

# RoboGolf (aka RoboPutting) – Robofest 2016 Game

11-13-2015 V1.08 (International Draft Version)

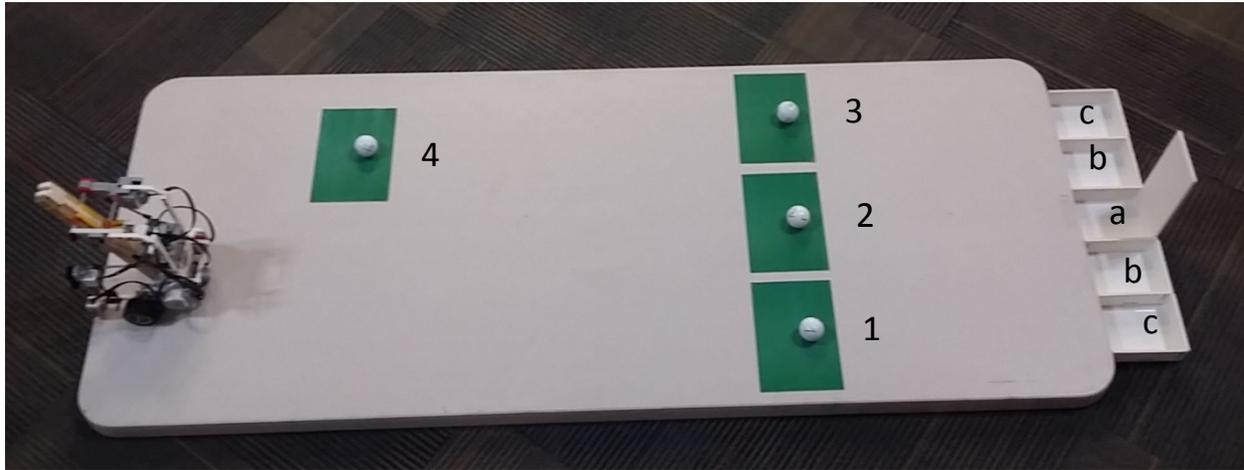


Figure 1. RoboGolf Playing Field (Jr. Division)

## A. Game Synopsis

There are four green areas with a golf ball. The robot is to autonomously find each green area, locate a golf ball, and putt the ball into a hole by using a specific piece of wood (wooden putter). The center hole, “a” in Figure 1, has the highest points. The location of the four green areas will be unveiled at the competition site for junior teams. However, the exact location of the green area No. 4 will be completely unknown to senior teams. The exact location of the golf ball on the green paper will also be unveiled to teams at the competition.

At the World Championship on May 14, 2016 at LTU, there will be unknown task(s) that require program changes and/or additions. In addition, at the World Championship, teams must demonstrate the assembly of the robot arm with the wooden putter without any adult’s help.

## B. Rules

1. 4 standard golf balls with numbers 1 ~ 4 marked by permanent marker will be used. Modification of the balls is not allowed.
2. 2 minutes are given per game round.
3. Starting location and robot orientation are unveiled before the work-time. The starting location will not be on green areas. It will not be between green areas 1~3 and the hole-slots. The front side of a robot could be defined as the direction normal to the putter ball contact surface.
4. The robot can putt only one ball at a time. The ball must only be touched/hit/struck once at the original location on the green to putt.
5. Teams cannot touch the robot during the round.
6. There is no Home Base. The robot does not need to return to where it started.

## C. Violations

If any of the following violation occurs, the game ends. Scores earned before the end can be retained.

1. Human contact/touch with the official playing field materials
2. Human contact/touch with the robot at any point on table after the start
3. The robot *touches* the hole-structures
4. The robot falls off the table (any part of the robot is touching the floor)

#### D. Invalid Putting occurs when:

1. The ball went into a hole, but was hit by the robot body, not by the wooden putter
2. The ball went into a hole, not by a single wooden putter hit (or strike)
3. The ball went into a hole, but was first moved by the robot body and then hit by the putter

If the above cases occur, the Judge must immediately announce “Invalid Putting” and record the ball number on the score sheet. Judges do not need to remove the ball from the hole. Note that if the ball does not go into the hole, then the Judges do not need to do anything.

#### E. Playing Field Setup

The playing field is a 30”x72” (actual size is about 75 x 182 cm) plastic folding table that can be purchased at discount stores like Lowes. The recommended brand is “LifeTime”. 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 such as almond or gray; however, the exact size, color, brightness, and edge shape are unknown until the competition day. The table is placed on a dark colored floor. Figure 2 is a drawing of the playing field features with dimensions. Table 1 describes the playing field values and whether the values are announced or not. Note that all 4 balls will be at the same position on their green area.

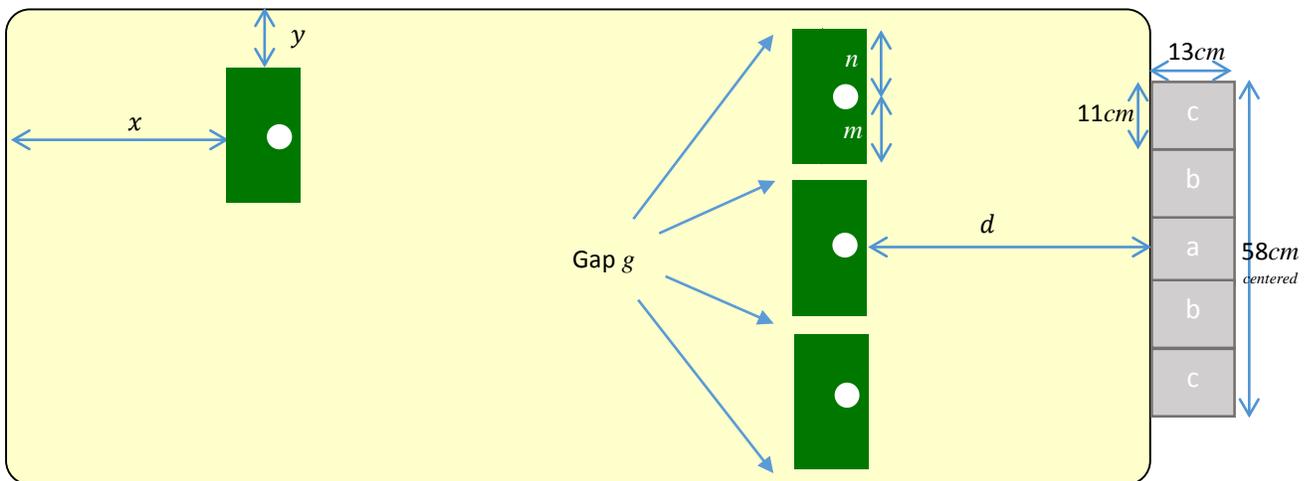


Figure 2. RoboGolf Playing Field Dimensions

	Min	Max	Unveiled?
$d$	35 cm	50 cm	The tables will be set up at the competition and remain in that configuration during the entire event. Teams are supposed to measure the values.
$g$	1.7 cm	2.3 cm	
$x$	35 cm	50 cm	Yes for Junior, No for Senior
$y$	5 cm	10 cm	Yes for Junior, No for Senior
$n/m$	1/7	7/1	Junior is 1; Senior unveiled

Table 1: Important values for the playing field

## F. Golf ball

Standard golf balls are used. The color of the balls may be white, but are unknown.

## G. Green area

The size of the green area is 15cm x 22cm. The RGB value of the green color is (0, 120, 0). The possible ball 7 locations are marked with “+” signs. It will be scotch-taped on four corners. As a part of the challenge, teams must design their robots in order to not be caught by the uneven surface due to the un-flat papers. [MS Word](#) and [PDF](#) files for letter size papers are available on the web. White edges of the paper should be cut out. See Figure 3.

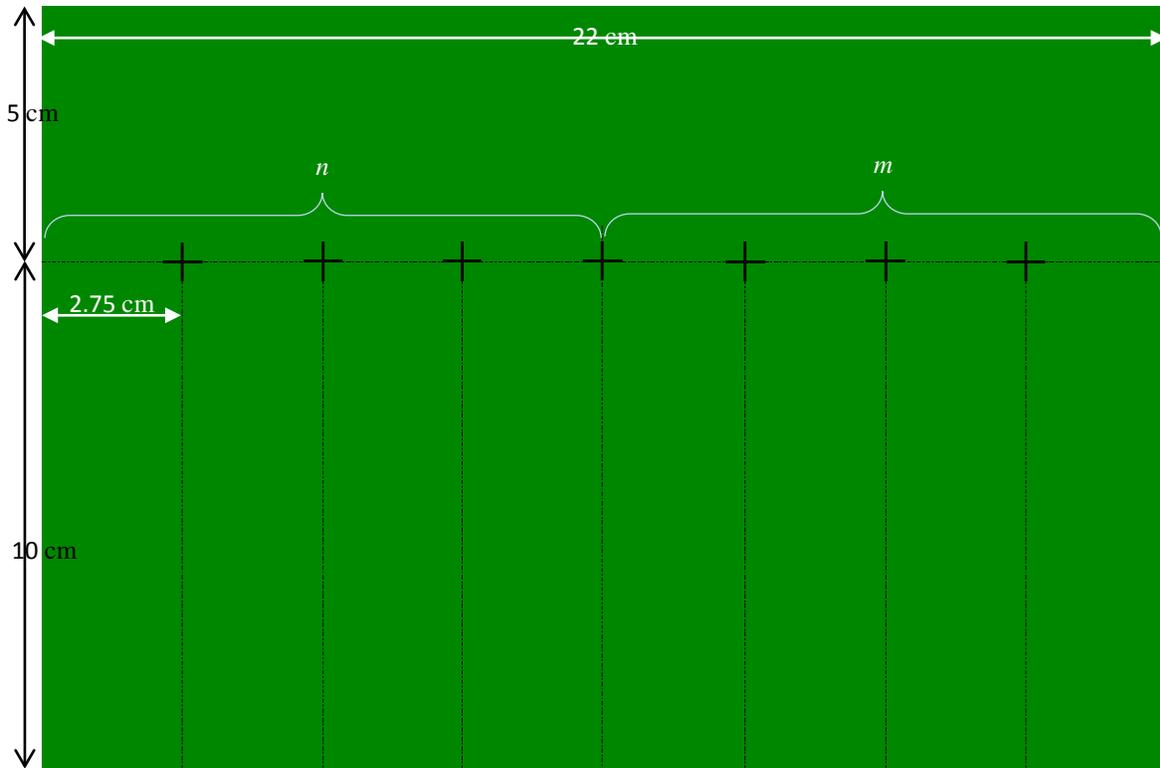


Figure 3. Green Area Dimension

## H. Wooden Putter

1x2 pine wood piece is used to make the wooden putter. Actual size is 1.9cm x 3.8cm x 28 cm. Weight is about 84g. The wooden putter can be slightly modified (for example: drilled to make holes) as long as the above dimensions are not changed. Only one putter shall be used for a robot. See Figure 4.



Figure 4. The wooden Putter

## I. Hole-slots

Hole-slots are made of white foam boards. The [Instructions to construct the slots in PDF](#) are available. Legs of the slots will be under the table, which means the table has a slight increasing slope toward the holes. The inside dimensions of each hole-slot is 11x13 cm. The wall thickness is 0.5 cm. All the slots can be taped together and centered to the table. See Figure 5.

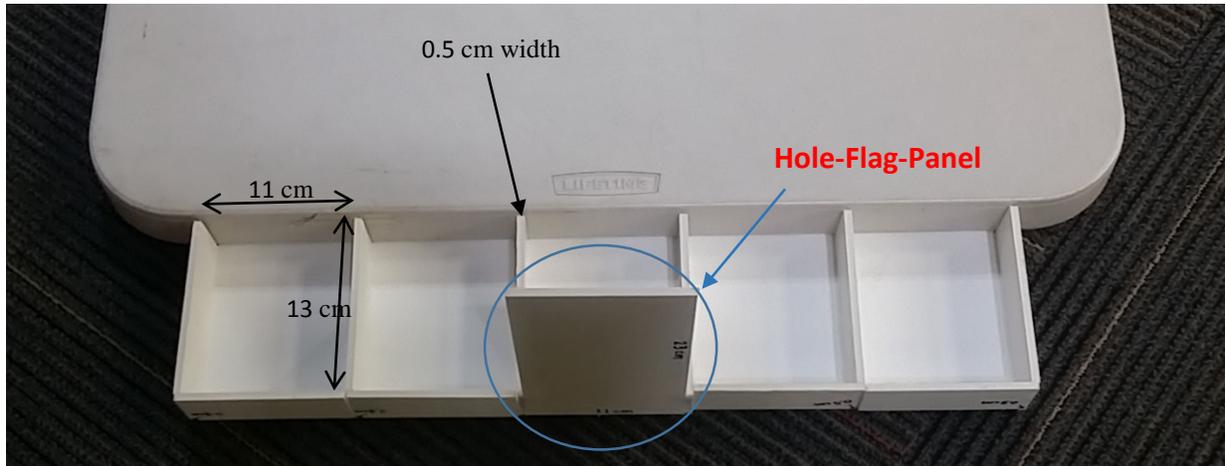


Figure 5. Setup of Hole-slots

## J. Robot Specifications (For both Junior and Senior Division)

1. Your robot may expand to putt the ball. However, it still must fit within a box with a 50 x 50 x 50 cm base when fully expanded.
2. Weight limitation: none
3. Any number of sensors/sensor types (unless it is harmful to humans)
4. Any number/type of motors/servo motors (multiplexor is OK to use)
5. Any material/robot kit may be used to construct your robot including tape, glue, bolts and nuts, rubber bands, etc.
6. A team ID tag on top of the robot is required.

## K. Differences between Junior and Senior age divisions

	Junior (5 ~ 8 <sup>th</sup> grades)	Senior (9 ~ 12 <sup>th</sup> grades)
<i>n/m</i>	1	Unveiled. Can be between 1/7 and 7/1
<i>x</i> and <i>y</i>	Unveiled.	Not unveiled at all. Robot must search for the green area No. 4.
Number of controllers	One	No limit

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

## L. Rules to Play Two Rounds and Determine Winners

1. Playing field configuration may be different for each round.
2. Teams will be given 30 minutes after unknown factors are unveiled to work on their robots. During this time, no adult (including parents and coach) is allowed in the pit.

3. All teams must submit their robot to the impound area when the 30 minute work-time is expired.
4. After impounding, the judges will reset green No. 4 location. (Senior division only)
5. The Emcee shall announce the following before each round: *No adult is allowed in the pit area from now till all the robots are impounded. Student must stay in the pit area until their robot is impounded. The use of any communications devices to remotely control robots or communicate with players is prohibited in this competition arena. If anyone sees any suspicious activities, please notify the nearest volunteer immediately. You are welcome to take pictures or video, but please make sure your flash light is off.*
6. Only two contestants per team are allowed at the playing field during your run.
7. Teams will compete in a pre-determined order decided by the site host.
8. Winners in each age division will be decided by the **average** Final Score of the 2 rounds. Tie breakers will be: (1) best Final Score of two rounds, (2) rerun, if needed. At the World Championship on May 14, completion time may be used as another tie breaker, if necessary. Details about the World Championship tie breakers will be notified on the World Championship 2016 page.

### M. Special Notes

1. Though every effort is made to be consistent and precise in all of the dimensions of the playing field and parts, Robofest assumes some error of up to  $\pm 0.3$  cm or  $\pm 2$  grams.
2. If there are multiple playing fields at the competition sites, the Chief Game Judge will check consistency between the playing fields.
3. When the robot is searching for the hole-flag-panel using distance sensor(s), Judges should maintain at least 4 feet distance from the table.
4. Final decisions are at the discretion of the Chief Game Judge.

### N. FAQs

1. What happens if the ball is putted before the 2 minutes end and enters into the hole after 2 minutes? **It is valid.**
2. What happens if a ball hits another ball? **The Game continues and scoring is done at the end of the game.**
3. What happens if a ball bounces out of the hole-slot after hitting another ball in the slot? **Game continues and scoring is done at the end of the game. The slot has enough room for more than 4 balls.**

### O. Bill of Materials to Construct a Playing Field

	Est. Unit Cost	Quantity	Cost
30" x 72" Folding Table; Suggested tables can be found at: <a href="http://www.buylifetime.com/Products/BLT/PID-22901.aspx">www.buylifetime.com/Products/BLT/PID-22901.aspx</a> ; Almond color; Folding tables will be re-used in future Robofest games. Note that the thickness of the table is about 4.5cm.	\$50 (at Lowe's)	1	\$50
Golf ball	\$1	4	\$4
White letter-size papers for printing green areas			N/A
White foam board, 20" x 30" x 3/16" (508 x 762 x 5 mm)	\$5	1	\$5
Scotch tape	\$2	1	\$2
1"x2" (1.9 cm x 3.8cm) pine wood piece top choice (6ft long) at Lowes	\$2.50	1	\$2.50
<b>Total</b>			<b>\$63.50</b>



# Robofest 2016 Game RoboGolf Scoring Sheet, An Example

Division: Junior / Senior Team Name: \_\_\_\_\_

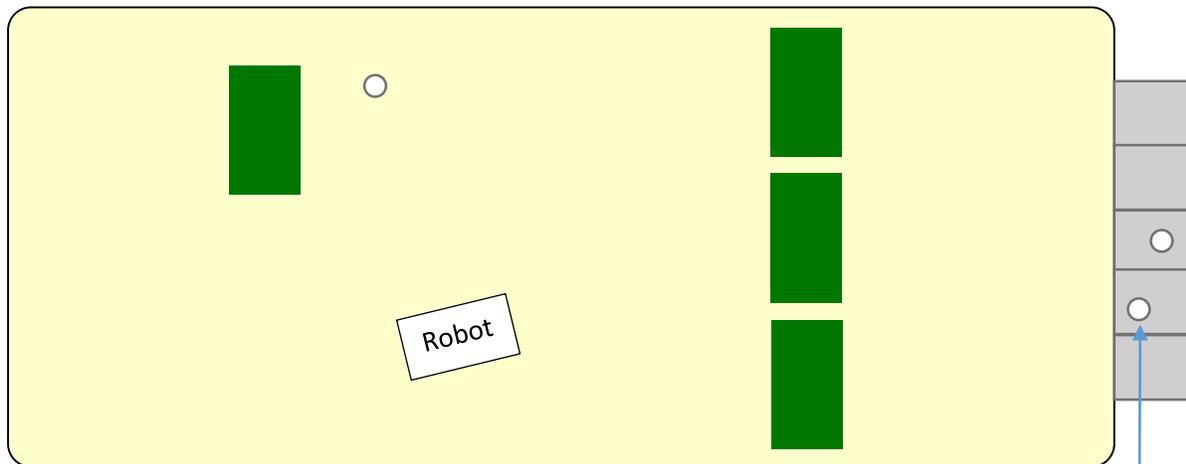
Team School / Organization Name: \_\_\_\_\_ Team Number: \_\_\_\_\_

Round: First Second Track No.: \_\_\_\_\_

Judging Items (Check after the game is over)	Count	Point Value (per count)	Score Earned
Number of legal balls in the center hole	0 <b>1</b> 2 3 4	22	<b>22</b> <i>Max. 88</i>
Number of legal balls in the 2 <sup>nd</sup> layer holes	<b>0</b> 1 2 3 4	15	<b>0</b> <i>Max. 60</i>
Number of legal balls in the 3 <sup>rd</sup> layer holes	<b>0</b> 1 2 3 4	10	<b>0</b> <i>Max. 40</i>
Number of invalid balls in the holes <i>Circle invalid ball ID numbers:</i> 1 <b>2</b> 3 4	0 <b>1</b> 2 3 4	5	<b>5</b> <i>Max. 20</i>
Balls outside the green not in the holes.	0 1 <b>2</b> 3 4	5	<b>10</b> <i>Max. 20</i>
The robot remained intact throughout Game.	0 (no) <b>1</b> (yes)	6	<b>6</b> <i>Max. 6</i>
The robot remained on the table from start until end.	0 (no) <b>1</b> (yes)	6	<b>6</b> <i>Max. 6</i>
	<b>Total Score</b>		<b>49</b>
	<b>Time taken in seconds</b> (may be used as a tie breaker for World Championships)		

Judge initials: \_\_\_\_\_

Team player signature: \_\_\_\_\_



○ ← Pushed by robot

Invalid ball, #2