

RoboHit™ – Robofest® 2017 Game

V1.6 Jan 13, 2017 (Revised Kick-off version; Final version will be available on January 15, 2017)

Red: changes after international version. Green: Changes after Nov 19th kick-off meeting.

1. Game Synopsis

A ball-stand is located at the center of a white square (Junior) or rectangle (Senior) shaped baseball field, placed on dark floor. A fence with 2 poles attached at both ends of a board is located as shown in Figure 1.

A robot is to locate the ball-stand (emptied water bottle with three AA batteries inside) and hit the ping-pong ball resting on the top of it using a standard pencil as a bat. Points are earned depending on where the ball is hit. A home-run will be scored if the ball flies over the fence or hits either pole.

Additional points are earned if the robot visits bases and returns back to Home-base, stops, and rests. A visit is defined by a block being completely removed from the field. Points are also earned if one or both of the trash objects are removed completely from the field.

All the tasks should be done completely autonomously within 2 minutes without any external help. Any robot kits may be used. At the World Championship on June 3, 2017 at St. Pete Beach, there will be unknown task(s) that require program changes and/or additions.

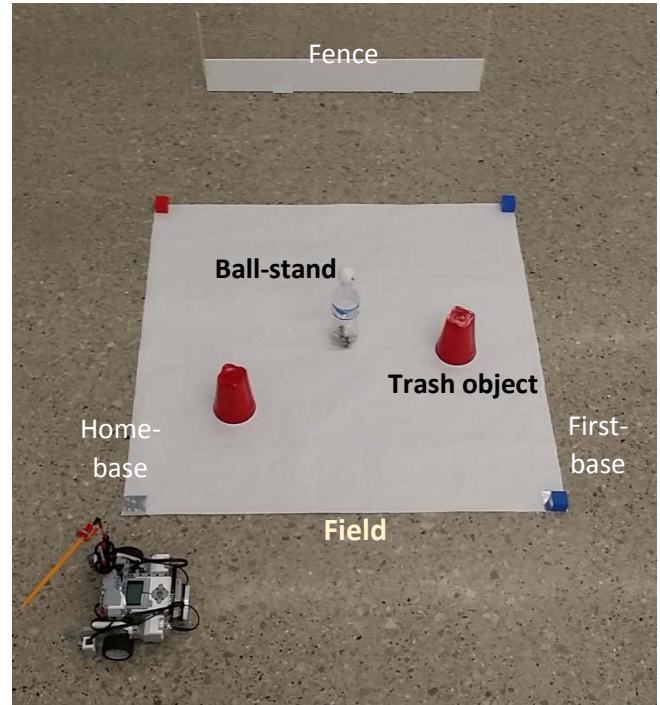


Figure 1. Jr. RoboHit Field

2. Detailed Rules

- a) Violations are defined as the following:
 - If human player touches either the robot or any field material
 - If the robot completely leaves the field, i.e., the distance between the edge of the robot and the edge of the Field (D2 in Figure 2) becomes greater than approximately 5cm without considering connector wires. (Judge's discretion; 5cm boundary will not be marked)
 - If the robot (including the bat) touches the fence
- b) If any violation explained in "a)" occurs, then judges will announce violation, stop the run, and ask team if they want to reset the whole field. See "d)". If team declines the reset, the run will end and the score will be calculated.
- c) The human player may also request to stop the run (no reset) or for a complete reset to be done at any time even if there is no violation. See "d)"
- d) Only one complete reset is allowed for a run with a penalty defined on the scoring sheet.
- e) When the field is reset, all the points earned from the previous attempt are lost (cleared).
- f) The complete reset will be done by a Judge while the 2-minute countdown timer continues to run. Judges must reset as quickly as possible. No partial reset is allowed.
- g) The robot may attempt/complete the three tasks (hit the ball, visit bases and remove trash objects) in any order with the final task then being to stop at Home-base at which point the timer will stop.

- h) The ball can be moved off the bottle without being hit by the bat, however the maximum score for the Ping-pong ball is 7. See section 1 of the score sheet
- i) Unknown factors will be unveiled according to Table 1 – Field Dimension and Unveil Times. A 30-minute work-time will be given to adjust the robot after the unveiling. During this time, all people except contestants and authorized staff/volunteers will be evacuated from the pit/room.

3. Game Playing Field (example for Sr. Division with Rectangle Field)

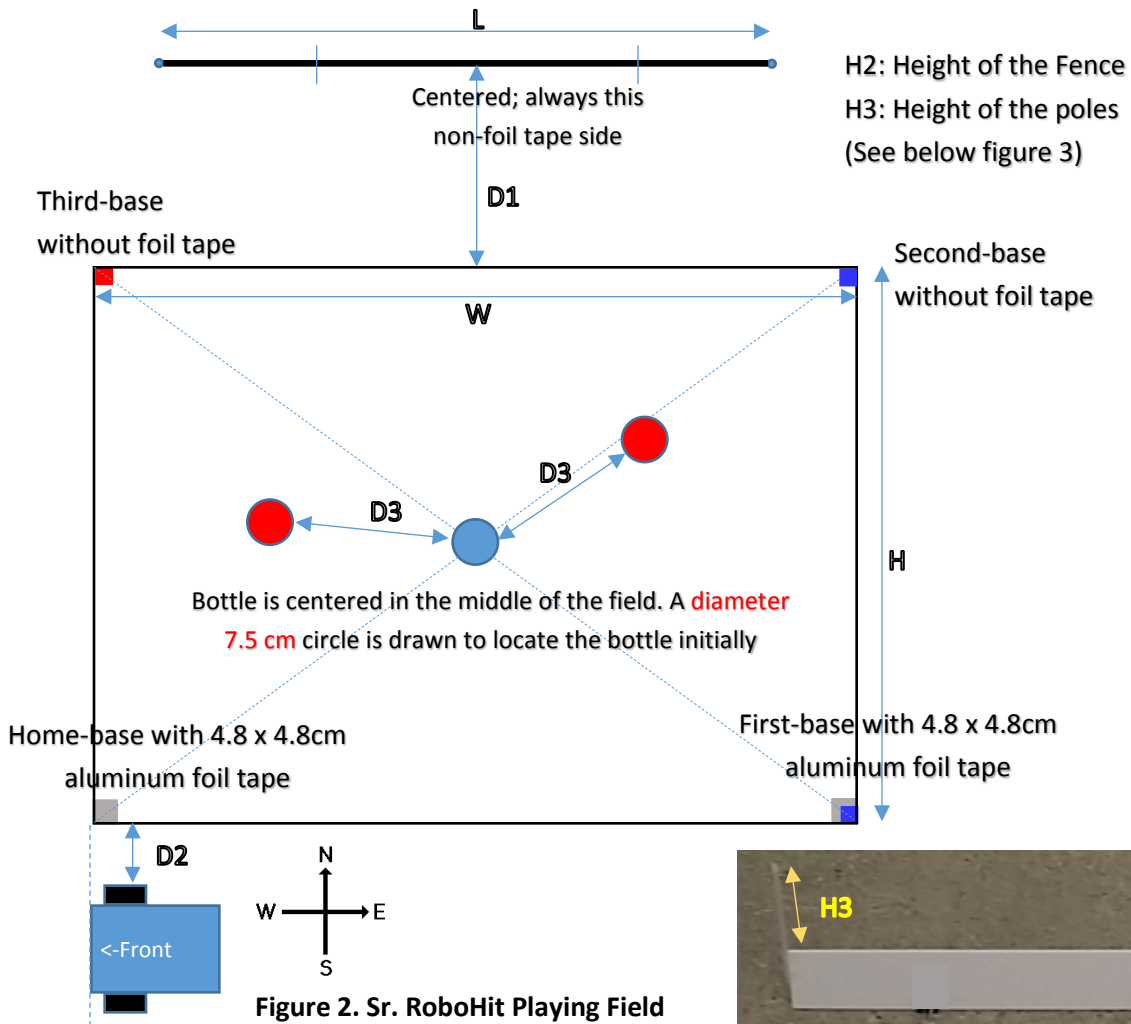


Figure 2. Sr. RoboHit Playing Field

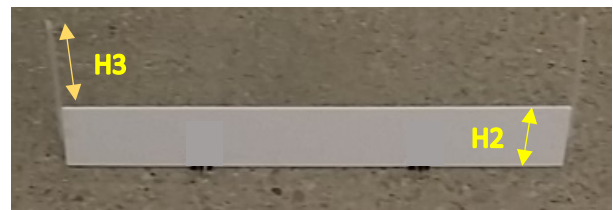


Figure 3. Fence with 2 poles

	Min value	Max value	Unveiled when?	Note
L	50cm	100cm	At the beginning of competition day	To be used for both rounds See figure 2 & 3
W	70cm	120cm		
H	70cm	120cm		
H2	12cm	30cm		
H3	15cm	18cm		
D1	35cm	60cm	Unveiled before work-time for each round	See figure 2 and table 3
D2	5cm	5cm	Fixed	Fixed
D3	10cm	Unknown	Unknown; different each round	may need to sense them

Table 1. Field Dimension and Unveil Times

Floor color	Unveiled at the beginning of competition day. If floor color is bright, dark papers/vinyl will be placed under the Field.
Field Material	White paper or vinyl; can be taped to the floor
Fence	Supporters will be placed & taped behind the fence.
Poles	Drinking straws. Diameter is 6 ~ 9mm. Color unknown. Taped at the edge of the fence
Home- & First- base	4.8 x 4.8cm aluminum foil tape; shiny silver. 3M HVAC tape
Bottle without the cap	500ml (16.9 FL Oz) bottle. The height without the cap is about 20cm. Unveiled at the beginning. The teams may measure the height after check-in. Bottle diameter is approximately 7cm in diameter.
Ping-pong ball	Standard size 40mm; color is unknown. https://www.amazon.com/gp/product/B00M9VXF50
Trash objects	Possible examples: plastic cup, empty soft drink can, etc. Height: 11~14cm. Diameter: 6.5~10.5cm, Weight: 12~15g. Color is unknown. Unveiled at the beginning of the day. Actual locations can be anywhere as long as D3 is maintained and will be revealed after all the robots are impounded.
Base objects	The cube is made of six 2x4 LEGO® bricks. 3.2 x 3.2 x 3.2cm. Weight is 13g. Color is unknown
Robot orientation	West, North, East, or South – Unveiled before work-time for each round

Table 2. Field Component Properties/Color and Unveil Times

4. Robot Specifications (For both Junior and Senior Division)

1. Robot may expand to hit the ball. However, it must fit within a 35 x 35 x 35cm box before expanding; after expansion, the max size must be less than 54 x 54 x 54cm including the pencil.
2. Weight limitation: none
3. A standard wooden pencil must be attached to the robot for use as a bat. Hexagonal or round shaped pencils are allowed. Triangular, carpenter, or flexible pencils are not allowed. Diameter is between 6mm and 7mm. Maximum length is 19cm. Shortened pencils are OK. Any part of the pencil surface including the eraser needs to hit the ball to constitute a “legally hit” ball.
4. Any number of sensors/sensor types (unless it is harmful to humans)
5. Any number/type of motors/servo motors (multiplexor is OK to use)
6. Any material/robot kit may be used to construct your robot including tape, glue, bolts and nuts, rubber bands, etc.
7. A Robofest team ID tag on top of the robot is required.
8. A label identifying the front side of the robot is required

5. Differences between Junior and Senior age divisions

	Junior (5 ~ 8 th grades)	Senior (9 ~ 12 th grades)
Field shape	Square	Rectangle
D1 value	Less than or equal to that of Sr.	Greater or equal to that of Jr.
Number of controllers	One	No limit

Table 3. Differences between Jr. and Sr. age divisions

6. 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 or the information will be projected on the screen.
3. Teams will be given 30 minutes (work-time) after unknown factors are unveiled to work on their robots. During this time, all people except contestants and authorized staff/volunteers will be evacuated from the pit/room

4. All teams must submit their robot to the impound area when 30-minute work-time has expired.
5. During the impounding process, judges will inspect robots. (size of the robot **before and after expanding**, Team ID, and label indicating the front side)
6. After impounding, the judges will setup official playing fields with trash objects.
7. Teams will compete in a pre-determined order decided by the site host.
8. A maximum of two contestants per team are allowed at the playing field during the run.
9. Contestants must move away at least 1m from the field edge after starting the robot.
10. **Timer stops only when the robot stops at Home Base at the end of the run.**
11. **Judges mark the score for the Ping-pong ball during the run.** Final scoring **for bases and trash objects** is done after the run is over.
12. Bottle (ball stand) location is checked after the run is over. See Section 8 for details.
13. A team member must sign the score sheet to confirm the team's score.
14. Entered scores shall be displayed to teams to validate data entry.
15. Winners in each age division will be decided by the **average** total Score of the 2 rounds. Tie breakers will be: (1) best Score of two rounds, (2) highest time left from best score, (3) rerun, if needed. **See Table 4.**

Team Name	Round 1 Score	R1 time left	Round 2 Score	R2 time left	Avg. Score	(1) Best score	(2) Time left best score	Rank
Team A	80	20	100	15	90	100	15	1
Team B	100	10	80	0	90	100	10	2
Team C	90	20	90	20	90	90	20	3

Table 4. Example of breaking ties

7. Important Reminders to be Announced Before Each Round

- Proctors are watching for Pit Violations including:
 - Coaches or Parents in the pit area during work-time.
 - Verbal/electronic communication between team and coach/parent during work-time.
 - Team member leaves the pit unsupervised before their robot is impounded.
 - Team alters its own robot in the impound area after impound.
 - Team handles or interferes with another team's computer or robot, either in the pit or impound area.
 - Destruction of property.
 - Use of inappropriate words and/or behavior toward team members, other teams, audience, judges or staff.
- Any violations can result in deduction of points or disqualification at the judge's discretion.
- If anyone sees any suspicious activities, please notify the nearest volunteer immediately.
- Spectators are welcome to take pictures or video, but please make sure your flash is off.

8. How to check whether the bottle (ball stand) remains on original location or not

A **7.5cm diameter** circle is drawn **with pencil** to locate the bottle initially as shown on Figure 4 and 5. If any part of the bottle is outside of the circle (see Figure 6), Judge will declare that the bottle has NOT remained on its original location. To help with judging the Base object, (LEGO cube), can be used (see Figure 7 and 8).

9. 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 a tolerance of $\pm 3\text{mm}$, 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 a 1m distance from the field.
4. Final decisions are at the discretion of the Chief Game Judge.

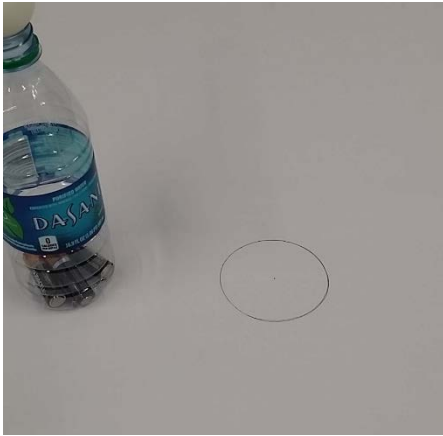


Figure 4. Circle on the mat



Figure 5. Initial Setup



Figure 6. Obvious out



Figure 7. The bottle remains inside circle



Figure 8. The bottle does not remain inside circle

Notice that the side of the bottle is wider than the bottom of the bottle, so the edge of the cube must touch the side of the bottle AND the circle for the bottle to be considered “in”.

10. FAQs (additional FAQs may be posted on the web)

- Is it a Home-run, if the ball flies over the fence poles but still between the 2 poles? **Yes.**
- Does the robot have to be at the original 35cm size at the end of the run? **No**
- Can the ball be moved/carried/touched by anything other than the pencil? **Yes, but lower points will be awarded. See Score Sheet.**
- Can a team repair robot and/or change program during the reset? **Yes.**
- Will the 5cm mark outside the Field mat be visible? **No**
- How many points if the ball hits the wall and bounces back onto the Field? **15**
- How long does the robot need to rest before the timer stops (Is there a countdown?) **The timer will stop when the robot stops at home base. If the robot then moves again (other than a small adjustment), the team will get “0” points for #5 (“stopped and rested”) on the scoresheet and the time left will be recorded as “0”**
- Can gears, springs, and/or rubber bands be used to assist the actuator in moving the pencil? **Yes, any material may be used to construct your robot.**
- Does the pencil have to swing to legally hit the ball? **No. Any part of the pencil surface including the eraser just needs to hit the ball to constitute a “legally hit” ball.**
- Is there an age limit for coaches or judges? **Yes. A coach/judge must be an adult.**
- Can players/coaches request that the edge of the field be taped down, or is solely up to the Site Host? **Players/coaches may ask the Site Host if he/she deems it necessary to use tape, however, the Site Host may grant or deny the request to tape down the fields at their own competition.**

- Does the pencil have to **swing** to legally hit the ball? **No, any part of the pencil surface including the eraser needs to hit the ball. The pencil does not have to move relative to the robot.**
- Is the robot allowed to carry/ have prolonged contact with the ping-pong ball, using the pencil/bat? **Yes, however, it will not be considered a legal hit and will be scored accordingly**
- Can the ball be moved by substances other than the pencil/bat, such as liquid/water, or gas? **Yes, but again, it will not be considered a legal hit and will be scored accordingly**
- Can the bottle be moved outside of the 7.5 in circle, but then moved back inside before time expires? **Yes, scoring is done at the end of the run for all items except the ping pong ball**
- Can the ball be punctured, broken, or physically altered in any way? **No**
- Can more than one pencil be used to move the ball? **A Legal Hit is scored when one pencil contacts the ball like a bat hits a baseball (either with a swing or by the forward motion of the robot).**
- Is D3 the distance from bottle edge to trash edge OR is it distance from center of bottle to center of trash? **Edge to edge**
- D3 is unknown according to the table in the online presentation. Will it be an unveiled variable at competition? **Trash Objects are placed after robots are impounded**

Robofest® 2017 Game RoboHit Scoring Sheet

Division: Junior / Senior

Team Name: _____

Team School / Organization Name: _____ Team Number: _____

Round: First Second Field No.: _____

	Judging Items		Location/ Or Count	Point Value (per count)	Score Earned / Lost
#1	Ping-pong ball	Legally hit by pencil	Home-run (over the fence or hits a pole)	30	Max. 30
			Touched the fence without first hitting the floor	15	
			Bounces over fence	13	
			Outside the field	10	
		On the field	8		
		NOT hit by pencil	Outside the field	7	
			On the field (off the bottle)	5	
On the bottle	0				
#2	Number of Bases visited. The LEGO blocks must be removed completely from the field*		0 1 2 3	10	Max. 30
#3	Number of trash objects removed completely from the field*		0 1 2	10	Max. 20
#4	Bottle (ball-stand) remained on original location. (The bottle is completely inside the circle on the mat)		0 1 (no) (yes)	5	Max. 5
#5	The robot came back to Home-base, stopped, and rested at the end of the run . Any part of the robot must be on <i>or</i> over the Home-base aluminum foil plate.		0 1 (no) (yes)	10	Max. 10
#6	The robot remained intact throughout the run.		0 1 (no) (yes)	5	Max. 5
#7	A Reset was done (Reset penalty)		0 1 (no) (yes)	-5	Max. 0
(*) No specific order required			Total Score		Max. 100
			Time left in seconds <i>Time stops when the robot comes to rest at Home Base. If #5 is no, then Time Left = 0</i>		

Judge initials: _____

Team player initials: _____