SM</sup> ( $n$ versus $n$ Multi Robot Team Sumo) – ROBOFEST® Game

v1.23



[Figure 1] Possible initial positions when  $n=2$

## Mission Synopsis

When  $n$  is two, a team consists of two robots. Push the opponent’s robots out of the Sumo ring.

**Learning Objectives:** motion, friction, velocity, acceleration, physics, logic, robot communication, sensor filters, object detection, sensor fusion, localization, navigation, and multi robot collaboration

## Robot Requirements

Maximum robot mass	1.3kg	Note that VEX can be used
Maximum robot width	25cm	Robots may expand their dimensions during the game
Maximum robot length	25cm	Robots may expand their dimensions during the game
Maximum robot height	25cm	Robots may expand their dimensions during the game
Number of robot controller per robot	One	Each robot must be 100% autonomous. No human control / signal is allowed. Remote host computer control is not allowed either.
Communication method between robots	Any	Bluetooth, ZigBee, or other communication mechanism is strongly encouraged to use.
Sensor types	Any	Unless it is harmful to humans. Note that on-board vision sensor is allowed.
Number of sensors	Any	
Motor types	Any	
Number of motors	Any	
Robot kit	Any	
Material	Any	You may use tape, glue, rubber bands, etc. (However, you cannot glue/tape the robot to the sumo ring floor. For example, vacuum or sticky wheels are not allowed)
Body color	Any	If color based object detection is used, then prepare two jerseys.
Programming language	Any	We encourage high school students to learn C-like language or Java

Other considerations:

- Each robot in a team does not need to be identical.
- Your robot cannot be designed to deliberately and intentionally damage the other robot or the Sumo ring.

- Each robot must have a name tag so that judges can identify teams easily.

### **Sumo Ring**

Two 30" x 72" plastic folding tables are used for the ring. The surface is light in color (almond); however, the exact color and brightness is unknown until the competition day. The four corners of the table are rounded. Suggested tables can be found on the web at: <http://www.buylifetime.com/Products/BLT/PID-22901.aspx> . You can find a table at local discount stores (K-mart or Lowe's) for \$50. Two tables will be connected by using a bright masking tape as shown in the figure on page 1. The exact color of the tape will be unveiled on the competition day. The table should be placed on a dark colored floor with the legs folded under. It is suggested to raise up tables around 10cm using (identical) books, Lego NXT boxes, or cans.

### **Sumo Match Rules**

A match consists of up to three games. **Maximum 2 minutes are given for each game.** The first robot team to win two games wins the match.

At the start of each game, the judge will randomly determine (1) the location of the robots and (2) the orientation of the robots, symmetrically. Figure 1 shows a possible position and orientation.

How to start a game is unknown. It will be unveiled on the day of the competition. Students must complete the unknown challenge that will require a downward facing light sensor. An example of the unknown start problem would be: The robot must wait until a light sensor detects bright flashlight. No adult help is allowed to complete this part. If this unknown challenge is not performed correctly, then the robot team loses the game. The team may try the next game for the match, if the team wants. It is **not** allowed to re-download programs between the games. The preparation time between games should be less than 1 minute.

When the game is started, human players should move back out of the way so spectators can see.

Players cannot touch their robots or enter the ring for the remainder of the game.

A robot team wins when all opponents are out of the ring and at least one robot of the team survives on the ring. A robot is out of the ring when any part of it touches the floor, even if that part is no longer connected to the main body of the robot.

A robot team **loses** a game if a robot is pushed out of the sumo ring by a friend.

**When 2 minute timer is up, the winner is decided by the number of surviving robots on the ring. If same, the game is tied.**

### **How to Schedule Matches and Determine Winners**

The site host can choose single elimination, double elimination, or round-robin (all-play-all) tournament. Also the following method could be possible.

First do the mock competition using two non-mobile mock robots (or Kleenex boxes) as opponents. Measure the time to push the stationary opponent robots. Based on the mock competition result, create single elimination tournament tree in such a way that best teams do not fight in early stage of the tournament (seeding).

The site host can decide tie breakers.

If two teams are using color to identify friend or opponents and they are both wearing the same color jersey, the team that must change the jersey is decided by lottery. The time to change the jersey and possibly the program should be less than **2** minutes. Each team has a right to gather jersey color data from the opponents once before the match. The time to collect data should be less than 20 seconds. Judge may announce the loss of a match, if a team is not ready to compete, after maximum 2 minutes.

### Maximum Team Size

- High School Team:  $n+1$ , where  $n$  is number of robots per team
- College Team:  $n$

### Other rules to play games

The Emcee shall announce the following when the competition begins:

*No adult is allowed in the pit area from now through the end of the competition. The use of any communications devices to remotely control robots is prohibited in this competition arena. Please turn off all such devices now. If anyone sees any suspicious activities, please get the attention of the nearest Robofest volunteer immediately. Only two team members can stay in the competition area; however, it is requested that all other members be around the competition field during the game play.*

Before the match, each team will introduce team members as well as their robots to the audience.

*The Chief Judge has all the discretion in making final decisions for the cases not considered in this rule.*

**FAQ** (Additional FAQs will be posted on the web at [www.robofest.net](http://www.robofest.net))

- [What if the opponent team is wearing same color jersey?](#) See “How to Plan Matches and Determine Winners” section above.
- [Can a human player give sound signal like clapping to robots?](#) No. Any signal by human players to robot is not allowed.
- [Can a human player give light signals using a flashlight or laser pen?](#) No. Any signal by human players to robot is not allowed once game is started.
- [My robot detected judges foot and fell out of the ring. Can I restart my robot?](#) No. Your program must detect the edge of the table.
- [A robot dropped a piece on the ring. Does this team lose a robot?](#) No. However, when the piece touches the floor, then the robot that lost the piece shall be removed from the ring by the judge.
- [Can we use digital compass sensors?](#) Yes.
- [Can we use an LPS \(Local Positioning System\) by setting up indoor satellites? Each robot will have a LPS sensor.](#) No, not at this time. Robofest plans to create new multi robot competition category using LPS in the future.

***It is encouraged to use this rule for your competitions. But it is required to get LTU Robofest office's permission to use this rule. Send email to [Robofest@LTU.edu](mailto:Robofest@LTU.edu) to get permission.***