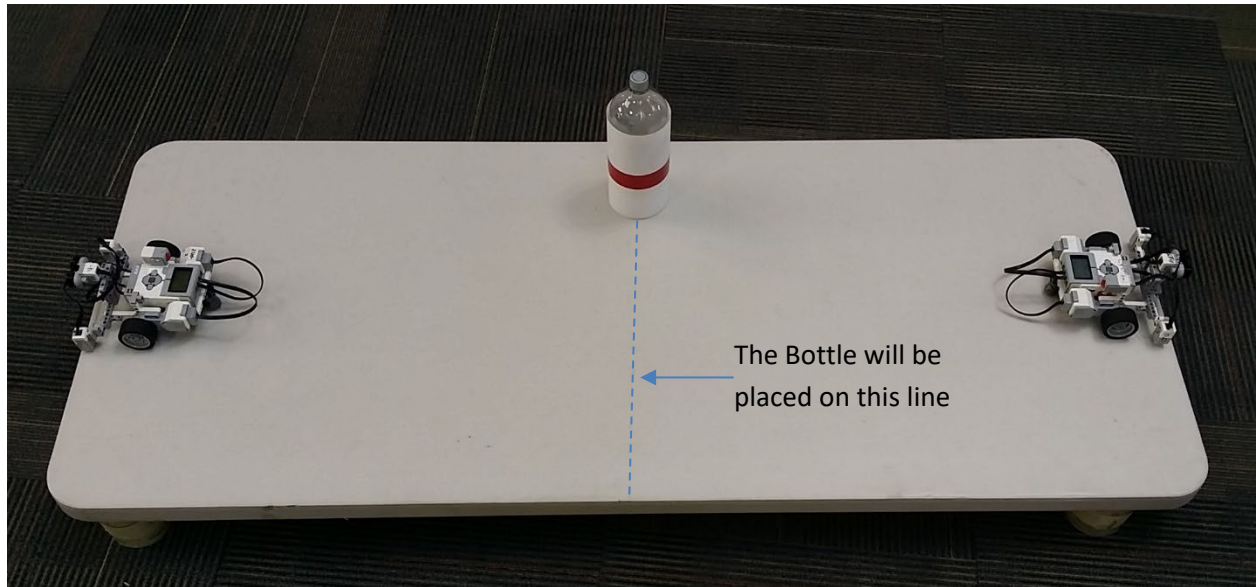
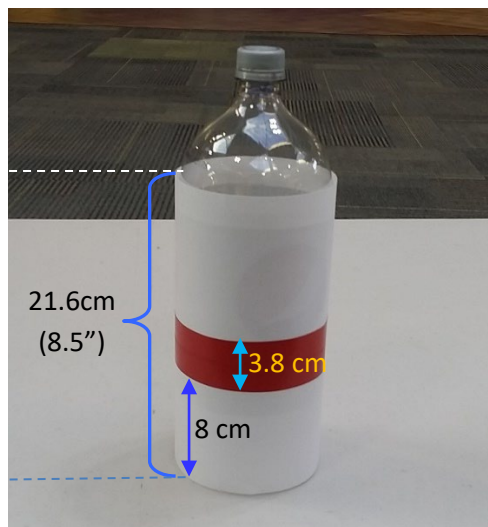


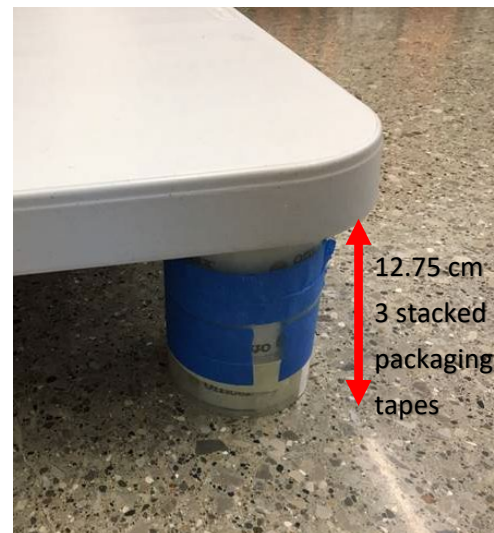
2018-2019 Season – Updated March 12, 2019



(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 for an autonomous robot 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 each robot. A robot is considered off the table when any part of it is touching the floor.

## 2. Determining a Winner

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

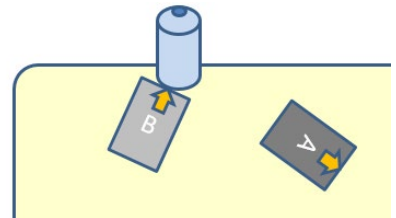
- (a) It intentionally pushes the **bottle** off the table and then remains intact and on the table for at least 3 seconds. **NOTE:** Judge must use a timing device such as the display timer, cell phone app, or stopwatch to insure time requirement has been met before declaring a winner.

- (b) It intentionally or unintentionally pushes the opponent off the table and then remains intact and on the table for at least 3 seconds. See (a) above.
- (c) It remains intact and on the table for at least 3 seconds after the opponent has committed “Sumocide” by falling off the table. See (a) above.
- (d) 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 intact and 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.

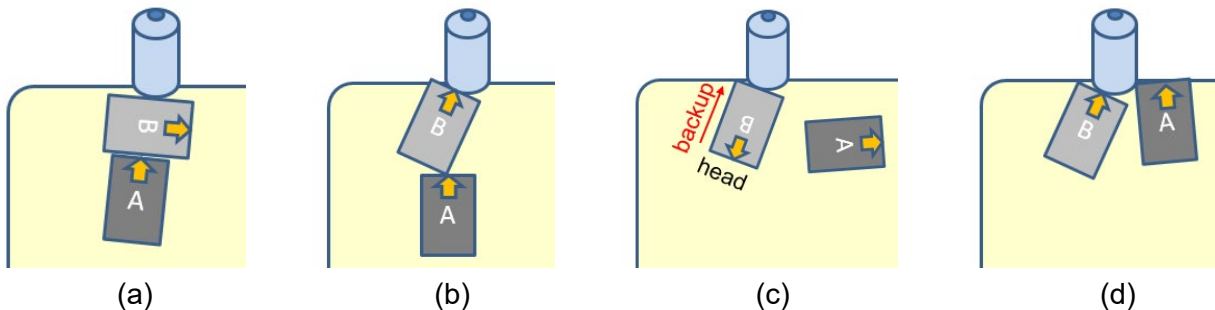
If the result of checking the above criteria is unclear, the game will be declared a tie and replayed. (For example, a robot dropped off the bottle, but the opponent robot pushed off the robot nearly at the end of 3 second survival time.

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.”



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

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

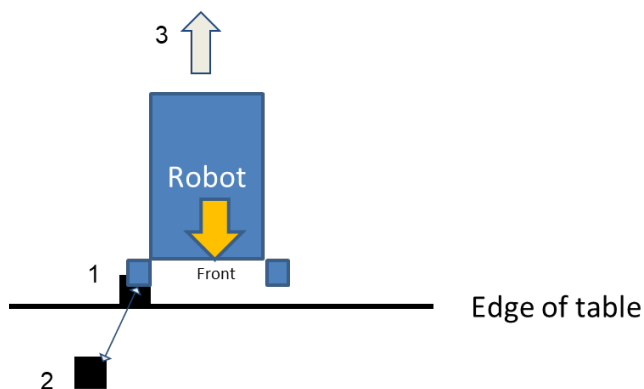
- The bottle is unintentionally pushed off the table.
- It is *not* clear which robot pushed the bottle off the table.

### 3. 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. Some examples of the *Unknown Tasks*:

*Example 1) a robot must wait 5 seconds after the game is started during which a judge will place a bottle on the table approximately equidistant from each robot.*

Example 2) a black sheet is placed under one of the light sensors. The robot must not start until the sheet is removed. Robot must then back up approximately 1 inch (25cm) and wait 3 seconds before continuing. A judge will place a bottle on the table approximately equidistant from each robot during the 3 sec. period.



(Figure 4) Unknown Start Example 2

#### 4. Age Divisions and Competitions

Junior Division (Grades 5-8) teams will be using one table shown in Figure 1. Senior Division (Grades 9-12) teams will use two tables with an unknown configuration and has different robot requirements. See Figure 5 and Section 6 below.

#### 5. Team Size

Maximum three (3) members per team for both Jr. Division and Sr. Divisions.

#### 6. Robot Requirements

Teams must bring a fully-constructed robot to the competition with labels clearly indicating their team ID 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 Classic   | Senior Unlimited |
|---|--|--|------------------|
| Maximum robot weight                    | 0.9 Kg   | 1.5 Kg   | 3 Kg             |
| Robot Brain                             | LEGO NXT, LEGO EV3, or Vex IQ  |  | Any              |
| Maximum robot width, length, and height | Must fit in 20x20x20cm box. Robots may <b>*NOT*</b> expand their dimensions during the game.                               | Must fit in 30x30x30cm box. Robots <b>may expand</b> their dimensions, but the maximum dimensions allowable is 35x35x35cm.   |                  |
| # of robot brains per robot             | One brain only   | Any  |                  |
| Traditional sensor types                | Any unless it can be harmful to humans.  |  |                  |
| On-board vision sensor system           | Not allowed  | Examples of allowed vision sensors:<br><ul style="list-style-type: none"> <li>NXTcam: <a href="http://www.mindsensors.com/ev3-and-nxt/14-vision-subsystem-camera-for-nxt-or-ev3-nxtcam-v4">http://www.mindsensors.com/ev3-and-nxt/14-vision-subsystem-camera-for-nxt-or-ev3-nxtcam-v4</a></li> <li>Pixicam: <a href="http://charmedlabs.com/default/pixy-for-lego-mindstorms/">http://charmedlabs.com/default/pixy-for-lego-mindstorms/</a></li> <li>Others such as smart phone vision: <a href="https://youtu.be/Kqyf0h16qI">https://youtu.be/Kqyf0h16qI</a></li> </ul> |                  |
| Number of sensors                       | At least one sensor that can detect dark/light contrast on the same plane AND at least one sensor that can detect objects. |  |                  |
| Motor types                             | LEGO NXT, LEGO EV3, or Vex IQ  |  | 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 <i>not</i> allowed. To determine if the tire is sticky or not, we will be use a small piece of paper. |
| Programming language | Any  |

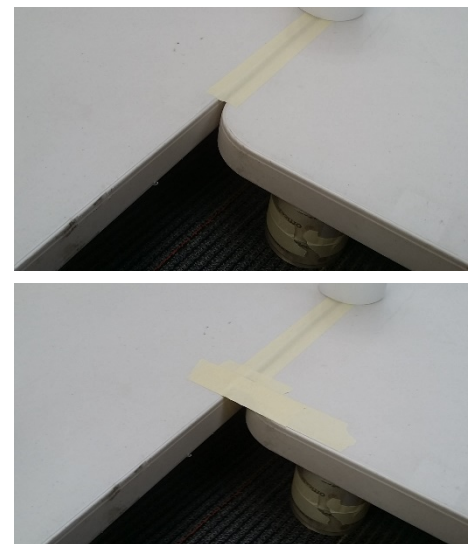
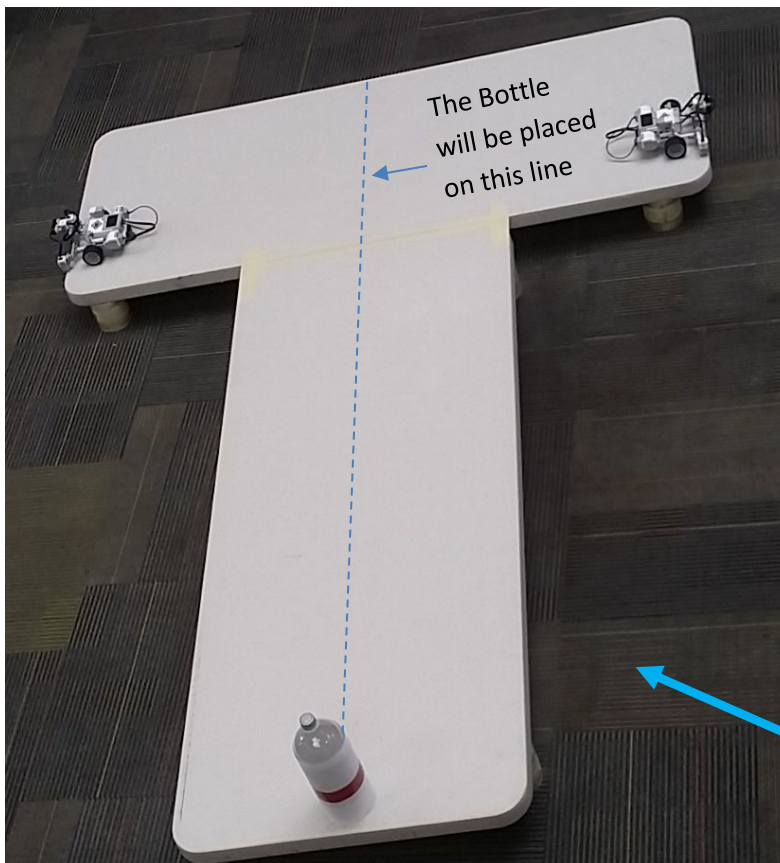
**Table 1 – Robot Specifications by Division**

## 7. 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 <https://www.lifetime.com/lifetime-2924g-6-foot-folding-table>. 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 packing tape for example, (we recommend a stack of three) as shown in Figure 3.

A two-liter bottle is covered with Legal size (8.5"x14") white paper. Red electrical tape or color 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 6a, 6b)** How to connect two tables with masking tape.

**(Figure 5)** An example of a possible Sr. Division table configuration. Two tables are taped together with masking tape.



## 8. Competition Procedures

- A. A BottleSumo competition has two competition sessions
  - a. Time Trial round to rank robots and seed a tournament bracket.
  - b. Single elimination tournament with “head to head” games.
- B. Only contestants are allowed to access the pit area, team tables, practice fields and official game fields throughout the competition day, including during the setup time before the opening ceremony, during work time and breaks (adult coaches, mentors, and other volunteers may assist with transporting team materials if necessary).
- C. Immediately after opening ceremonies, the method of starting the robot (Unknown Task) is unveiled. 30 minutes will be given to teams to work on their robot. No adult help is allowed at this time.
- D. After the 30 minute work period, all the robots are impounded. During impound robot size and weight will be checked. Judges will also inspect the robot for any illegal materials.
- E. **Time Trials:** The Judge will measure the time taken for each robot (one per table) to push two bottles (for Jr. Division) or three bottles (for Sr. Divisions) off the table. The maximum time given is 2 minutes.
  - (a) The Unknown Task must be used to initiate the robot.
  - (b) Time will be recorded to 1/100 of a second.
  - (c) Teams will be ranked based on their time and the number of bottles successfully pushed off the table in the 2-minute time limit.
  - (d) If a robot commits “Sumocide,” survival time and number of bottles pushed off will be recorded
  - (e) If a robot fails the unknown start task, it will be ranked at the bottom of the trails.
  - (f) Ties will be determined by team ID# (Lower ID# is ranked higher).
  - (g) Special prizes may be awarded based on these Time Trial results.
  - (h) After each team’s trial, their robot must be returned to impound.
- F. After the Time Trials of all the robots, teams are allowed to take the robots back to the team table to work on the robot until the tournament bracket is ready.
- G. During this time, a single elimination seeded tournament bracket will be created based on the rankings from the time trials. (See <http://www.printyourbrackets.com>) and <http://www.robofest.net/images/20172018/PDFS/BottleSumo1718Scoresheet.pdf>).
- H. Before the elimination rounds begin, all the robots must be impounded again. The size and weight of each robot will be checked again.

| <b>BottleSumo Time Trial Scoresheet</b>                           |           |   |    |                |
|---|-----------|---|----|----------------|
|   | Division  | Jr  | Sr |                |
|   | Team ID   | <input style="width: 100%;" type="text"/> |    |                |
|   | Team Name | <input style="width: 100%;" type="text"/> |    |                |
| Unknown Start was Correct?  |           | Y   | N  |                |
| Completion time<br>(Robot stays on table and removes all bottles) |           | <input style="width: 100%;" type="text"/> |    |                |
|   |           | OR  |    |                |
| Survival Time<br>(Robot falls off table or not all bottles off)   |           | <input style="width: 100%;" type="text"/> |    |                |
| Number of Bottles pushed off                                      |           | 0   | 1  | 2              |
|   |           |   |    | 3<br>(Sr Only) |
| Judge's Initials  |           | <input style="width: 100%;" type="text"/> |    |                |
| Team Member's Initials  |           | <input style="width: 100%;" type="text"/> |    |                |

(Figure 7) Example of Time Trial Scoresheet

## 9. Game Match Rules

- A. The Unknown Task will require the robot to wait for a starting signal such as a timer delay or a sensor event. The bottle is placed at an unknown location equidistant from the two robots during this wait period. The bottle location can be different for each game. (See the blue dashed line on Figures 1 & 5).
- B. If the robot violates the starting requirements, the robot automatically loses the game, unless the other robot also violates the starting requirement, in which case it is a tie.
- C. A match consists of the best of three games.
- D. At the start of each game, the judge will announce (a) the location of the robots on the table and (b) the orientation of the robots (For example, see Figure 1 and 5).
- E. Immediately after the Judge gives the signal to start the game, each robot must satisfy the unknown starting requirements, the Unknown Task, mentioned in section 1. Students/judges must move at least 1 meter away from the table edges and may not approach the table until after the end of the game.
- F. If any piece/part of the robot falls off or is intentionally released from the robot, and subsequently falls on the floor, the other robot will be IMMEDIATELY declared the winner.
- G. If the bottle is pushed off the table unintentionally (by chance), the game continues with head-to-head sumo wrestling (See section 1).
- H. A maximum of 2 minutes is given for each game. A tie game will be declared if the judge determines that:
  - (a) Both robots at the same moment have any of their parts touch the floor (except in the case of F).
  - (b) The robots both fall off the table within three seconds of each other.
  - (c) NO progress is being made for 20 seconds at Judge's discretion. 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!)
  - (d) BOTH robots fail to start.
  - (e) There is no winner after two minutes.
  - (f) If the result is unclear or too close to call.
- I. If the match is a tie, then the tie breakers will be (1) the time trial result (2) additional game(s) up to 2 additional games (3) tie-breaker time trial with one bottle.

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

## FAQs (Frequently Asked Questions)

- 1) Is the Unknown Task required? **Yes, successful implementation of the Unknown Task is required in order to participate in the time trial and the matches. Robots that fail to complete the Unknown Task during the time trial will be ranked at the bottom of the trials. A robot that fails to complete the Unknown Task during a game automatically loses the game, unless the other robot also violates the starting requirement, in which case it is a tie.**
- 2) 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.**
- 3) 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.**
- 4) 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.**
- 5) 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.**
- 6) Robot A failed the unknown start. Robot B was successful and survived on the table at least 3 seconds. **B is the winner.**

- 7) Both robots failed the unknown start. [Tie Game](#).
- 8) My start button was not pressed correctly. Can I touch the robot after the game started? [No](#).
- 9) 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, and subsequently falls on the floor, the other robot will be IMMEDIATELY declared the winner.](#)
- 10) What if the match is a tie after three games? [If the match is a tie after three games, then the tie breakers will be \(1\) the time trial result \(2\) additional game\(s\) up to 2 additional games \(3\) tie-breaker time trial with one bottle. The Judge will use his/her discretion to make any decisions for the situations not documented in these rules. The Judges' rulings are final.](#)

Change log: 3/12/2019- Robot specifications changed from 20 cm to 30 cm to match US Final Version.