



World Robot Olympiad 2021

Regular Category

Elementary



Energy at Home

Official Game Rules for the WRO International Final

(Note: Rules for local WRO events may vary!)

Version: January 15th

WRO International Premium Partners





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PART ONE – GAME DESCRIPTION

1. Introduction

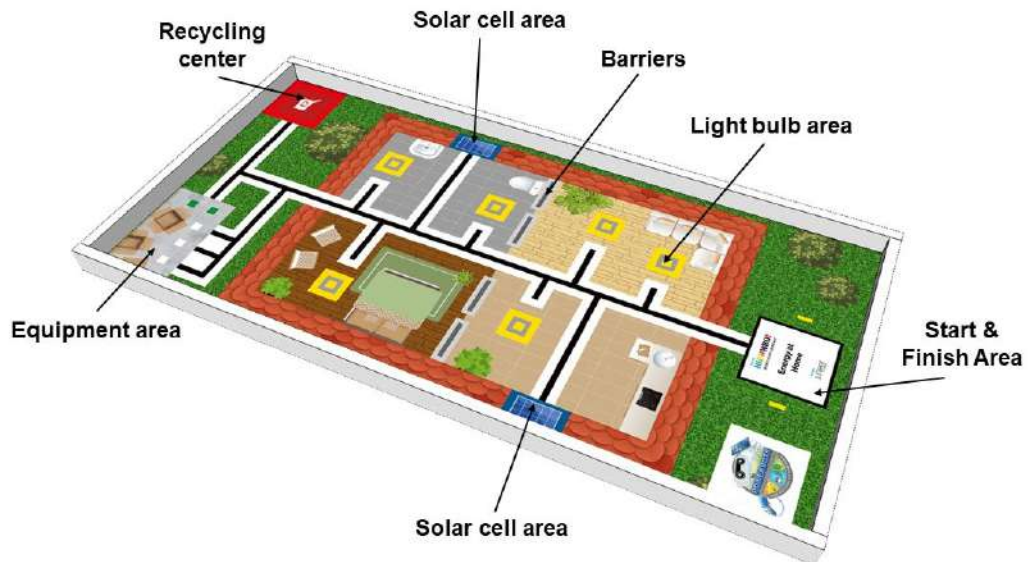
Using our energy resources responsibly is very important for our future. This is important for our whole society, but also for our own houses.

On the playing field of the Elementary age group, the robot helps to modernize a house. The robot will replace old lamps with new energy saving lamps. The robot also needs to mount solar cells on the roof and needs to install intelligent smart home devices.

This work will help to reduce the energy demand of the house and to make the best use of renewable energy.

2. Game Field

The following graphic shows the game field with the different areas.



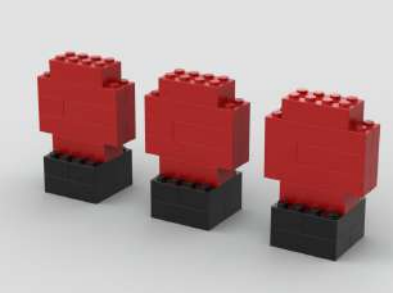
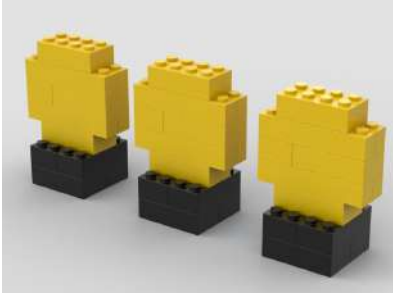

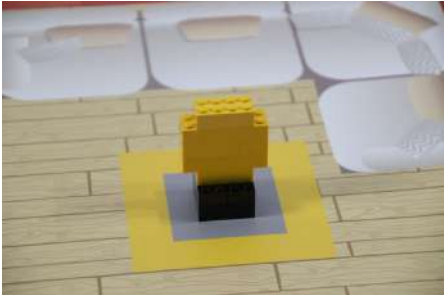
If the table is larger than the game mat, center the mat to all sides inside the table.

For more information about the table and game mat specifications, please take a look at WRO Regular Category General Rules, Rule 4. The printable file of the mat is available on www.wro-association.org.

3. Game Objects, Positioning, Randomization

Old light bulbs (3x red, 3x yellow)

There are six old light bulbs that are **randomly placed in each round** on the little yellow square inside the light bulb areas.

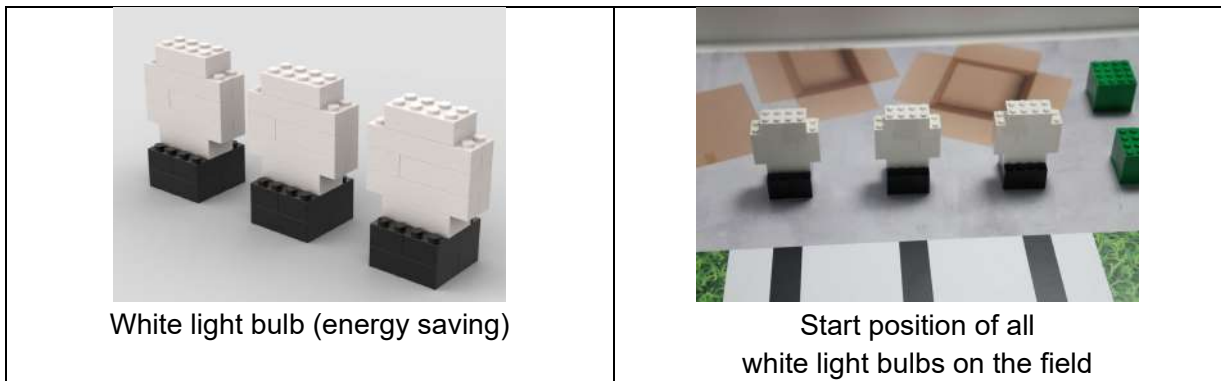
 <p>Red Light Bulb (not working)</p>	 <p>Yellow Light Bulb (working)</p>
 <p>Start position of a light bulb on the little yellow square inside the light bulb areas</p>	 <p>Start position of a light bulb on the little yellow square inside the light bulb areas</p>

One possible randomization you can see here
(red X for red light bulb, yellow X for yellow light bulb):



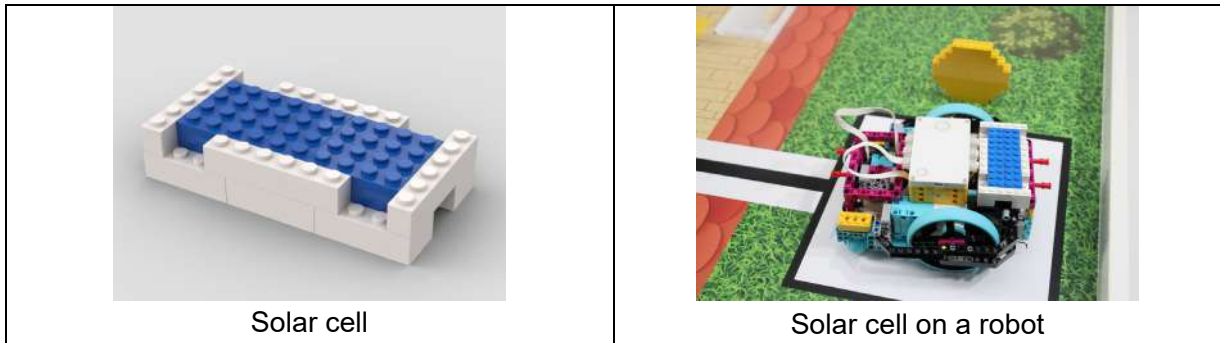
Energy saving light bulb (3x white)

Three energy saving light bulbs are always placed on the white squares in the equipment area.



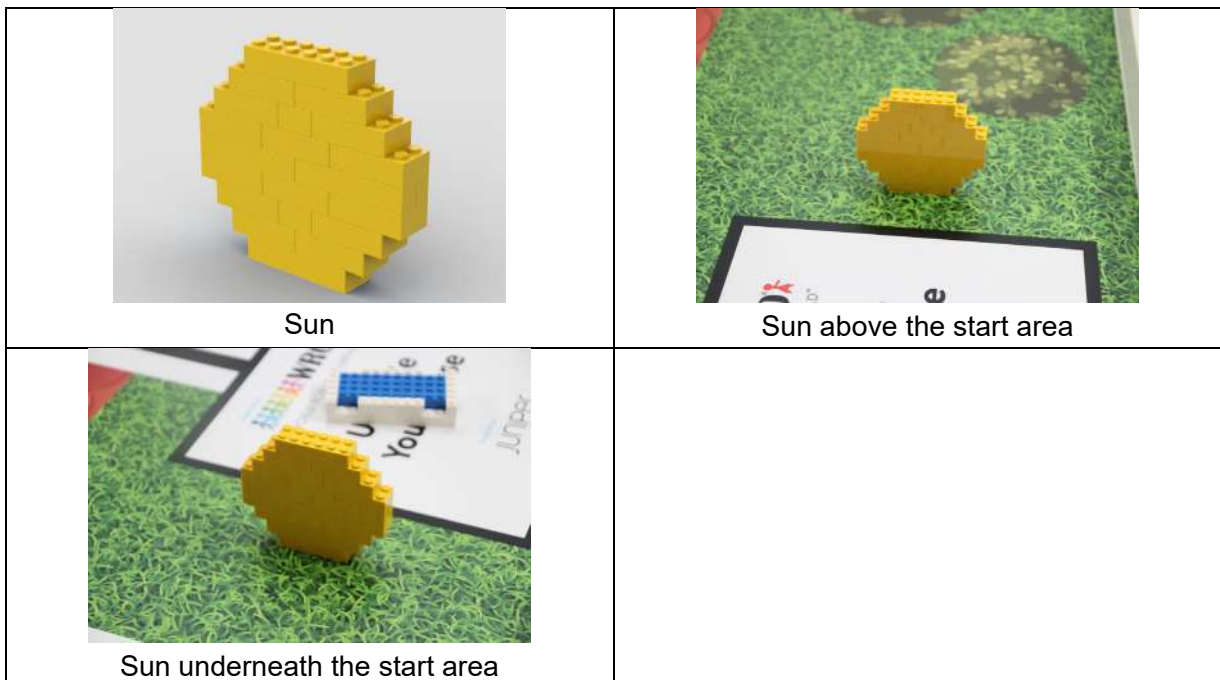
Solar cell (1x)

There is one solar cell that should be placed on the robot at the start of the run.



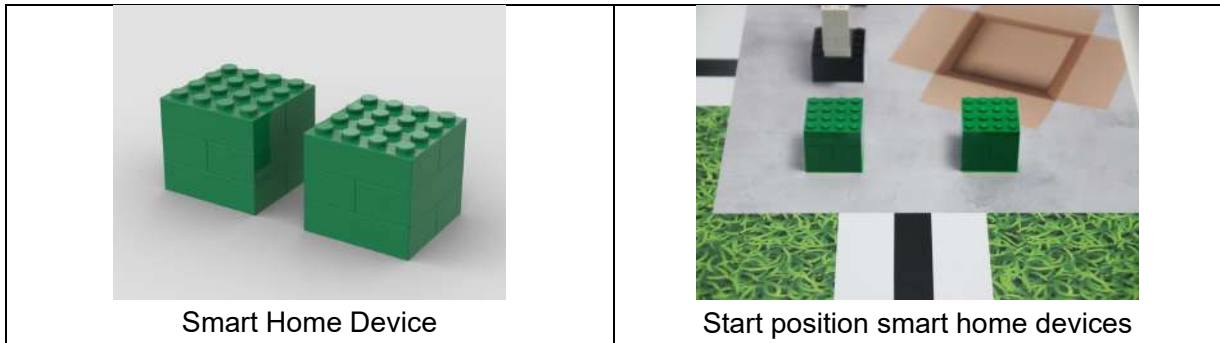
Sun (1x)

We welcome the sun to our game field as well. The sun is placed **randomly on either the little yellow rectangle above or underneath** the start area.



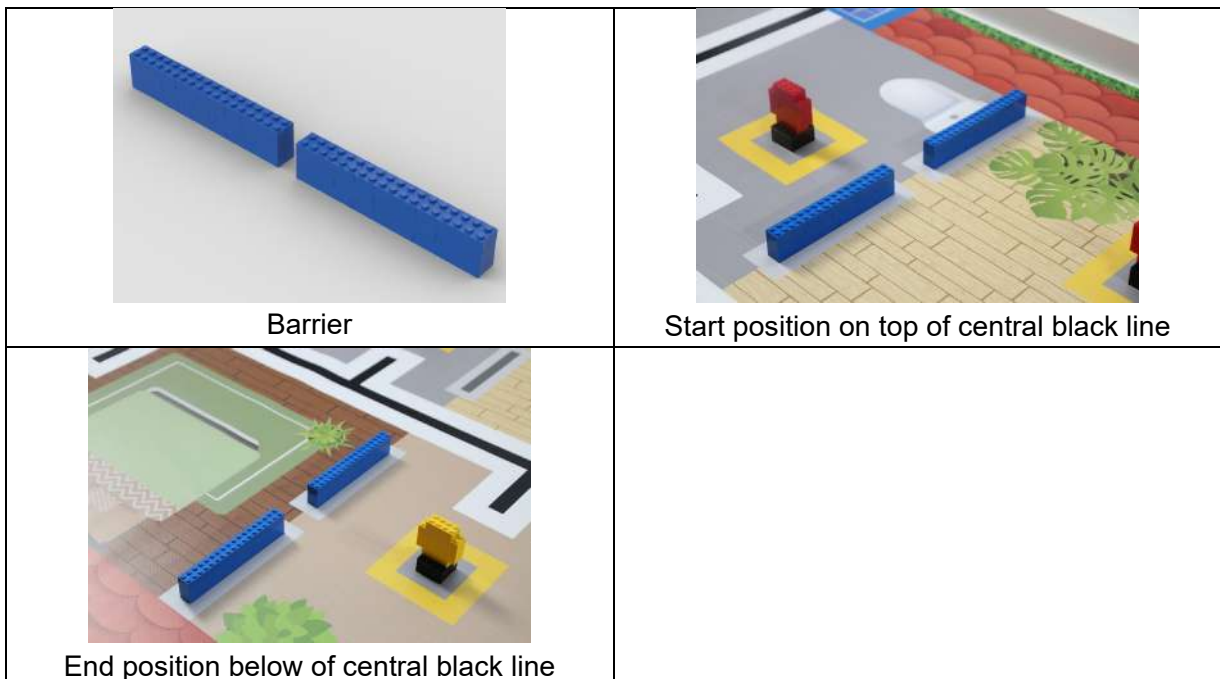
Smart Home Device (2x)

There are two smart home devices that are always placed on the green squares in the equipment area.



Barrier (2x)

There are two barriers on the field. Both barriers are either placed on top or below the central black line. They are never placed in a mixed way (so there is never one on top, one below).



Summary randomization

On the **competition day**, the position of the barriers is randomly selected (both on top of or below the black line).

For **each round**, the following objects are randomly placed:

- Position of the sun (either above or underneath the start area)
- Position of red and yellow light bulbs (in the different light bulb areas)

4. Robot Missions

For a better understanding, the missions will be explained in multiple sections.
The team can decide in which order they will do the missions.

4.1. Install solar cell

Depending on the position of the sun at the beginning of the round, the solar cell should be installed on the correct side of the roof, see the following graphic:



Full points are awarded if the solar cell is completely inside the correct blue area and studs on top.

4.2. Remove old light bulbs

Another task is to find the old light bulbs that are not working anymore (red light bulbs), remove them from their position and bring them to the recycling center.

Some points are awarded if the light bulbs are outside of the bigger yellow square, full points are awarded if the light bulbs are completely inside the recycling center.



4.3. Install energy saving light bulbs

Once the red light bulbs are removed, the robot should collect the new white, energy saving light bulbs and install them in the different rooms.

Full points are awarded if a new energy saving light bulb is completely inside the bigger yellow square area that was used by a red light bulb before. Maximum one new energy saving light bulb counts per area.

4.4. Place smart home devices

The intelligent use of all smart energy devices in a home can help to reduce the energy usage. Therefore, smart home devices should be placed into the rooms of the house.

Some points are awarded if the smart home devices are placed into a room with a red light bulb at the start of the round. Full points are awarded if the smart home devices are placed in a room where the red light bulb is also replaced by a white, energy saving light bulb. Only one smart home device per room counts. If two smart home devices are in one room, you will get zero points.

4.5. Park the robot

The mission is complete when the robot returns to the Start & Finish area, stops, and the chassis of the robot is entirely (top-view) within the Start & Finish area (cables are allowed to be outside of the Start & Finish area).

4.6. Get bonus points

Bonus points will be awarded for not moving or damaging the barriers and for not moving or damaging the old but still working yellow light bulbs from their starting positions.

5. Scoring

Definitions for the scoring

“Completely” means that the game object is only touching the corresponding area (not including the black lines).

Important for the light bulb scoring: If more than one light bulb is completely in the same big yellow area, there are no points for these bulbs. If a white light bulb is affected, this light bulb does not count for the smart home device scoring.

Tasks	Each	Total
Install solar cell		
Solar cell completely inside the correct blue area and studs on top.		10
Remove old light bulbs		
Red light bulb outside of the big yellow square and not inside the recycling center.	6	18
OR: Red light bulb completely inside the recycling center.	8	24
Install energy saving light bulb		
White light bulb completely inside the big yellow square.	10	30
Place smart home device (only one smart home device per room)		
Smart home device in a room with a red light bulb at the start of the round and without an energy saving light bulb.	3	6
Smart home device in a room with a red light bulb at the start of the round and with a correctly placed energy saving light bulb.	7	14
Park the robot		
Robot completely stops in the Start & Finish Area <i>(only if other points, not bonus, are assigned)</i>		7
Get bonus points		
Barrier is not moved or damaged.	2	4
Yellow light bulb is not moved or damaged from the starting position.	2	6
Maximum Score		95



Scoring Sheet

Team name: _____

Round: _____

Tasks	Each	Total	#	Total
Install solar cell				
Solar cell completely inside the correct blue area and studs on top.		10		
Remove old light bulbs				
Red light bulb outside of the big yellow square and not inside the recycling center.	6	18		
OR: Red light bulb completely inside the recycling center.	8	24		
Install energy saving light bulb				
White light bulb completely inside the big yellow square.	10	30		
Place smart home device (only one smart home device per room)				
Smart home device in a room with a red light bulb at the start of the round and without an energy saving light bulb.	3	6		
Smart home device in a room with a red light bulb at the start of the round and with a correctly placed energy saving light bulb.	7	14		
Park the robot				
Robot completely stops in the Start & Finish Area <i>(only if other points, not bonus, are assigned)</i>		7		
Get bonus points				
Barrier is not moved or damaged.	2	4		
Yellow light bulb is not moved or damaged from the starting position.	2	6		
Sum of Game Score		95		
Surprise Rule				
Total Score in this run				
Time in full seconds				

Signature Team

Signature Judge

Scoring Interpretation

Solar cell completely inside the correct blue area and studs on top. → 10 points



10 points (studs on top)



0 points (partly outside)



0 points (studs not on top)

Red light bulb outside of the big yellow square and not inside the recycling center.

→ 6 points each



6 points (outside)



0 points (not outside)



0 points (still partly inside)

OR: Red light bulb completely inside the recycling center.

→ 8 points each



8 points



8 points (OK if not standing)



8 points
(all parts touching the mat)



0 points for this task (not completely in, some parts touching outside), but then still 6 points for being outside of the yellow square

White light bulb completely inside the big yellow square. → 10 points each



10 points



10 points
(ok if not standing)



10 points
(all parts touching inside)



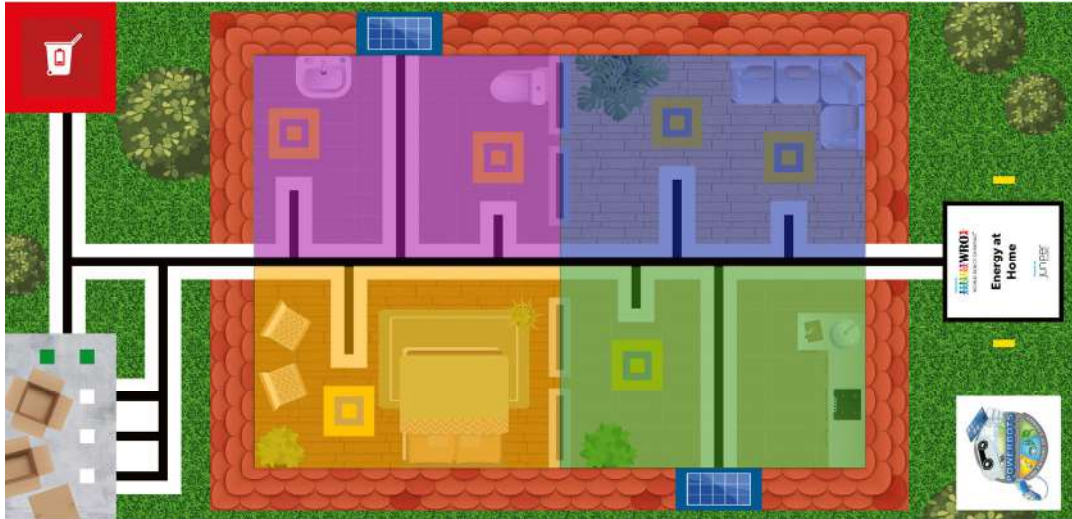
0 points (not inside the big yellow square)



0 points (if two bulbs are in the area, no bulb counts)

Definition of the rooms

The following graphic shows the different rooms in purple, blue, yellow and green. Only the black line in the middle **does not belong** to any of the rooms inside the house.



Smart home device in a room with a red light bulb at the start of the round and **without an energy saving light bulb.** → 3 points each



3 points



3 points
(red light has been there at the start of the round)



0 points (black line in the middle does not belong to any room)



0 points (two smart home devices in one room)

Smart home device in a room with a red light bulb at the start of the round and **with a correctly placed energy saving light bulb.** → 7 points each



7 points (energy saving light bulb correctly placed)



0 points (black line in the middle does not belong to any room)



3 points (see above, because energy saving light bulb is not correctly placed)



0 points (two smart home devices in one room)

Robot completely stops in the Start & Finish Area (only if other points, not bonus, are assigned) → 7 points



The projection of the robot is completely inside the start/finish area.

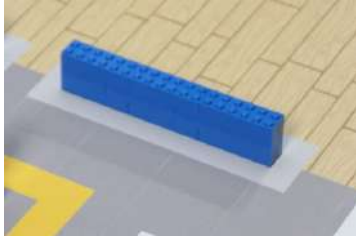


The projection of the robot is completely inside, and cables are out. That is still OK.

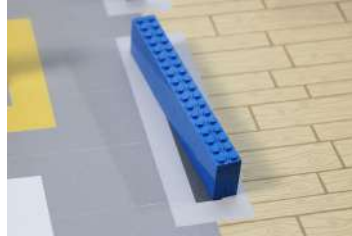


No points if the projection of the robot is not in the start/finish area.

Barrier is not moved or damaged. → 2 points each



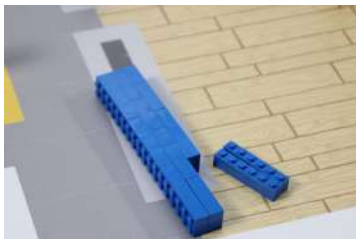
2 points, not moved.



2 points, only moved inside the grey area.



0 points, moved outside of grey area.



0 points, damaged.

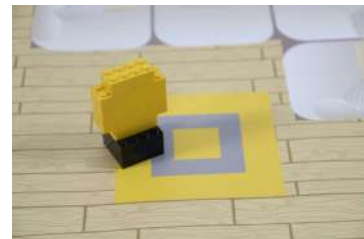
Yellow light bulb is not moved or damaged from the starting position. → 2 points each



2 points, not moved.



2 points, only moved inside the grey area.



0 points, moved outside of the grey area.



6. Local, regional, and international events

WRO competitions take place in around 90 countries, and we know that teams in each country expect a different level of complexity. The challenge as described in this document will be used for international WRO events. This is the last stage of the competition, where the teams with the best solutions participate. That is why the game rules are challenging.

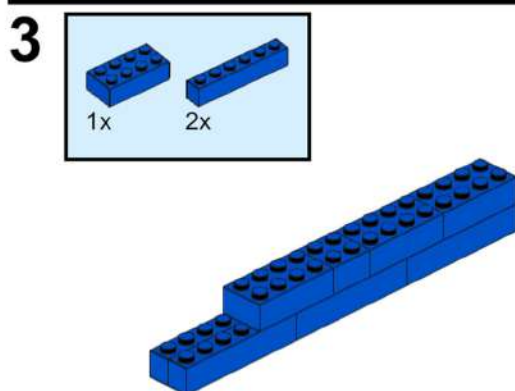
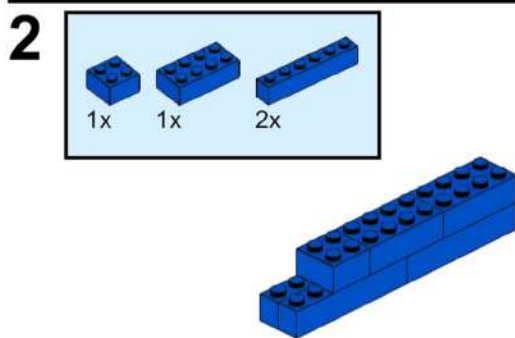
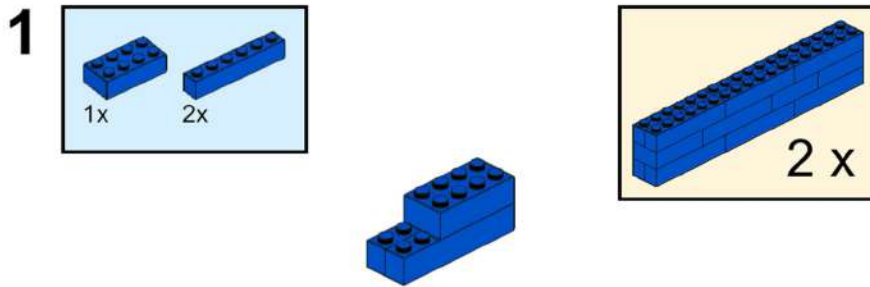
WRO feels that all participants need to be able to have a good experience in the competition. Teams with less experience should also be able to score points and succeed. This builds confidence in their ability to master technical skills, which is important for their future choices in education.

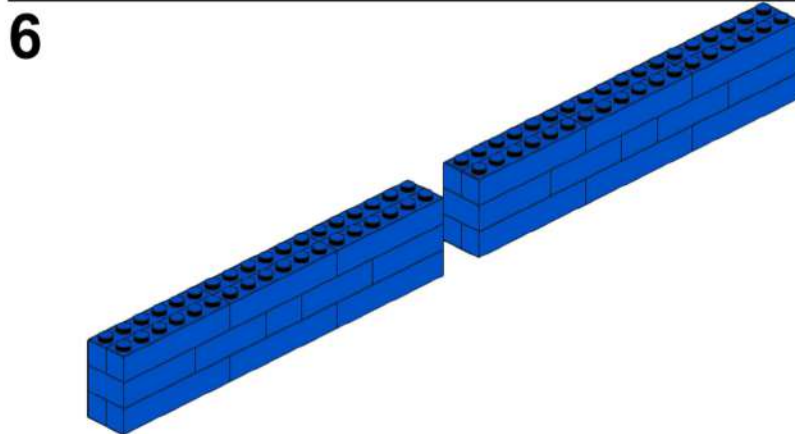
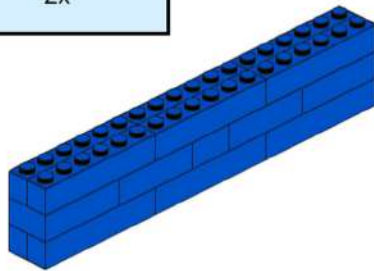
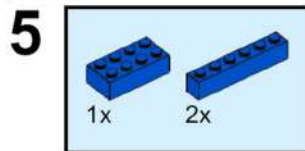
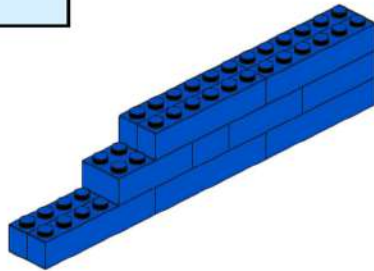
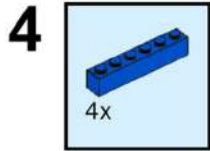
This is why WRO Association recommends that our National Organizers decide if they want to adapt the rules for events in their country. They can make the challenges easier for local, regional, and national events, so that all participants have a positive experience. Our National Organizers can make their own choices, so each competition fits their specific situation and ideas. Here we provide some ideas to make the challenges easier.

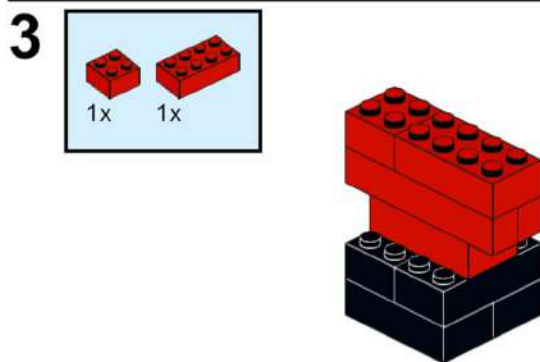
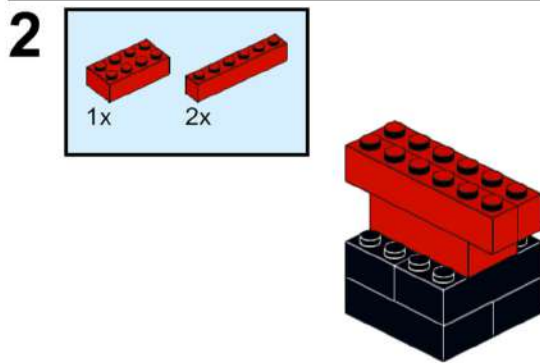
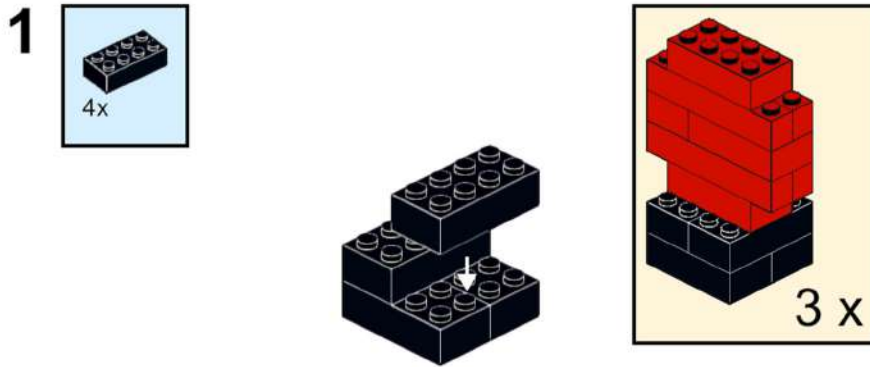
Ideas for simplifications:

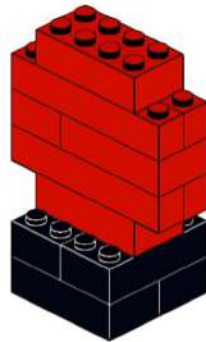
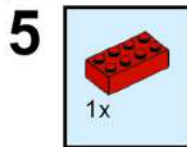
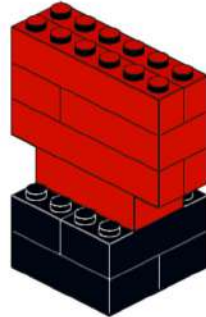
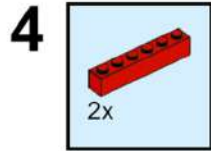
- No randomization of the barriers
- Randomization of the light bulbs only on the competition day

PART TWO – ASSEMBLY OF GAME OBJECTS

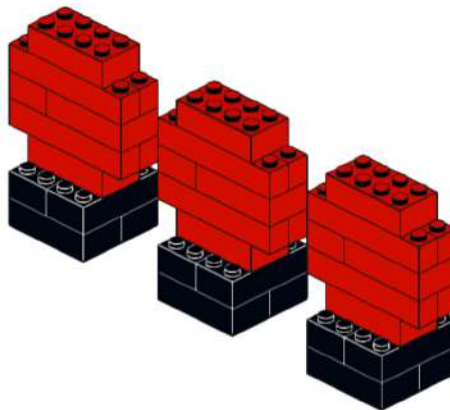


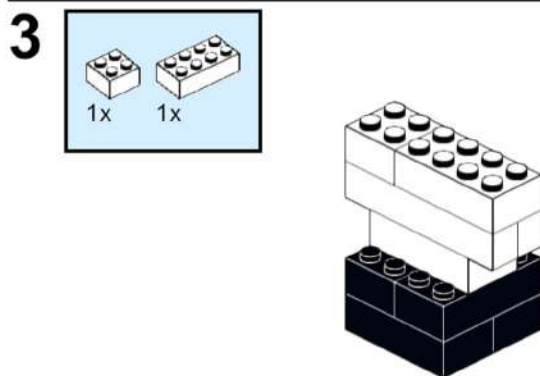
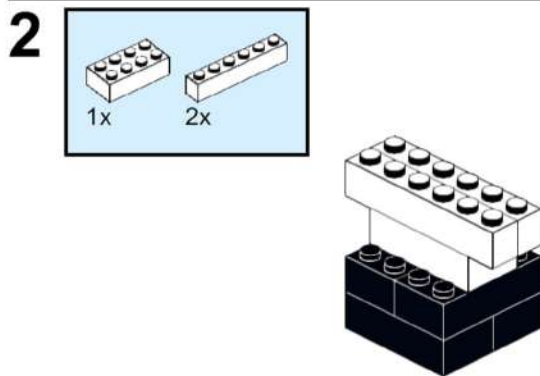
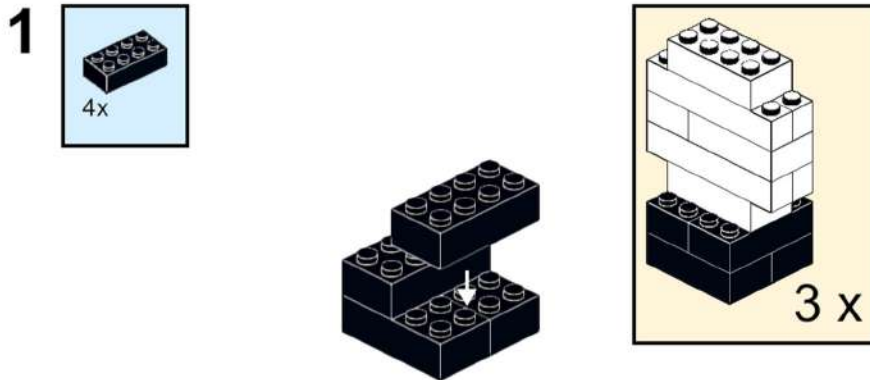


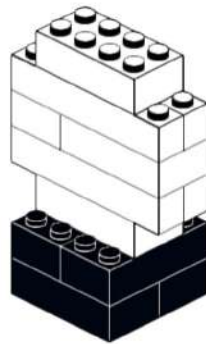
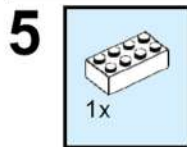
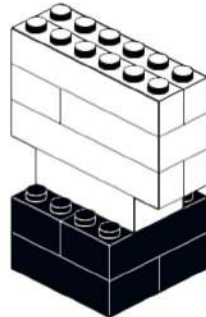
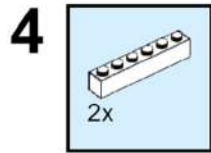




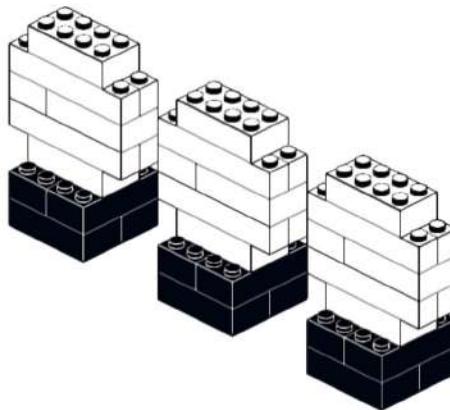
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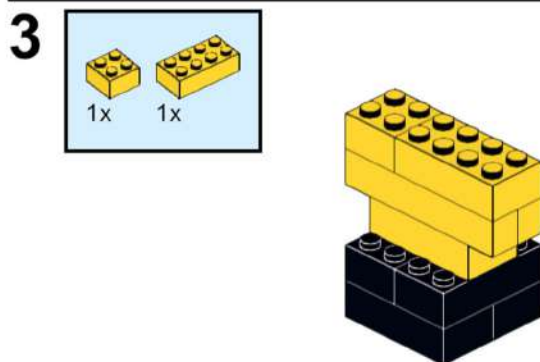
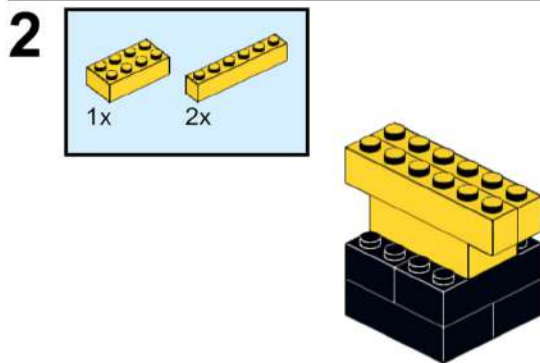
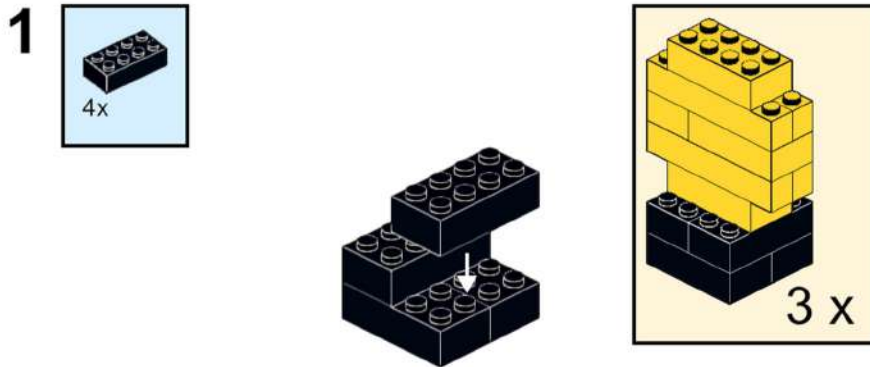


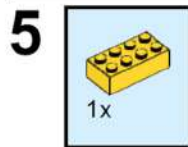
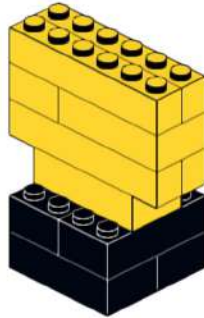
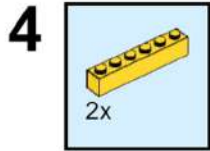




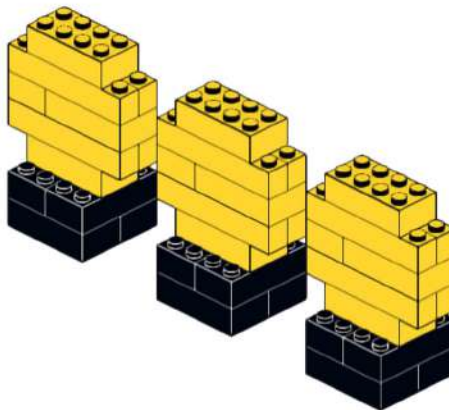
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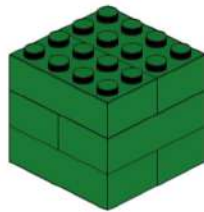
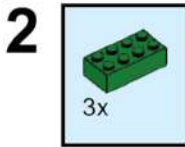
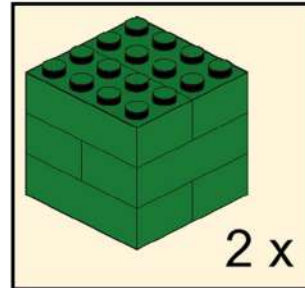
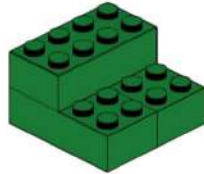
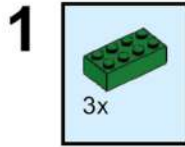






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