

# Sumo Robot - Kit Competition Rules

Daniel Zheng<sup>1</sup> (Chair)

## Competition Description

Two teams place an autonomous Pololu Zumo robot in a circular ring called a Dohyo, and much like the traditional Japanese martial art of Sumo wrestling, each robot attempts to push the opposing robot out of the ring. Once one of the robots has been pushed out of the ring, the round is over, and the one who remains in the Dohyo is considered the winner. Whichever team's robot successfully wins two rounds is permitted to proceed to the next tier of the competition. In the kit competition, all teams will have the exact same robot; it is up to the team to write the best and most strategic code in order to win.

### Corresponding emails:

<sup>1</sup>daniel.zheng@pitt.edu

## Contents

<b>1</b>	<b>Eligibility</b>	<b>1</b>
1.1	IEEE Membership	1
1.2	Team Size	1
1.3	Graduate Students	1
1.4	Team Roster	1
	Change in Team Roster	
1.5	IEEE	1
<b>2</b>	<b>Robot Specifications</b>	<b>1</b>
2.1	Robot	1
2.2	Add-ons	2
<b>3</b>	<b>Robot Design</b>	<b>2</b>
3.1	Autonomy	2
3.2	Materials	2
3.3	Power and Safety	2
3.4	Human and Robot Safety	2
	Judge's Discretion • Safety Inspection	
<b>4</b>	<b>Dohyo</b>	<b>2</b>
4.1	Specifications	2
4.2	Interference Area	2
<b>5</b>	<b>Competition Structure</b>	<b>2</b>
5.1	Tournament Style	2
	Winners Bracket • Losers Bracket	
5.2	Matches	2
5.3	Rounds	2
	Setup • Initializing Robot • Starting Delay • False Start • Leaving the Interference Area • Ending a Round • Leaving the Dohyo	
5.4	Special Conditions	3
	Match Delay • Overtime • Third Round Overtime • Malfunction • Mutual Draw	

## 1. Eligibility

### IEEE Membership

All competitors must be an IEEE member with the University they are representing.

### Team Size

Each team shall consist of 1-5 members from any discipline. There is no restriction on the number of teams from a given university that may enter the competition.

### Graduate Students

Graduate students are not allowed to participate. Teams must be made up of only undergraduate students.

### Team Roster

A team roster shall be presented to the competition organizers as well as the judge(s) before March 23rd.

#### Change in Team Roster

There will be **no exceptions** to the March 23rd deadline. If there is a change in the roster before this date, it is up to the team to report the change to the competition organizers. Arriving with a team which contains members who were previously undeclared is grounds for a denial to compete.

### IEEE

Every team member must be a National IEEE member.

## 2. Robot Specifications

### Robot

The robot is the Pololu Zumo 32U4, which can be bought from their website **here** or on Amazon **here**. If buying from another seller, please check with Dan Zheng or Dan Gilmour before purchasing. The robot used in competition must be this robot. Teams with the same robot from previous years are free to reuse their bot as long as all hardware modifications are removed.

**Add-ons**

No physical add-ons are allowed. Only software modifications will be permitted for the kit competition.

### 3. Robot Design

**Autonomy**

Once placed on the Dohyo and started, the robot must move entirely autonomously without any outside aid.

**Materials**

As mentioned in section 2, all teams must use the exact same robot. Proof of purchase must be provided by each team electronically to Dan Zheng and must be approved before the March 31st registration deadline.

**Power and Safety**

The robot is to be powered by the 4 AA batteries it is built to use. The robot cannot be destructive or harmful in any way.

**Human and Robot Safety**

The robot shall be non-offensive, non-destructive, and non-harmful to humans as well as to the facilities at the competition. Failure to comply to these terms is grounds for disqualification of the bot from the competition, whether the infraction was intentional or not.

**Judge's Discretion**

The acting referee of the match will judge to their discretion whether or not the infraction warrants disqualification.

**Safety Inspection**

In an attempt to prevent these incidents from happening, all robots are required to go through a safety inspection which can include but is not limited to: demonstration of robot, handling of the robot, and requesting to see source code.

### 4. Dohyo

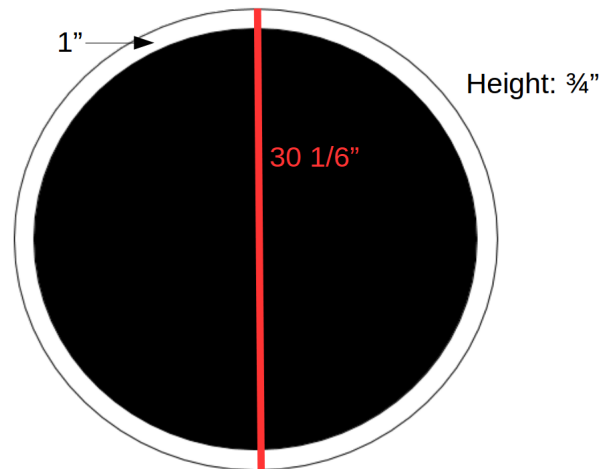
**Specifications**

For this competition, the Dohyo seen in Figure 1 will be used in the competition. This Dohyo is constructed of panel wood and has the following dimensions:

- Diameter -  $30\frac{1}{16}$  inches
- Height -  $\frac{3}{4}$  inch
- Border Width: 1 inch

**Interference Area**

There will be a circle with diameter of 55 inches centered at the center of the Dohyo which acts as the Interference Zone. This zone shall remain unoccupied and will not contain any obstacles which could inhibit the proper functionality of the robot. The only time a person is allowed within this area is when setting up, starting, or retrieving a robot.



**Figure 1.** Diagram of the Dohyo with two blue sumobots placed antiparallel, as is prior to the start sequence.

### 5. Competition Structure

**Tournament Style**

Similar to past years, the competition shall be structured as a Double Elimination Competition. Teams will begin in the “winners bracket” at the start of the competition.

**Winners Bracket**

This bracket will contain only those who have not lost any match, up until the semi-final rounds. The winner of a match occurring in this bracket will move on to further matches within the bracket. Those teams who lose in this bracket fall to the losers bracket.

**Losers Bracket**

Once a team has lost a round from the Winners Bracket, they are placed into the Losers Bracket. If a team loses a match while competing in this bracket, they are eliminated from the competition. The team which can move forward in this bracket without accruing another loss will be placed back into the winners bracket to compete in the semi-final rounds.

**Matches**

A match between two robots shall be broken up into three individual rounds. The first robot to receive two victories is considered the winner.

**Rounds****Setup**

The robots shall be placed parallel to one another in the center of the Dohyo shown in Figure 1.

**Initializing Robot**

At the beginning of each round, the referee will say “Ready. set. Go!”. At the end of this phrase, the team member which placed the robot will press a physical switch which will initialize the robot.

### **Starting Delay**

The robot shall not begin moving until after five seconds have passed since the pressing of the button.

### **False Start**

If a robot is begins operation before the five-second wait period, the round will be restarted and a warning will be issued. If a robot is issued three warnings, it immediately forfeits the round.

### **Leaving the Interference Area**

During the 5 second delay, all contestants and judges must leave the Interference area.

### **Ending a Round**

A round shall end at the end of three minutes of combat or if a robot leaves the Dohyo, whichever comes first.

### **Leaving the Dohyo**

Leaving the Dohyo is defined as **ANY** part of the robot touching the floor that the Dohyo is place on. The robot that leaves the Dohyo first for any reason is considered the loser of the round.

## **Special Conditions**

### **Match Delay**

If for any reason, a team has not placed their robot on the Dohyo after five minutes of the beginning of the match, the

other team will automatically be declared the winner of the match.

### **Overtime**

In the event that a round extends past the three minutes allotted, the round is considered to be a tie. Should all three rounds be declared a tie, both teams shall be sent to the loser's bracket.

### **Third Round Overtime**

If a tie occurs in the third round when the score is at 1 to 1, a fourth round shall be added. If at the end of this round there is a tie, both teams shall be sent to the loser's bracket.

### **Malfunction**

A round can be ended if a robot begins to smoke, leak, falls apart, or acts in such a way that poses a threat to the people nearby. If this occurs, the robot which is still intact is declared the winner of the round.

### **Mutual Draw**

A round can be ended early if both teams agree to a tie as the result of the round. This is to allow teams to not damage their bots due to stalled motors or other harmful circumstances. Both teams must agree to the draw for this to occur.