World Robot Olympiad 2016

Regular Category

Junior High School

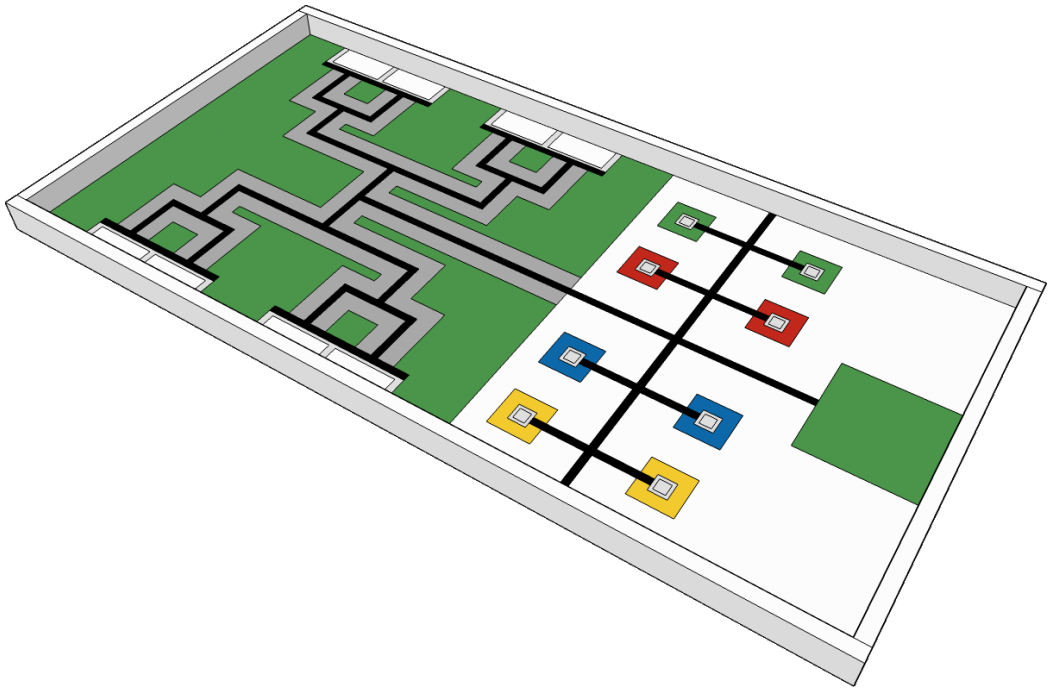
Game description, rules and scoring

Waste Sorting

version: 15 January 2016

Introduction

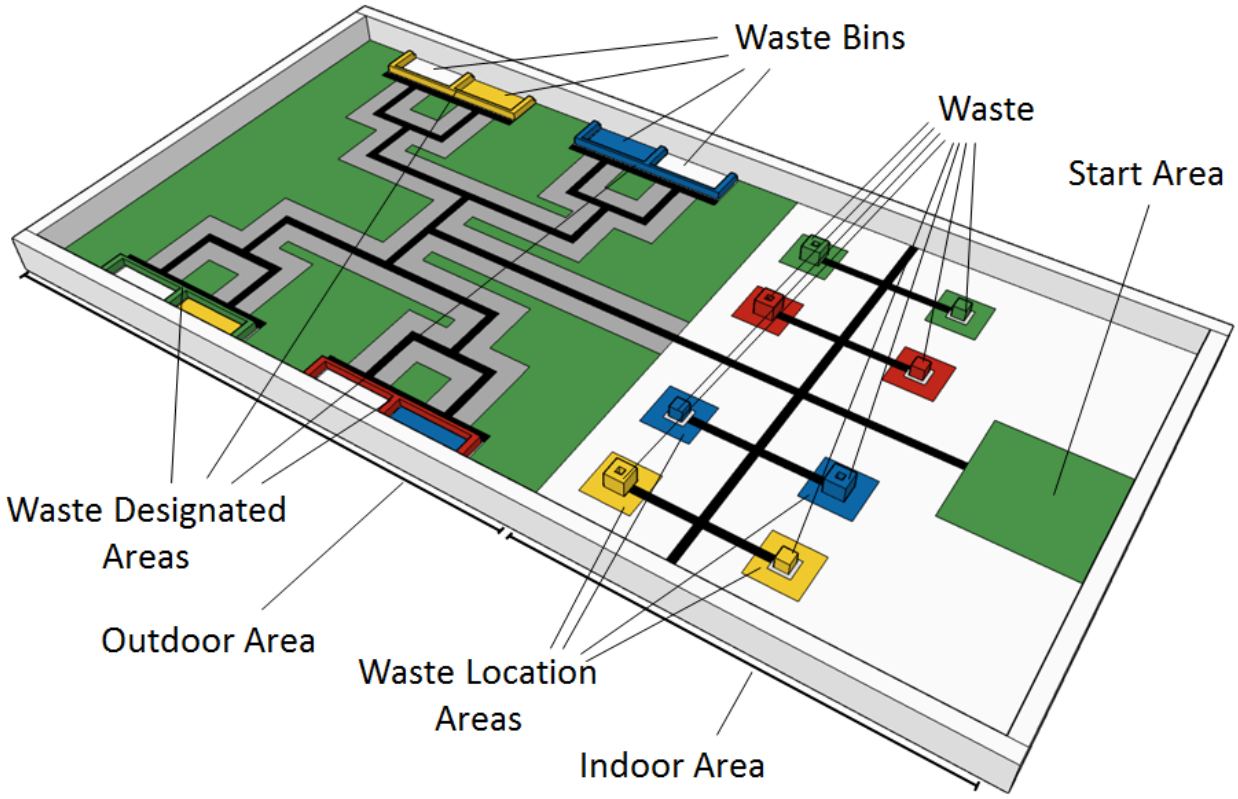
The challenge is to make a robot that collect certain kinds of recyclable waste from a home into recycling waste bins to be picked up by Municipal Service. First, the robot has to identify the kinds of waste that will be picked up next by Municipal Service and the positions of the empty recycling waste bins where the robot should put the requested waste. Afterwards the robot shall bring the correct kinds of waste from the waste areas in the home to the recycling empty waste bins and finally the robot shall move to an area so the robot is ready for the next sorting round.



Contents

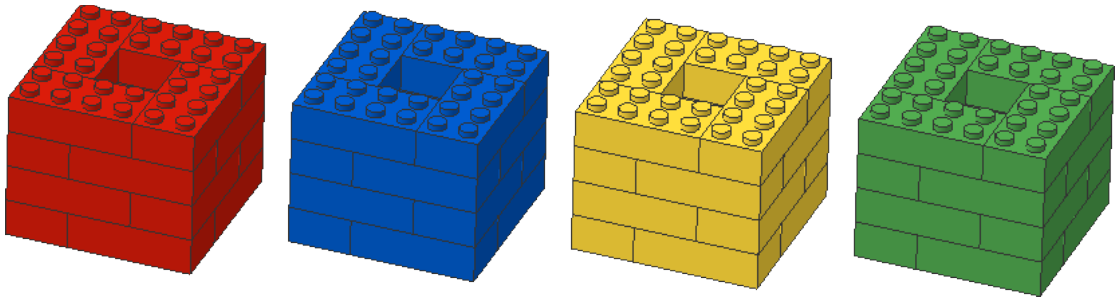
Game Description:

The mission of the robot is to bring 4 pieces of sorted recyclable waste from a home into 4 empty recycling waste bins in the outdoor area. The robot selects the 4 pieces of recyclable waste from 8 pieces of waste positioned in the indoor area at 8 waste location areas. Small or large LEGO cubes of the colors red, blue, green or yellow represent the recyclable waste. There are 4 waste designated areas in the outdoor area with 8 possible positions for empty recycling waste bins. In 4 of the waste bin positions 4 empty recycling bins are placed to request the kinds of waste the robot should bring from the indoor area to the empty recycling bins. The 4 empty recycling waste bins are represented by tiles (colored cardboard or paper) of the colors red, blue, green or yellow placed in 4 of the 8 waste bins surrounded by LEGO brick walls of the colors red, blue, green and yellow.

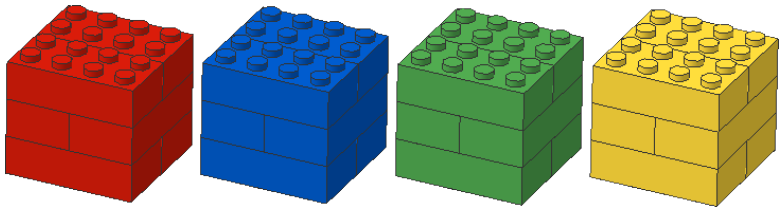


There are 8 different recyclable waste blocks (LEGO blocks):

- 1 large red block; 1 large blue block, 1 large yellow block and 1 large green block

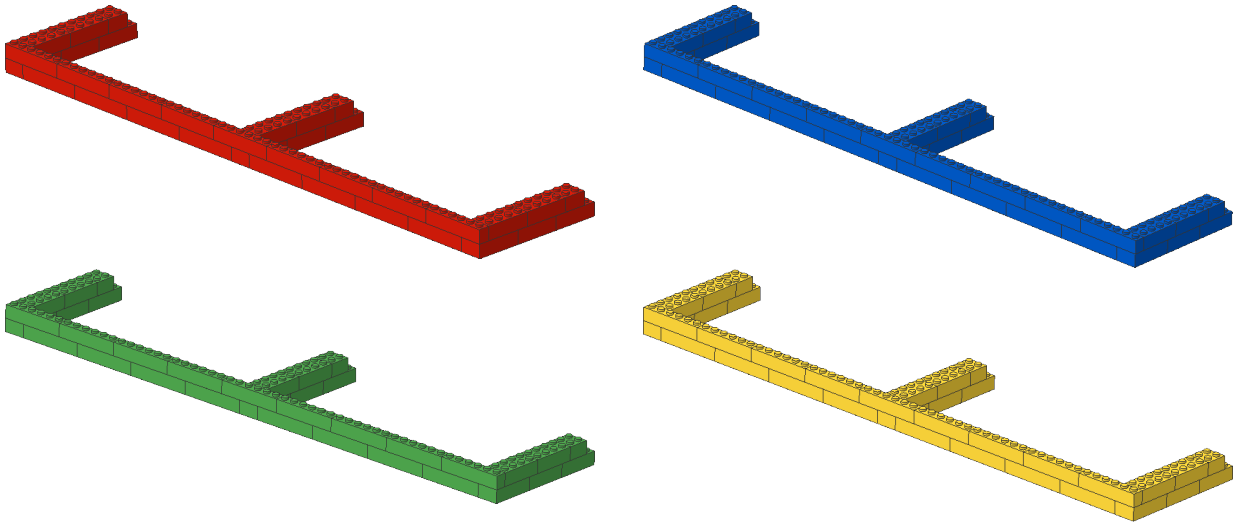


- 1 small red block, 1 small blue block, 1 small yellow block and 1 small green block

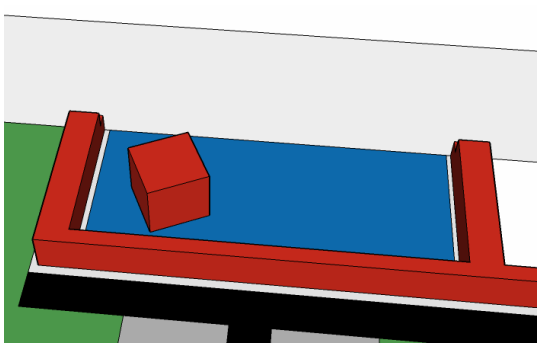


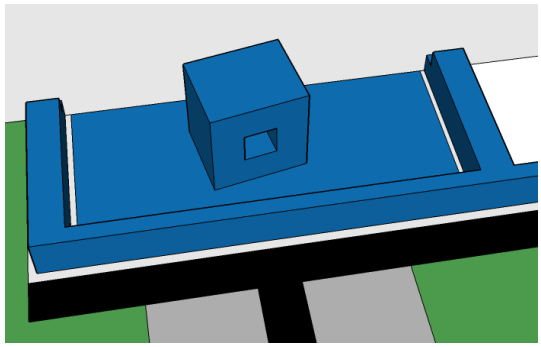
The 8 different waste blocks are randomly placed in the 8 indoor waste areas with red blocks in the red areas, blue blocks in the blue areas, green blocks in the green areas and yellow blocks in the yellow areas.

There are 4 LEGO walls of the colors red, blue, green and yellow around the two waste bins in each of the 4 waste designated area:



The color of the LEGO wall around a waste designated area defines the color of the waste block that the robot should bring to one of the two bins in the waste designated area. A colored tile placed inside one of the two bins marks the bin as the empty bin and the color of the tile defines the size of the waste block to bring from the indoor area to this empty bin. For example a blue tile placed inside a red bin means that the robot should bring a small red waste block to this bin:





In general, a tile inside a bin means that this bin should be filled with a small waste block if the color of the tile is different from the wall color and the waste block should be large if the color of the tile is equal to the wall color.

The robot will start from within the start area (green square). The challenge for the robot is to bring a blue waste block to the blue waste designated area, a red block to a red designated area and so on. The waste block should be placed in the bin of the waste designated area with a colored tile. The color determines if a small block or a large block should be placed in this bin: If the color of the marked bin matches with the color of the wall, the large block should be placed; if the color of the marked bin does not match with the color of the wall, the small block should be placed.

The time taken to do the mission is 2 minutes.

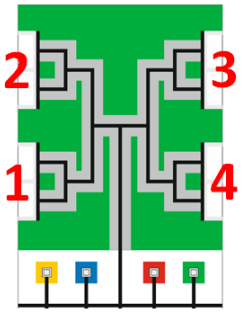
Game Rules:

1. All teams must go to their designated pit area, be seated and wait for the announcement of the start of the assembly time.
2. The competition format for this challenge is:
    a. Qualifying rounds (best score taken).
    b. Quarterfinals (1 round).
    c. Semifinals (1 round).
    d. Finals (1 round).
3. Assembly time for this challenge is 150 minutes and will occur before qualifying round 1.
4. Maintenance time for each subsequent round is as follows:
    a. For qualifying round 2, 45 minutes.
    b. For qualifying round 3, 30 minutes.
    c. For quarterfinals round, 15 minutes.
    d. For semifinals round, 15 minutes.
    e. For finals round, 10 minutes.

5. Before the robot is placed in the quarantine area for inspection the robot must have only one program with the name "run" in the "Software Files" folder on the NXT brick or only one project on the EV3 brick. The name of the project must be "WRO2016" and the main executable file must be named "run". The judge is allowed to do inspection of the brick before the robot is run. If more than one executable (on the NXT brick) or project (on the EV3 brick) is detected the participant must remove all files, which violates the requirement.

6. The robot will have 2 minutes to complete the challenge. Time begins at the point when the judge gives the signal to start. The robot must be placed in the starting area so the projection of the robot on the game mat is completely within the start area. The EV3/NXT brick is switched off. The participants are allowed to make physical adjustments to the robot in the starting area. However, it is not allowed to enter data to a program by changing positions or orientation of the robot parts. If a judge identifies that the team could be disqualified from the competition. Once physical adjustments have been made to the satisfaction of the participants, the judge will give the signal for the EV3/NXT brick to be switched on and a program to be selected (but not run). Participants must wait for the judge's signal to start before setting the robot into motion (run the program).

7. At the start of the assembly time the teams get information about the color of the walls around the designated waste areas. The color of the walls is chosen as follows: 4 blocks with colors red, blue, yellow and green are placed in a non-transparent box, then they are taken one by one from the box, the color of the first block defines the color of the wall around the designated waste area #1, the color of the second block defines the color of the wall around the designated waste area #2 and so on.



8. After the quarantine time the following is determined randomly before each round:

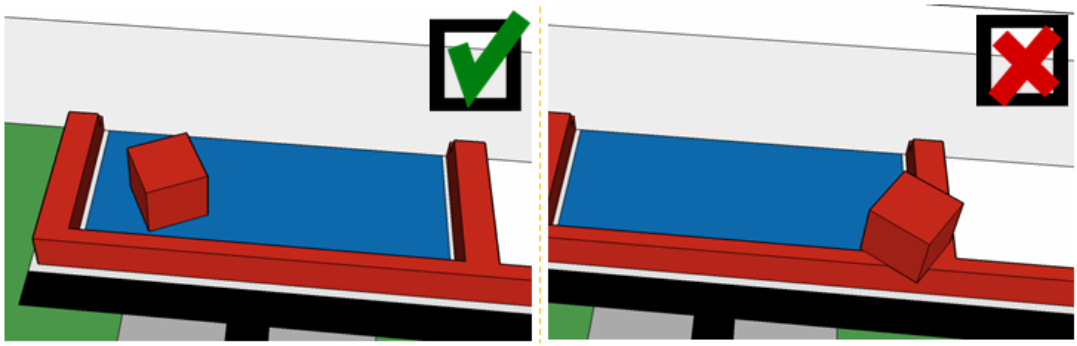
    1) Location of the waste blocks in the waste location areas. It can be done by tossing a coin for every waste location areas of every color: if it is a tail, a small block of the corresponding color is placed on the left side of the waste location area; otherwise the block is placed on the right side of the waste location area. A large block is placed in the unused location of the corresponding color. Small blocks are placed completely inside the small squares within the gray square of the waste location area. Large blocks are placed completely within the gray square of the area. Both small and large blocks are placed by studs directed up.
    2) The color of the tile in each designated waste area. First, a coin is tossed to determine if the color of the tile should match with the color of the wall in each designated waste area. If a tail is tossed, the tile should be the same color as the

wall; otherwise the color of the tile is defined as follows: The 3 blocks with colors not matching the color of the wall are placed in a non-transparent box, then one block is taken from the box, the color of the block defines the color of the tile placed in the corresponding area.

3) The bin of each designated waste area to be marked with a title as the empty bin where the waste block should be placed. A coin is tossed and if it is a tail the tile is placed in the left bin of the area; otherwise the right bin is used.

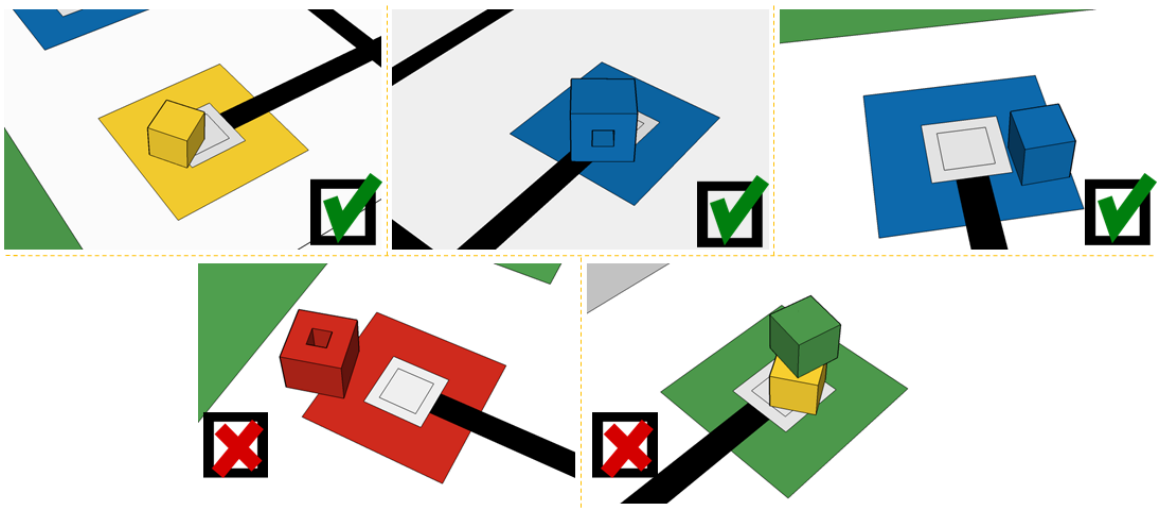
9. The robot's mission is to bring 4 waste blocks from the waste location areas to the bins of the designated waste areas marked with colored tiles. The size of the waste blocks to be moved is determined by the color of the tile. If the color of the marked bin matches with the color of the wall, the large block should be placed; if the color of the marked bin does not match with the color of the wall, the small block should be placed. After the completion of the task the robot must finish in the start area.

10. The waste blocks can be placed by the robot in any orientation and any position inside the empty waste bin. The block must touch the mat or the tile in order to be considered within the waste bin. The block must not be damaged (disassembled).



11. If there is more than one waste block in any empty bin, no points will be awarded for any of the waste block.

12. If the waste block not intended to be moved to any waste bin remains in a waste location area of matching color additional points will be provided. The block must not be damaged (disassembled) and all its parts touching the mat must be within the waste location area of the corresponding color. The waste location area could be different from the area where the block was located before the robot run.



13. The robot must not move or damage the walls around the designated waste areas.

14. It is not allowed for the teams to touch the robot during the run.

15. The robot can leave on the field any parts of the robot that are not containing main units (controller, motors, sensors) if needed. As soon as the part is touching the field or its game element and does not touch the robot it is considered as a free LEGO element not being part of the robot.

16. If there is any uncertainty during the task, the judge makes the final decision. They will bias their decision to the worst outcome available for the context of the situation.

17. Your attempt and time will end if:
    a. Challenge time (2 minutes) has ended.
    b. Any team member touches the robot during the run.
    c. The robot has completely left the game table.
    d. A team member shouts "STOP" to end the run.
    e. Violation of the rules and regulations within.
    f. When the projection of the robot is completely in the start area.

Scoring

1. Score will only be calculated at the end of the challenge or when time stops.
2. Maximum score = 100 points
3. If teams have the same score, ranking is decided by the fastest time recorded.

Scoring Table:

Particulars	Points Each	Total	Max Game Total
For every small waste block completely within an empty waste bin. The color of the wall matches the color of the waste	20 points per waste block	80 points max	

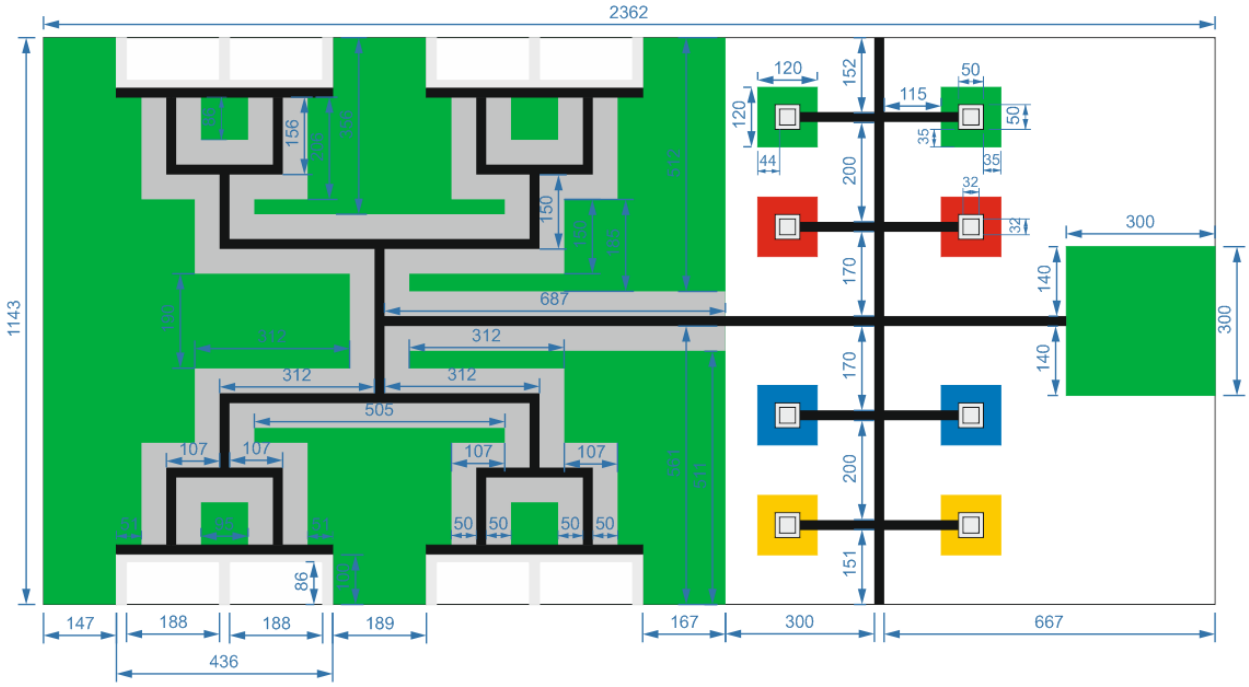
block and the color of the tile within the bin is different from the color of the waste block.			
For every large waste block completely within an empty waste bin. The color of the wall matches the color of the waste block and the color of the tile within the bin matches the color of the waste block.	20 points per waste block	80 points max	
For every small waste block completely within an empty waste bin. The color of the wall matches the color of the waste block and the color of the tile within the bin matches the color of the waste block.	5 points per waste block	20 points max	
For every large waste block completely within an empty waste bin. The color of the wall matches the color of the waste block and the color of the tile within the bin is different from the color of the waste block.	5 points per waste block	20 points max	
For every waste block completely within an empty waste bin. The color of the wall is different from the color of the waste block.	1 point per waste block	4 points max	
For every waste block completely in the unmarked bin of a waste designated area.	1 point per waste block	4 points max	
Four waste blocks are correctly placed completely in the correct bins of the correct waste designated areas. Other bins are empty.		5 points	
Four waste location areas are empty and the other four waste location areas contains four waste blocks not intended to be moved to any waste bin. These blocks are completely within the waste location areas of the corresponding color.		10 points	
Any wall broken or moved outside their surrounding outline (at least a part of the wall).	-5 points per wall	-20 points	
Robot ends completely in start area (green) and positive points were obtained at any moment of the run.		5 points	
			100 points

If two situations are applicable to assign points, the situation with greater score is being accounted.

Table Specifications

1. The internal sizes of a game table are 2362 mm x 1143 mm.
2. The external sizes of the table are 2438 mm x 1219 mm.
3. Primary color of a table surface is white.
4. Height of the borders: 70 ± 20 mm

Game Mat Specifications



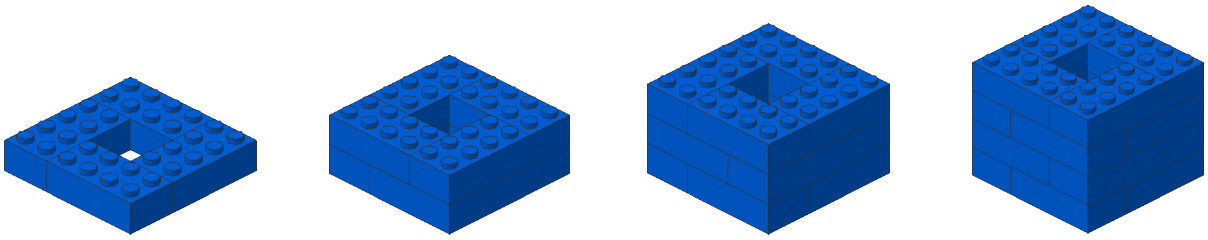
1. All lines are 20 ± 1 mm
2. Dimensions may vary within ± 5mm
3. If the table is larger than the game mat the button edge and the right edge of the game mat should align with two walls on the table.

Game Object Specifications

There are 8 different recyclable waste blocks (LEGO blocks):

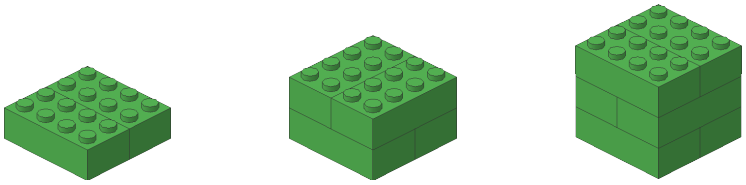
- 1 large red block; 1 small red block
- 1 large blue block; 1 small blue block
- 1 large green block; 1 small green block
- 1 large yellow block; 1 small yellow block

Large block:



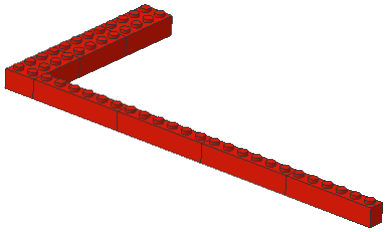
Step 1 Step 2 Step 3 Step 4

Small block:

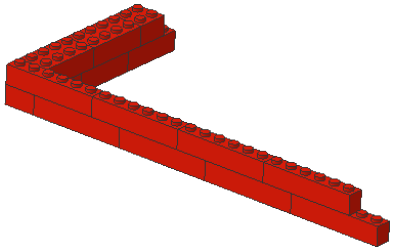


Step 1 Step 2 Step 3

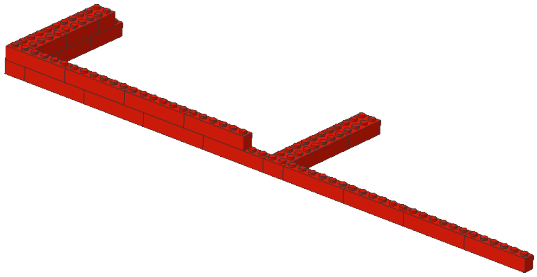
There are 4 walls around the designated waste areas, a red, a blue, a green and a yellow wall:



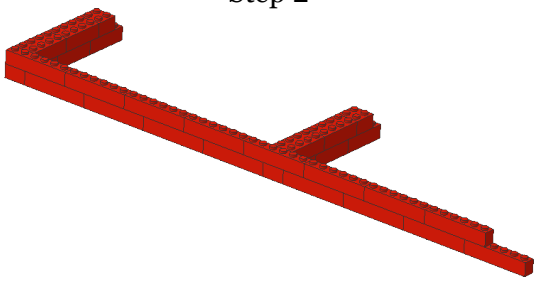
Step 1



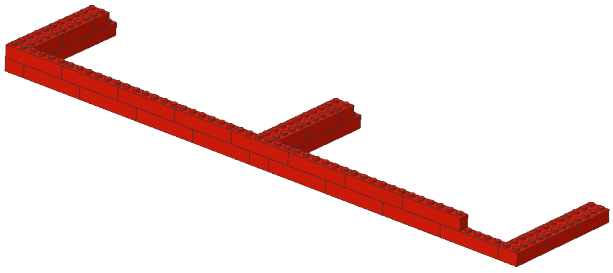
Step 2



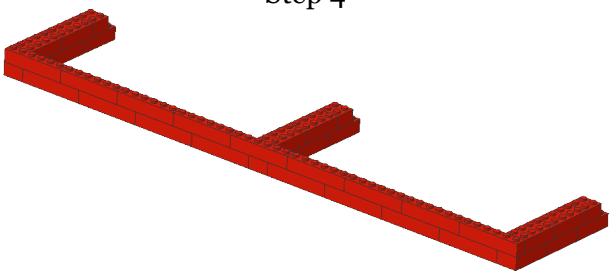
Step 3



Step 4



Step 5



Step 6

There are 8 tiles 188 x 86 mm made from cardboard or paper:

- 4 items of red color;
- 4 items of blue color;
- 4 items of green color;
- 4 items of yellow color.

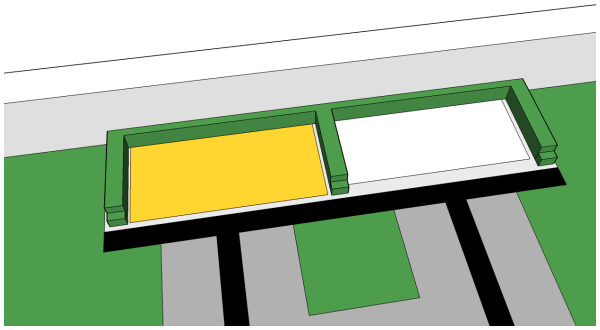
The thickness of the tile will not exceed 1.5 mm.

Alternative rules suggestions

Some country organizers may wish to modify the game rules to simplify the challenge.

Here are a few suggestions.

1. Some organizers may want to reduce mechanical complexity of the challenge by changing orientation of the walls:



2. Some organizers may want to fix positions for particular size of waste blocks in waste location areas, e.g. as: