

RoboBowl – Robofest 2015 Game

11-14-2014 (International version; To be finalized in mid-January 2015)

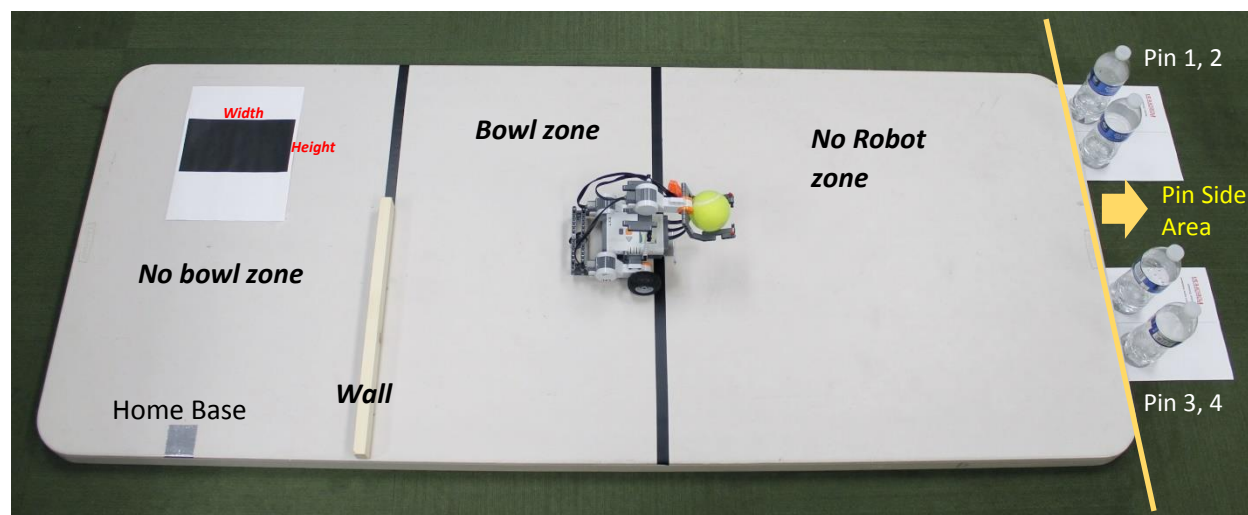


Figure 1 – RoboBowl Playing Field (Sr. Division pins)

Game Synopsis

The robot is to bowl, throw, shoot, or kick a tennis ball to knock down four pins (500 ml water bottles). If pins are knocked down, the highest point value will be awarded. If the ball just moves pins (not knocked down), or ends up in the pin side area, partial points as defined in the score sheet will be awarded. In addition, the robot is required to report the height of the black rectangle shape on a letter size paper in millimeters. The location of Pins 1 and 2 will be unveiled. The location of Pins 3 and 4 is based on the rectangle height measurement.

Rules

1. 7 tennis balls and 2 minutes are given per game.
2. The robot can carry (play) only one ball at a time.
3. When the ball is released from the robot, the ball cannot be re-used.
4. The ball is manually loaded by a human player only when the robot is at Home Base.
5. The robot cannot *physically touch* the “No Robot” zone, table surface to the right of the center black line as shown in Figure 1. Part of the robot may hover above the “No Robot” zone, as long as it does not touch the table surface.
6. Robot can bowl the ball as long as rule number 5 above is not violated. If the ball is released when any part of the robot touches the “No Robot” zone, it is a violation. See Violations section below.
7. For each violation, a ball is removed (dead). See *Violations section* below.
8. Robot must return to Home Base after each bowl, to get the next ball.
9. The robot is required to report the height x of the black rectangle printed on the letter size paper in millimeters **after** the game is over. See Figures 2 and 6.

Violations

If any of the following violation occurs, then one ball is removed & marked as dead. The Judge will order a team player to grab the robot immediately to restart at the Home Base.

1. Human contact with the official playing field materials, other than balls at Home Base
2. Human contact with the robot at any point on table other than Home Base
3. Robot falls off the table (Any part of the robot is touching the floor)
4. If any part of the robot touches the “No Robot” zone. The black tape is not regarded as No robot Zone.
5. The ball was released when any part of the robot was touching the “No Bowl Zone”, near Home Base. The black tape is not regarded as No Bowl Zone.

Playing Field Setup

The playing field is a 30”x72” (actual size is 75.6 x 182.3cm) plastic folding table that can be purchased at discount stores like Lowes, Kmart, or Sam’s Club. Recommended brand is “LifeTime”. The surface is light in color such as almond; however, the exact color, brightness, and edge shape are unknown until the competition day. The four corners of the table are rounded. The thickness of the table is about 4.5cm. The table is placed on a dark colored floor. Figure 2 is a drawing of the playing field features with dimensions shown in table 1. The 2” tall wall is made of a 1”x2” (1.9 cm x 3.7cm) pine wood bar attached to the table with VELCRO® or Dual Lock. The size of aluminum foil tape for the Home Base is approximately 5cmx5cm. Standard electrical tape (1.9cm wide) is used for the black lines. Four corners of the letter size paper will be taped.

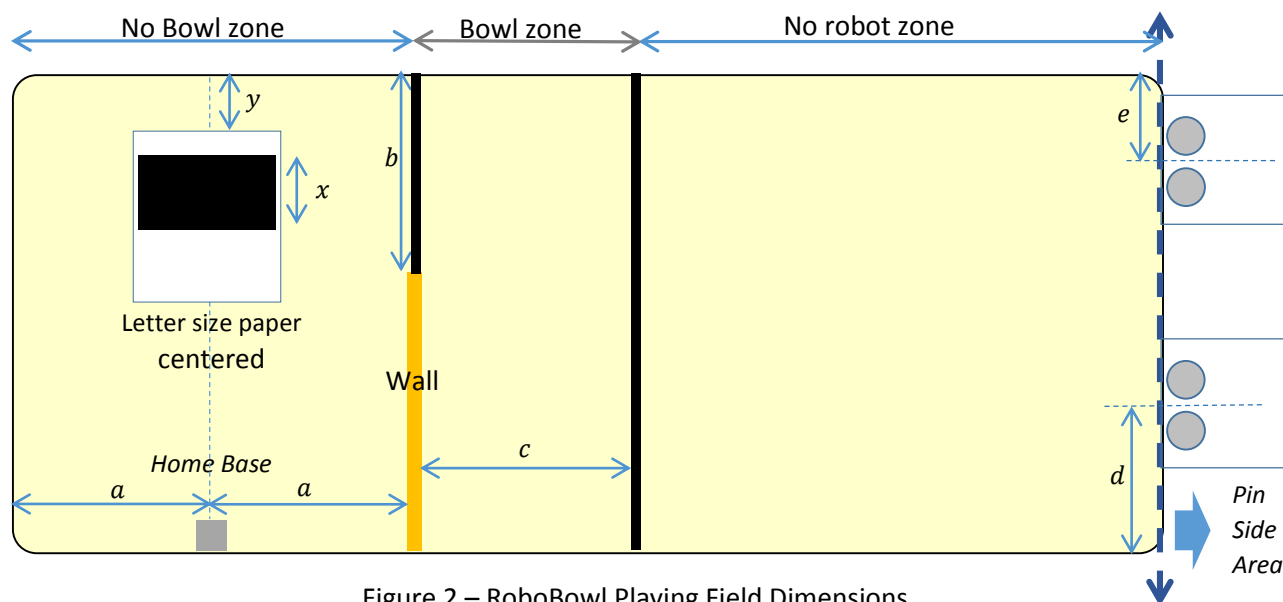


Figure 2 – RoboBowl Playing Field Dimensions

	Min	Max	Unveiled?
a, b	25cm	28cm	The tables will be set up at the competition and remain in that configuration during the entire event
c	35cm	50cm	
d	See table 2 below	See table 2 below	A formula to calculate d will be unveiled. For example: $d = x/2$
e	12cm	18cm	Unveiled
x	90mm	235mm	The robot must measure this value
y	5cm	10cm	Changing for each round

Table 1: Important values for the playing field

To Set Up the Bowl Pins

Four 500 ml water bottles are used for the pins. Height is approximate 21cm. Diameter of the bottom portion is around 6.5cm. Exact shape of bottle is unknown. Bottles will be partially filled with water. Two bottles will be placed on each letter size sheets of paper (21.6cm X 27.9cm) as shown in Figure 3 & 4.

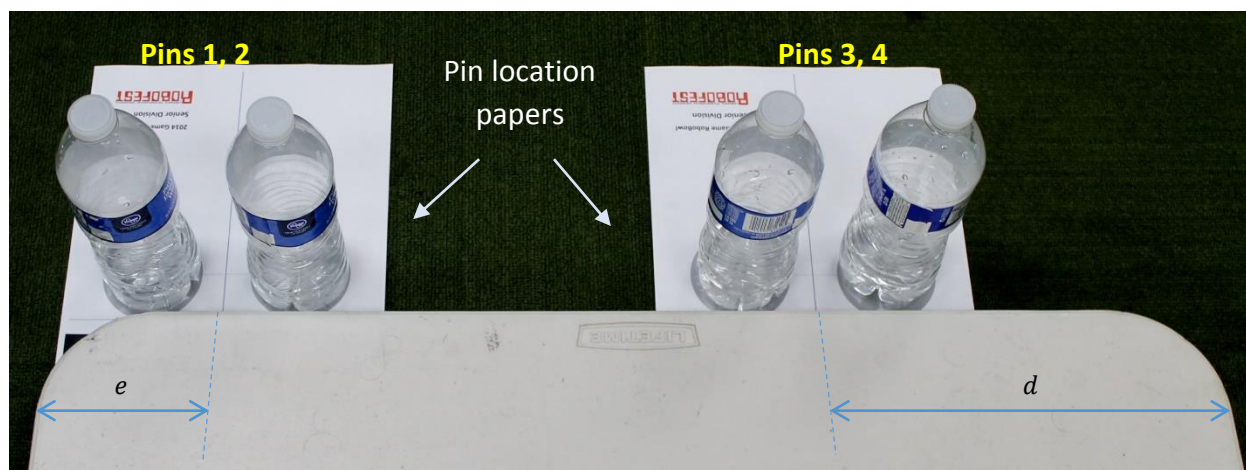


Figure 3 – RoboBowl Pin Setup (Sr. Division)

The letter size paper has two circles for the bottles and a center line to locate each paper relative to the edge of the table (See Figure 5). The papers may be taped down on the floor. PDF files for the papers may be downloaded:

- Jr. Division: <http://www.robofest.net/2015/pinlocatorJr.pdf>
- Sr. Division: <http://www.robofest.net/2015/pinlocatorSr.pdf>

Please note the only difference between the Jr. and Sr. Division is the spacing between the pins.

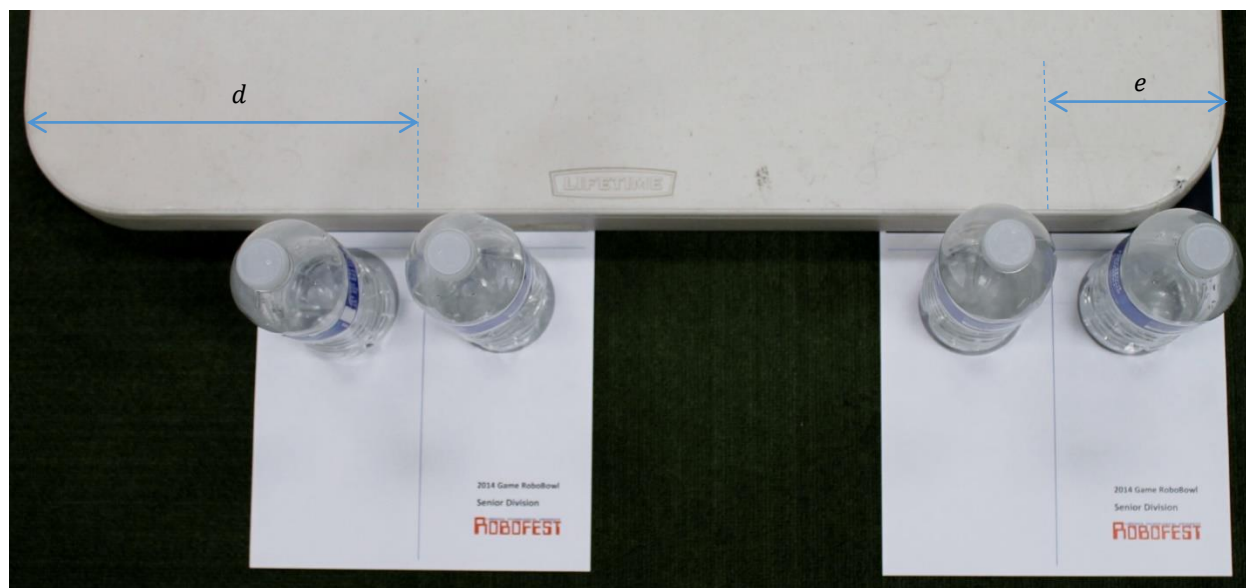


Figure 4 – RoboBowl Pin Setup from behind (Sr. Division)

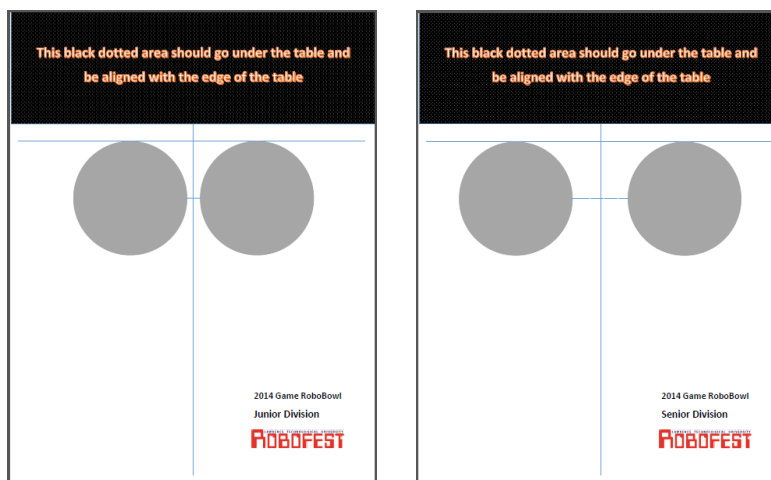


Figure 5 – RoboBowl Pin locator letter size papers (left: Jr. Division, right: Sr. Division)

The location, e , for pin locator page of pins 1 and 2 will be unveiled at the beginning of the 30 minute period. However, the location of the pin locator page for pins 3 and 4 will be unknown and placed after the robots are impounded. The unknown distance, d , must be calculated from the measurement, x , and an unveiled formula for d which is based on x .

For example, the unveiled formula could be $d = x/2 + 200$. In this case, the location of the pin locator center line from the edge of the table, d , will be determined by dividing the robot measured distance, x , by 2 and adding 200mm. If the measured distance, x , is 100mm, then $d = 100 / 2 + 200$ which is 250mm.

Measure Black Rectangle Shape on a Paper

The *height* of a black rectangle shape below determines x in millimeters in table 1. The following Figure 6 shows dimensions of the Black Rectangle shape on a letter size paper in detail. A PDF sample page can be downloaded from: <http://www.robofest.net/2015/bbpaper.pdf>

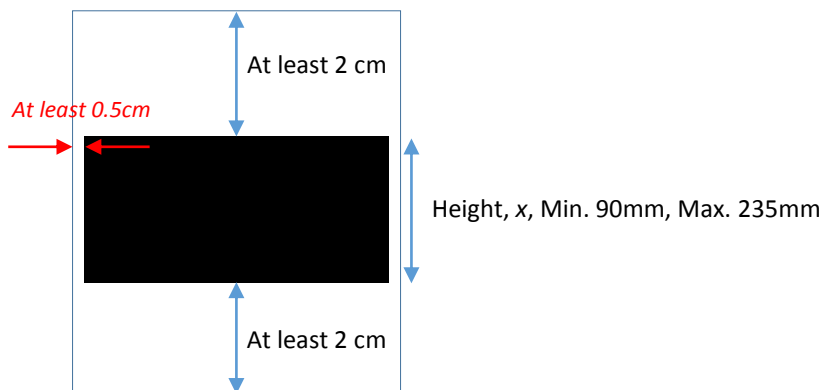


Figure 6 – A black rectangle shape on a letter size paper

Robot Specifications (For both Junior and Senior Division)

- Your robot may expand to bowl the ball. However, it still must fit in within a box with 35cm x 35 cm base (height of the box is unlimited) when fully expanded.
- Height and weight limitation: none
- Any number of sensors/sensor types (unless it is harmful to humans)

- Any number/type of motors/servo motors (multiplexor is OK to use)
- Any material/robot kit may be used to construct your robot including tape, glue, bolts and nuts, rubber bands, etc.
- Team ID tag on top of the robot is required.

Differences between Junior and Senior age divisions

	Junior (5 ~ 8 th grades)	Senior (9 ~ 12 th grades)
Weight of the bottle with water	Greater than 120g and less than 170g	Greater than 150g and less than 250g
The formula to calculate d	Simple $20 \leq d \leq 40\text{cm}$	Complex $10\text{cm} \leq d \leq 50\text{cm}$
Distance between two bottles	~ 7mm	~ 34mm
Number of controllers	One	Not limited

Table 2: Differences between Jr. and Sr. age divisions

FAQ

Q. A bottle was knocked down or moved because it was hit by another bottle. Is that counted as “knocked down” or “moved”? [Yes](#)

Q. A ball was dropped in the No Bowl Zone. What should Judge do? [Judge will announce the ball as dead and ask the team to restart with a new ball.](#)

Q. A ball was released when the robot was touching the No Robot Zone and a bottle was knocked down. What should Judge do? [Judge will announce the ball as dead, reset the bottle, and ask the team to restart with a new ball.](#)

Q. The robot fell off the table while holding a ball. What should Judge do? [Judge will take the ball and announce the ball as dead, and ask the team to restart with a new ball.](#)

Q. The robot without a ball fell off the table when it comes back Home Base. What should Judge do? [Judge will take one ball and announce the ball as dead, and ask the team to restart with a new ball.](#)

Q. A human player touches the robot with a ball outside Home Base. What should Judge do? [Judge will take the ball and announce the ball as dead, and ask the team to restart with a new ball.](#)

Q. A human player touches the robot without a ball outside Home Base. What should Judge do? [Judge will take a ball and announce the ball as dead, and ask the team to restart with a new ball.](#)

Q. There was a violation, but there is no ball alive. What should Judge do? [Judge will ask the team to restart. \(The team may try the rectangle shape height reporting\)](#)

Robofest 2015 Game RoboBowl Scoring Sheet

Division: Junior / Senior Team Name: _____

Team School / Organization Name: _____ Team Number: _____

 Round: First Second Track No.: _____

Judging Items		Count	Point Value (per count)	Score Earned / Lost
Points to be tabulated at the very end of a Game	Number of pins knocked down	0 1 2 3 4	15	Max. 60
	Number of pins moved that were not knocked down	0 1 2 3 4	10	Max. 40
	Number of balls that did not touch any pin, but ended up in "Pin Side Area"	0 ~ 7	2	Max. 14
Number of live (unused) balls (<i>Count only when all four pins were knocked down</i>)		0 ~ 6	3	Max. 18
The robot reported the height, x: _____ (*) (<i>Measured Value</i>) in millimeters at the end of the Game.		0 1 (no) (yes)	5	Max. 5
The robot remained intact throughout Game.		0 1 (no) (yes)	5	Max. 5
Number of dead balls due to violations (just to count)		0 ~ 7	0	
(*) If Measured Value was "blank", Final Score is Total Score. If Measured Value is a number, calculate $e = \frac{ \text{CorrectValue} - \text{MeasuredValue} }{\text{CorrectValue}}$ $\text{Final Score} = \begin{cases} \text{Total Score} & \text{if } e > 1.0 \\ \text{Total Score} + 15 * (1 - e) & \text{otherwise} \end{cases}$		Total Score Max. possible is 100		
		Final Score ** Calculated by Scorekeeper using Excel. Not to be rounded.		

Judge initials: _____

Team player initials: _____