

# RoboGolf (aka RoboPutting) – Robofest 2016 Game

1-16-2016 V2.0 (Frozen Official version; Changes after Official version can be found on the [web](#))

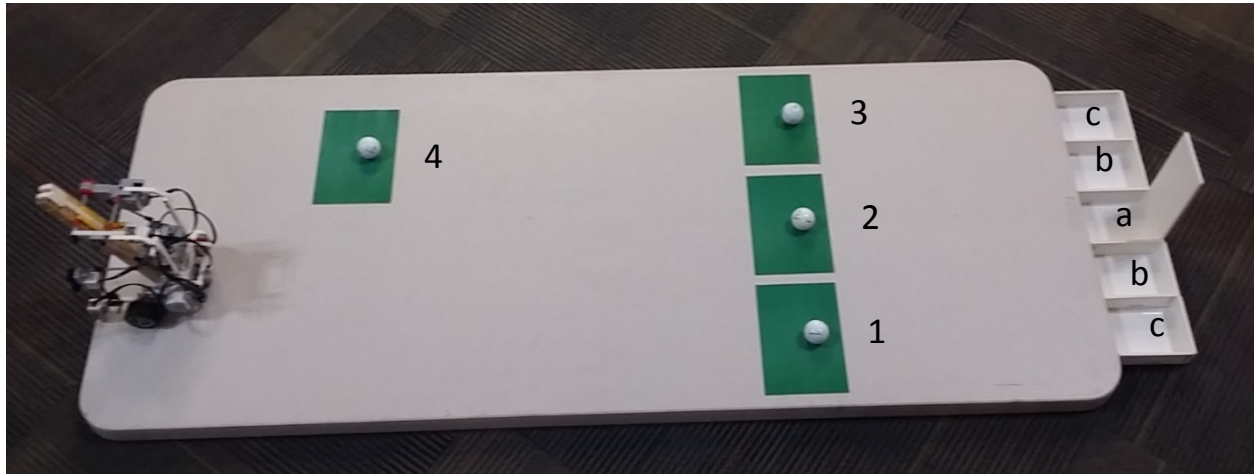


Figure 1. RoboGolf Playing Field, an example

## 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, **stop**, 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 **for each round**. 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 the robot must be labeled before impounding.**
4. The robot can putt only one ball at a time. The ball may only be struck/hit once and at the original location on the green.
5. **The robot body must be at rest while the robot is striking the ball with the putter.**
6. **The wooden putter must be moved by at least one actuator, for example motor.**
7. Teams cannot touch the robot during the round.
8. There is no Home Base. The robot does not need to return to where it started.
9. Only Judge can end the round.

## C. Violations

If any of the following violations occur, the round ends. Scores earned before the end of a round are retained.

1. Human contact/touch with the official playing field materials
2. Human contact/touch with the robot at any point after the start. (See item G on scoresheet)
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 ball is declared when it goes into a hole-slot by illegal putting as below:**

1. The ball was hit by the robot body, not by the wooden putter
2. The ball was **pushed**, but not hit or struck by the putter
3. The ball was **legally putted, not from the original location**
4. The robot body was moving when the putter struck/hit the ball

If the above cases occur, the Judge must immediately announce “Invalid” and record the invalid ball number on the score sheet. The round continues, and the Judge leaves the ball where it lies either in the hole or on the table. (If the ball does not go into a slot by invalid putting listed above, Judges do not need to do anything during the game.)

**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 (not on the top of tables). 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. All practice and official game tables will have same (with some tolerance)  $d$ ,  $g1\sim g4$  values.

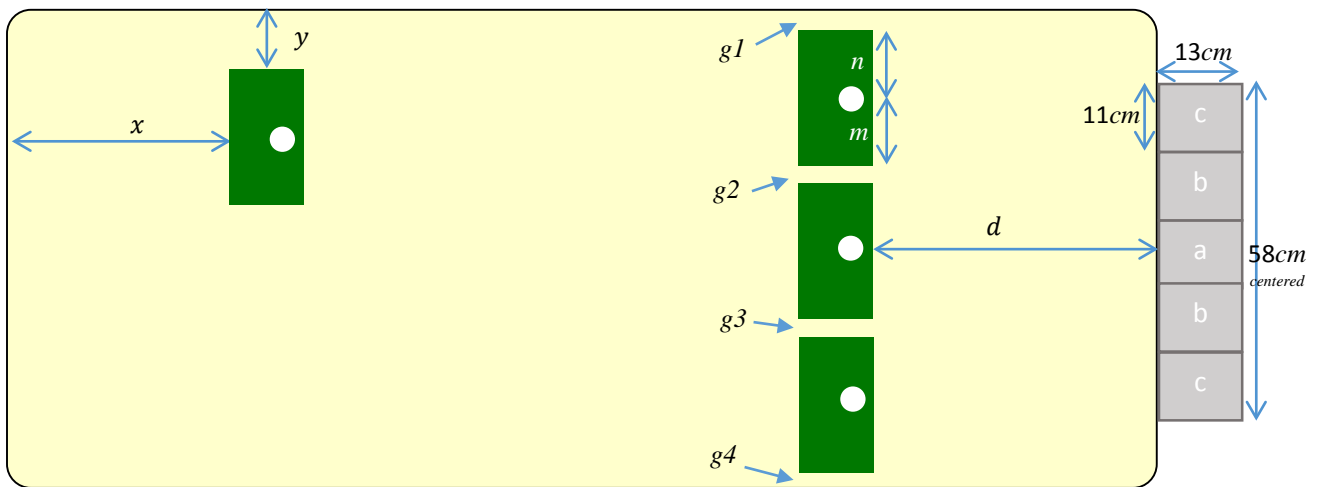


Figure 2. RoboGolf Playing Field Dimensions

	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.
$g1 \sim g4$	1.5 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 (= 4/4); 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. **Ball number will be hand-written by using permanent marker in unknown color.**

## 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 7 ball 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. Exact type of the tape is an unknown factor. [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.

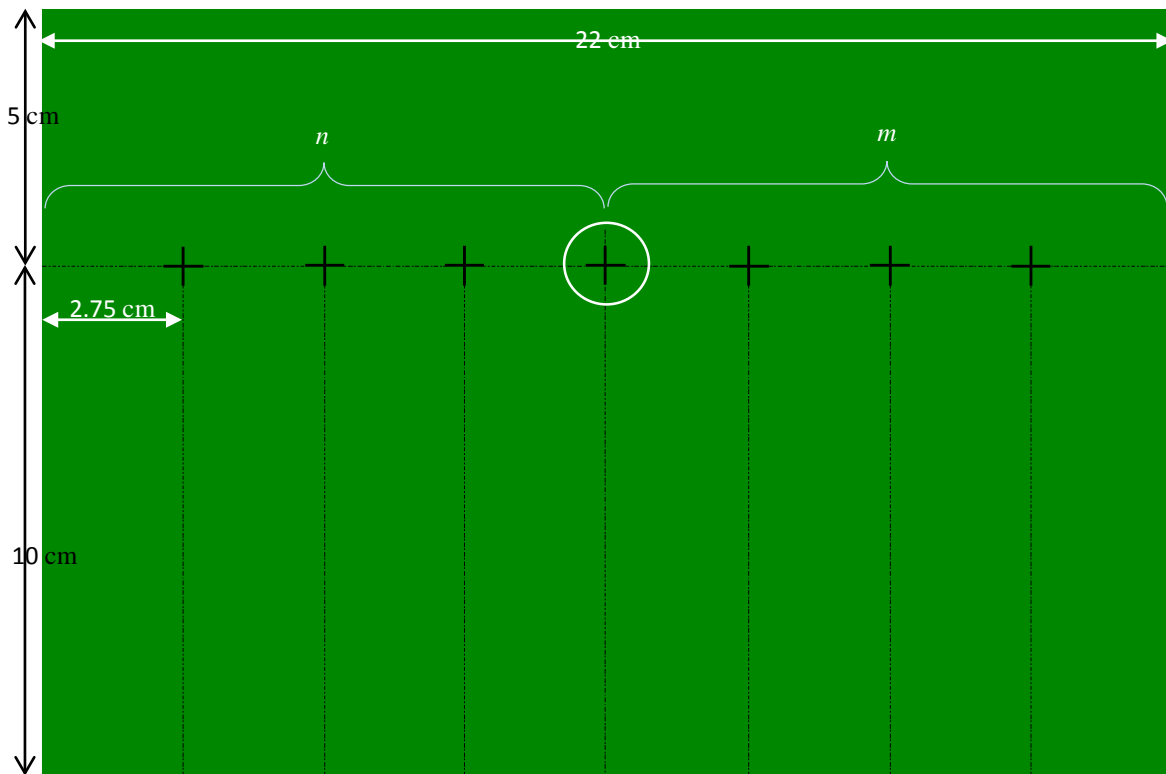


Figure 3. Green Area Dimension

## H. Wooden Putter

1x2 un-painted wood piece is used to make the wooden putter. Pine wood is recommended. The dimension is shown in Figure 4. **The tolerance of the dimension is  $\pm 1\text{mm}$ .** The wooden putter can be slightly modified (for example: drilled to make holes **or sanded**) as long as the dimensions are **maintained**. The putter should be designed to hit the ball with wood part only. Only one putter **operated by at least one actuator** shall be used for a robot.

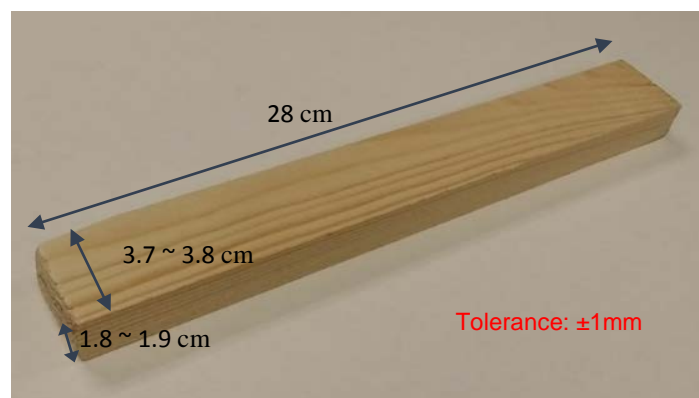


Figure 4. The wooden Putter

## 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.

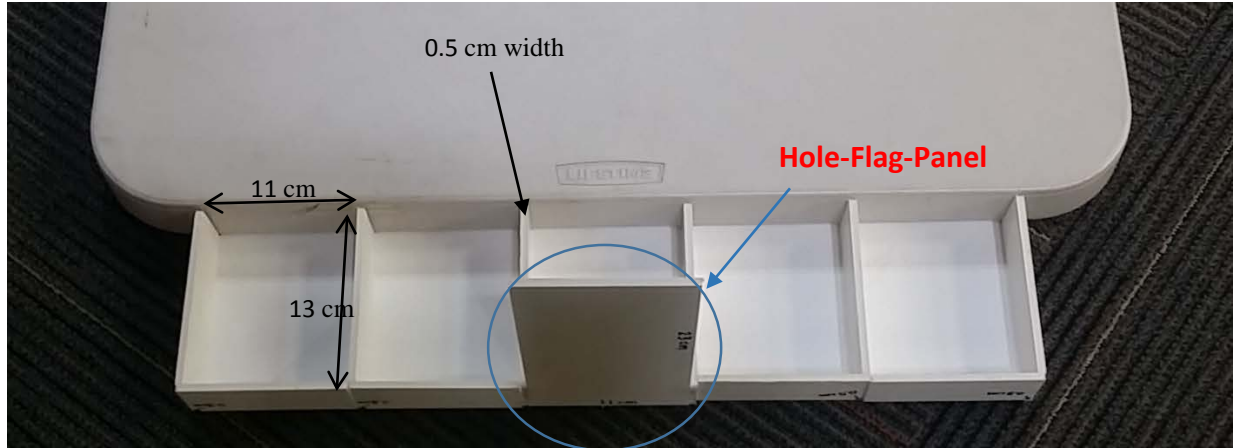


Figure 5. Setup of Hole-slots

## 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 Robofest team ID tag on top of the robot is required.
7. A label identifying the front side 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)
$n/m$	1 ( $n$ is equal to $m$ )	Unveiled. Can be between 1/7 and 7/1
$x$ and $y$	Unveiled prior to the work-time for each round	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. When unknown factors are unveiled, teams will be provided hard-copy of unveiled information.
3. Teams will be given 30 minutes (work-time) after unknown factors are unveiled to work on their robots. During this time, no adult (including parents and coach) is allowed in the pit.
4. All teams must submit their robot to the impound area when the 30 minute work-time is expired.

5. During the impounding process, judges will inspect robots. (size of the robot, the putter, Team ID, **and label indicating the front side**)
6. After impounding, the judges will reset Green Area No. 4 location. (Senior division only)
7. The Emcee shall announce **Section M** before the work-time begins each round.
8. Teams will compete in a pre-determined order decided by the site host.
9. Only two contestants per team are allowed at the playing field during your run.
10. **Contestants must move away at least 1m from the table edge after starting the robot.**
11. **A team member must sign the score sheet to confirm the team's score.**
12. Entered scores shall be displayed to teams to validate data entry.
13. 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 announced on the World Championship 2016 page.

### M. Important Announcements Before Each Round

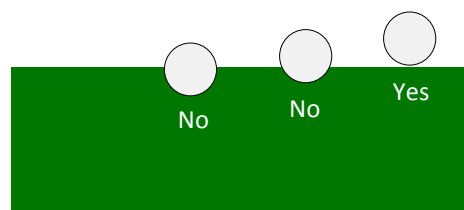
- No adult is allowed in the pit area during work-time.
- Any verbal/electronic communication between coach/parent/contestants is prohibited during work-time. If anyone sees any suspicious activities, please notify the nearest volunteer immediately.
- Students must stay in the pit area until their robot is impounded.
- Spectators are welcome to take pictures or video, but please make sure your flash is off.

### N. 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, **unless stated otherwise.**
2. If there are multiple playing fields at the competition sites, the Chief Game Judge will check consistency between the playing fields.
3. Judges & contestants should maintain at least **1m** distance from the table.
4. Final decisions are at the discretion of the Chief Game Judge.

### O. FAQs

1. What happens if the ball is putted before the 2 minutes end and enters into the hole after the 2 minutes end? **It is valid.**
2. What happens if a ball hits another ball? **The game round continues and scoring is done at the end of the round.**
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.**
4. The ball was putted and landed on another green area. Can the team get 5 points? **Yes**
5. How to decide whether a ball is outside the green? It must be completely outside. **See Figure below.**



6. Are the greens #1, #2, and #3 parallel to each other? **The Green Areas will be setup as parallel as possible. But there will be some error margin.**
7. Can teams use pool stick style or baseball batting style putting? **Yes.**
8. Can you add more weight to the putter? **We will check only the dimension of the wood.**
9. Can holes be drilled in the wood? **Yes. We encourage students to use screws or nuts and bolts rather than glue, since we will require teams to detach the wood from the robot to start the competition at the World Championship.**
10. How will the starting location be determined by the center of the robot or by the edge? **By the edge. Team should select what is considered the “front” of their robot and label it. Once it is chosen and labeled, it cannot be changed.**
11. Is there a chance to restart? **No. Once started, there will be no restarting.**
12. Can student verbally say when they want the round to be ended? **No. Team members cannot terminate the game or approach the table to grab the robot. The game will end only if one of the following occurs:**
  - The 2 minute time limit expires
  - All 4 balls have been hit and have come to rest AND the robot stops on the table
  - The robot leaves the table (the table will be on the floor, so it would not fall)
  - The Judge asks the team members if they would like to end the round if the robot malfunctions or stops moving
13. Can a robot use a touch sensor to start? **Yes.**
14. Balls moved since Robot was heavy or it struck the table. Do we reset the balls? **No. Game continues. Robots should be constructed to move without disrupting the balls on the table. Disrupted balls will not get any points. See item E on scoresheet.**

## P. 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; It will be re-used in future Robofest games. Note that the thickness of the table is ~ 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

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
A	Number of legal balls in the center hole	0 1 2 3 4	22	Max. 88
B	Number of legal balls in the 2 <sup>nd</sup> layer holes	0 1 2 3 4	15	Max. 60
C	Number of legal balls in the 3 <sup>rd</sup> layer holes	0 1 2 3 4	10	Max. 40
D	Number of invalid balls in the hole-slots <i>Circle invalid ball numbers: 1 2 3 4</i>	0 1 2 3 4	5	Max. 20
E	Number of <i>undisrupted</i> balls outside their own green (not in the hole-slots)	0 1 2 3 4	5	Max. 20
F	The robot remained intact <b>from start until end</b>	0 1 (no) (yes)	6	Max. 6
G	The robot remained on the table from start until end. <b>(if touched by human hand, score = 0)</b>	0 1 (no) (yes)	6	Max. 6
			<b>Total Score</b>	
			<b>Time taken in seconds</b> (may be used as a tie breaker for World Championships)	

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

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

*Scores cannot be changed after signing*



# 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
A	Number of legal balls in the center hole	0 <b>1</b> 2 3 4	22	<b>22</b> <i>Max. 88</i>
B	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>
C	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>
D	Number of invalid balls in the hole-slots <i>Circle invalid ball numbers: 1 <b>2</b> 3 4</i>	0 <b>1</b> 2 3 4	5	<b>5</b> <i>Max. 20</i>
E	Number of <i>undisrupted</i> balls outside their own green (not in the hole-slots)	0 1 <b>2</b> 3 4	5	<b>10</b> <i>Max. 20</i>
F	The robot remained intact <b>from start until end</b>	0 <b>1</b> (no) (yes)	6	<b>6</b> <i>Max. 6</i>
G	The robot remained on the table from start until end. <b>(if touched by human hand, score = 0)</b>	0 <b>1</b> (no) (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: \_\_\_\_\_

