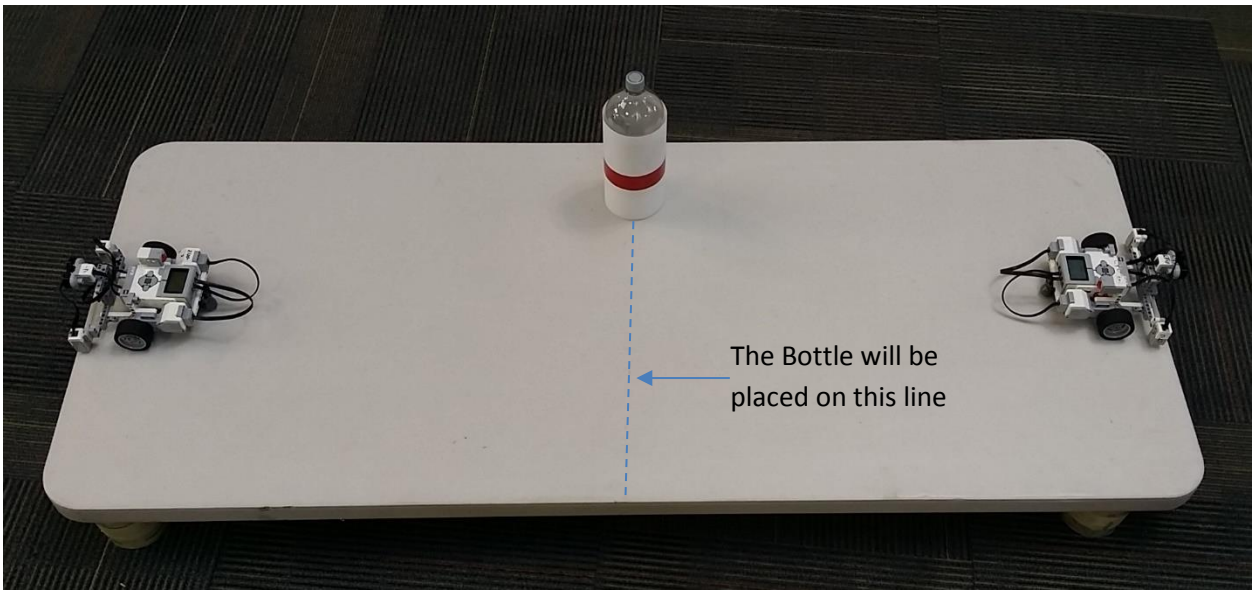
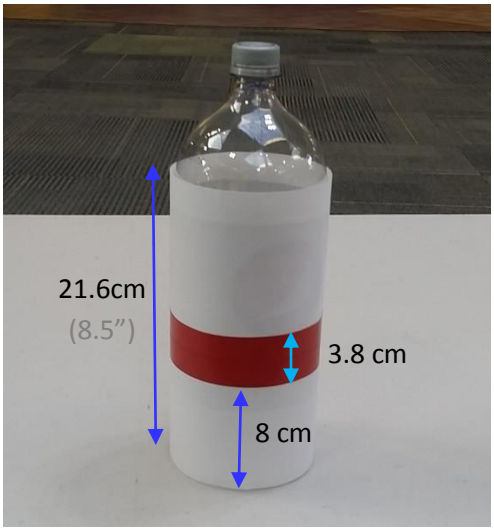
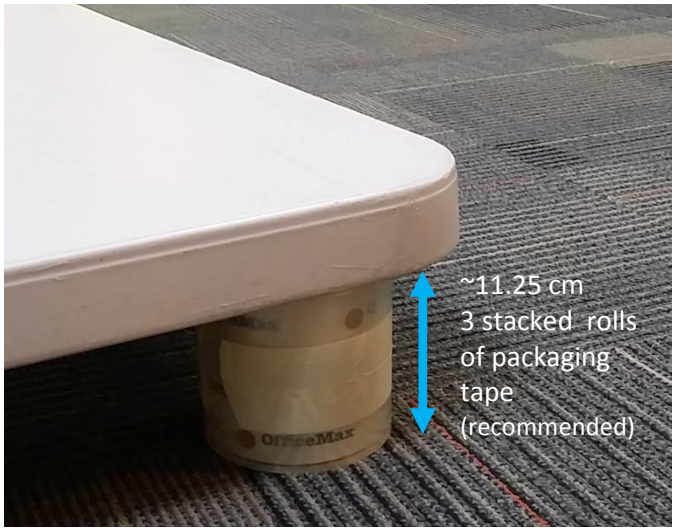
1-27-17, V1.4.1 (Final version)




(**Figure 1**) An example of BottleSumo Game Initial Configuration, Junior Division




(**Figure 2**) Bottle Dimensions




(**Figure 3**) Raised Table Setup

## 1. Game Objective and Synopsis

The objective of BottleSumo is to **EITHER** be the first robot to find and ***intentionally**** push a two-liter bottle (filled with 1 liter of water – see Figure 2) off the table **OR** be the last robot remaining on the table. The bottle will be placed at a location that is the same distance away from the two robots.

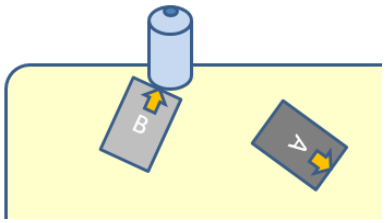
A robot is considered off the table when any part of it is touching the floor.

A robot is declared the winner of a game if one of the following criteria is met:

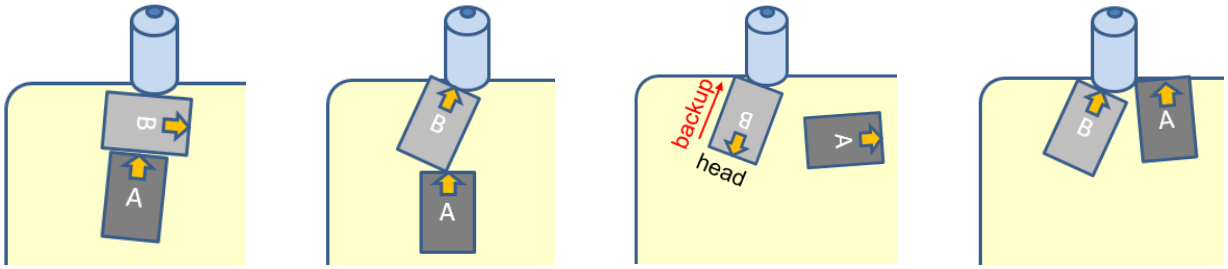
- It intentionally pushes the bottle off the table and then remains on the table for at least 3 seconds. **NOTE:** Judge must count to three to insure time requirement has been met before declaring a winner.
- It intentionally or unintentionally pushes the opponent off the table and then remains on the table for at least 3 seconds. **NOTE:** Judge must count forward to three (1..2..3..not 3..2..1) to insure time requirement has been met before declaring a winner.
- It remains on the table for at least 3 seconds after the opponent has committed "Sumocide" by falling off the table. **NOTE:** Judge must count to three to insure time requirement has been met before declaring a winner.
- If its opponent first pushes the bottle off the table but then commits "Sumocide" before the judge reaches the end of the 3 second count, the robot must remain on the table for an additional 3 seconds to win the game. **NOTE:** Judge must begin a new count to three after the opponent's "Sumocide" to insure time requirement has been met before declaring a winner.

Each robot must be fully autonomous. No human control, signal, or remote computer control (tele-operation) is allowed.

(*) **Intentionally** pushing the bottle off the table is defined as "the robot pushes the bottle off the table with any side of the robot that has a sensor, while neither the robot nor the bottle is in contact with the second robot." See the right figure. Robot A is not in contact with B or bottle.




**Unintentionally** pushing the bottle off the table is defined as "when the bottle falls off the table while both robots are in contact with each other [see (a) and (b) below], or when a robot pushes the bottle off the table with a side that does not have a sensor, as in the case when a robot is spinning [see (c) below], for example."




(a) (b) (c) (d)

As shown in figure (d) above, suppose B pushed the bottle off the table. It is an unintentional (not a clean) push, since the bottle was touched by robot A.

The game continues without the Bottle as head-to-head sumo wrestling when:

- The bottle is unintentionally pushed off the table
- It is *not* clear which robot pushed the bottle off the table

How to start the game (the way to start the robot moving) is an **unknown task** that is unveiled 30 minutes prior to impounding robots – *An example of the unknown task: a robot must wait 5 seconds after the game is started during which time a judge will place a bottle on the table approximately equidistant from each robot.*

## 2. Age Divisions and Competitions

Junior (Grades 5-8) Division teams will be using one table shown in Figure 1. Senior (Grades 9-12) teams will use two tables with an unknown configuration and has different robot requirements. See Figure 4 and Section 4 below.

## 3. Team Size

Maximum three members per team for both Jr. Division and Sr. Division.

## 4. Robot Requirements

Teams must bring a fully-constructed robot to the competition with a label clearly indicating their team number and the "front" of their robot. Teams will need to bring laptop computers to modify their programs to solve the unknown starting task as well as to adjust their programs for the lighting conditions, floor color, and table color, etc. that are unknown until the competition day. The following table shows details about robot specifications.

| | Junior Division | Senior Division |
|---|---|---|
| Maximum robot weight | 1 Kg | |
| Robot Controller | Lego NXT or EV3 | Any |
| Maximum robot width, length, and height | Must fit in 25x25x25cm box. Robots may *NOT* expand their dimensions during the game. | Must fit in 25x25x25cm box. Robots **may expand** their dimensions, but the maximum dimensions allowable is 35x35x35cm. |
| Number of robot controllers per robot | One controller only | Any |
| Traditional sensor types | Any unless it can be harmful to humans. | |
| On-board vision sensor system | Not allowed | Allowed |
| Number of sensors | Any | |
| Motor types | Any | |
| Number of motors | Maximum 3 | |
| Wheels or legs | Either | |
| Material | Any. You may use tape, glue, rubber bands, etc. (However, you cannot glue/tape the robot to the sumo ring floor.) Vacuum or sticky tires are ***not*** allowed. | |
| Programming language | Any | |

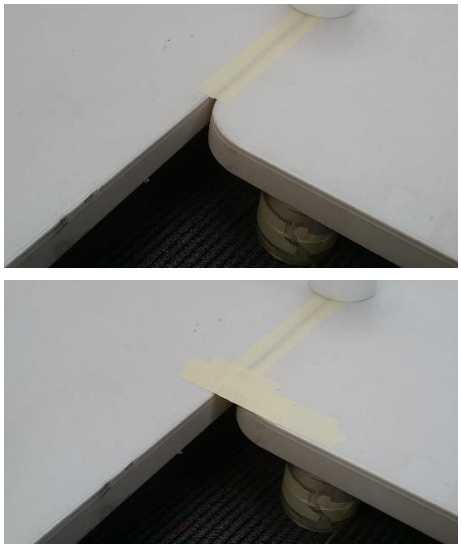
## 5. Game Playing Field Table

The tables that are used for the competition are 30"x72" (actual size is about 75 cm x 182 cm) plastic folding tables. The recommended brand is "LifeTime" which can be found at http://www.buylifetime.com/Products/BLT/PID-22901.aspx. The four corners of the table are rounded. The radius of the corner circle is 4cm ~ 7cm. The thickness of the table is about 4.5cm. The surface is light in color, for example, almond, tan, or gray. The exact size, color, brightness, and edge shape are unknown until the day of the competition. The table is placed on a dark colored floor with the legs folded under. The table can be raised up with rolls of tape (we recommend a stack of three), for example, as shown in Figure 3.

A two-liter bottle is covered with Legal size (8.5"x14") white paper. Red electrical tape or colored paper is used to create a red stripe as shown in Figure 2. The exact color of the red tape is unknown until the competition day.

The Senior Division field is made up of two tables. An example of a possible setup is shown in Figure 4. Figure 5a and 5b show how to connect them using masking tape similar to the color of the table. The exact color of the tape is unknown until the competition day.


(**Figure 4**) An example of a possible Sr. Division table configuration. Two tables are taped together with masking tape.



(**Figure 5a, 5b**) How to connect two tables with masking tape

## 6. Competition Procedures

A. Immediately after opening ceremonies, the method of starting the robot is unveiled. Examples of possible unknown start conditions could include (1) requiring the robot to delay movement for a specified number of seconds, (2) requiring the robot to respond to a sensor event such as a light bulb flash, (3) a combination of these tasks.
B. 30 minutes will be given to teams to work on programming their robot to satisfy the unveiled start condition. No adult help is allowed at this time.
C. After the 30 minute student work period, all the robots are impounded. At that time, robot size and weight will be checked. Judges will also inspect the robot for any illegal materials.
D. ***Time Trials***: The Judge will measure the time taken for each robot (one per table) to push two bottles (for Junior Division) or three bottles (for Senior Division) off the table. The maximum time given is 2 minutes.

- Time will be recorded to 1/100 of a second.
- Teams will be ranked based on their time trial results and the number of bottles successfully pushed off the table in the 2-minute time limit.
- If a robot commits Sumocide, survival time and number of bottles pushed off will be recorded
- If a robot fails the unknown start task, it will be ranked lowest
- Ties will be determined by team ID # (Lowest ID# is ranked the highest)
- Special prizes may be awarded based on these Time Trial results
- After each team's trial, their robot must be returned to impound.

E. After the Time Trials of all the robots, judges will allow teams to take the robots back to the team table to work on the robot for about 10 minutes.
F. During this time, a single elimination seeded tournament bracket will be created based on the rankings from the time trials.
G. Before the competition begins, all the robots must be impounded again. The size and weight of each robot will be checked again.
H. The Emcee will begin the official competition by reviewing important game rules and announcing procedures for implementation of the start conditions. (See examples of possible start procedures in Section 8.)

**7. Game Match Rules**

1) A match consists of up to three games.
2) Only one team player is allowed to start the robot.
3) At the start of each game, while the robots are in impound, the starting location and the orientation of the robots are announced. (See Figure 1 and 4 for examples of possible start locations/orientations).
4) The teams position their robots on the table and based on the unknown start condition, the judge or the emcee prompts the teams to run the program.
5) *S*tudents must immediately move at least ***1 meter*** away from the table edges at the start of the game and may not approach the table again until after the end of the game.
6) The judge will place the bottle on the table equidistant from the two robots at an appropriate time during the start procedure. The bottle location can be different for each Game. (See the blue dashed line on Figure 1 and 4). Judges must immediately move at least ***1 meter*** away from the table edges after positioning the bottle.
7) If any piece/part of the robot falls off or is intentionally released from the robot, the robot automatically loses the game.
8) If the bottle is pushed off the table unintentionally (by chance), the game continues with head-to-head sumo wrestling. (See section 1)
9) A maximum of 2 minutes is given for each game. A tie game will be declared if the judge determines that:
    - Both robots at the same moment have any of their parts touch the floor.
    - The robots both fall off the table within three seconds of each other.
    - NO progress is being made for about 20 seconds. The judge will announce a “Ten-second countdown” and begin a 10-9-8-7-6-5-4-3-2-1 countdown out loud before ending the game. (Audience participation encouraged!)
    - BOTH robots fail to start.
    - There is no winner after two minutes.
10) If the match is a tie, then the tie breakers will be (1) the time trial result (2) additional game(s)

The Judge will use his/her discretion to make any decisions for the situations not documented in these rules. The Judges’ rulings are final.

**8. Examples of Emcee's Announcements for Implementation of Start Conditions**

Example 1: Unknown start task is to wait 5 seconds after the program is started before moving.

> (1) Robots ready?
> (2) Run the program and move back; Judges! Position the bottle.

Example 2: Unknown start task is to wait until light bulb flash is detected before moving.

> (1) Robots ready?
> (2) Run the program and move back; Judges! Position the bottle.
> (3) Judges! Turn on the lights

**FAQs**

1) Can a robot have multiple programs to select from when a game is started? Yes. However, the selection must be done quickly. Teams will not have maintenance time between games.

2) If robot A intentionally pushes the bottle off the table, but it fell off the table before the 3 seconds. The opponent B survives at least 3 seconds after the A's fall. Who is the winner? B is the winner

3) If robot A pushes robot B off the table, but A fell off the table too before the 3 seconds. Who is the winner? Tie Game

4) If robot A intentionally pushes the bottle off the table, but it fell off the table before the 3 seconds. Then the opponent B committed "Sumocide" without surviving 3 seconds after the A's fall. Who is the winner? Tie Game

5) Robot A failed the unknown start. Robot B was successful and survived on the table at least 3 seconds. B is the winner

6) Both robots failed the unknown start. Tie Game

7) My start button was not pressed correctly. Can I touch the robot after the game started? No

8) What if a piece drops off the robot during a game? If any piece/part of the robot falls off or is intentionally released from the robot, the robot automatically loses the game.