Quadrathlon Challenge



Version 1.0
September 2019

SITUATION :

Welcome to the Robotic Quadrathlon, an electrifying competition featuring four challenges in one! Unlike classic Olympic Games, robots will have to perform all the sports on the program in a single shot and, of course, without outside help! Therefore, all of the Olympic qualities will be evaluated, including strength, endurance, precision and agility.

Are you ready to design a robot capable of meeting this huge challenge? If so, then we have only one more thing to tell you:

On your mark, get set… **Go!**

Overall function of the robot

You must design a robot athlete capable of participating in the Robotic Quadrathlon which will include:

1. **Snorkeling:** Retrieve a weight from the bottom of the Olympic pool
2. **Weightlifting:** Lift and move a weight
3. **Precision shooting:** Hit 3 targets of different heights
4. **Curling:** Play the final end of a curling round

Two levels of difficulty are possible, White and Black, the latter being more difficult. The differences between the 2 levels can be summarized as follows:

Challenge	WHITE	BLACK
Snorkeling	Place the weight in the green zone	Place the weight in the enclosure in the green zone
Precision shooting	Location of targets known in advance	Targets randomly placed in each round but in the same order
Curling	Location of stones known in advance	Stones randomly placed in each round

Description of the robot

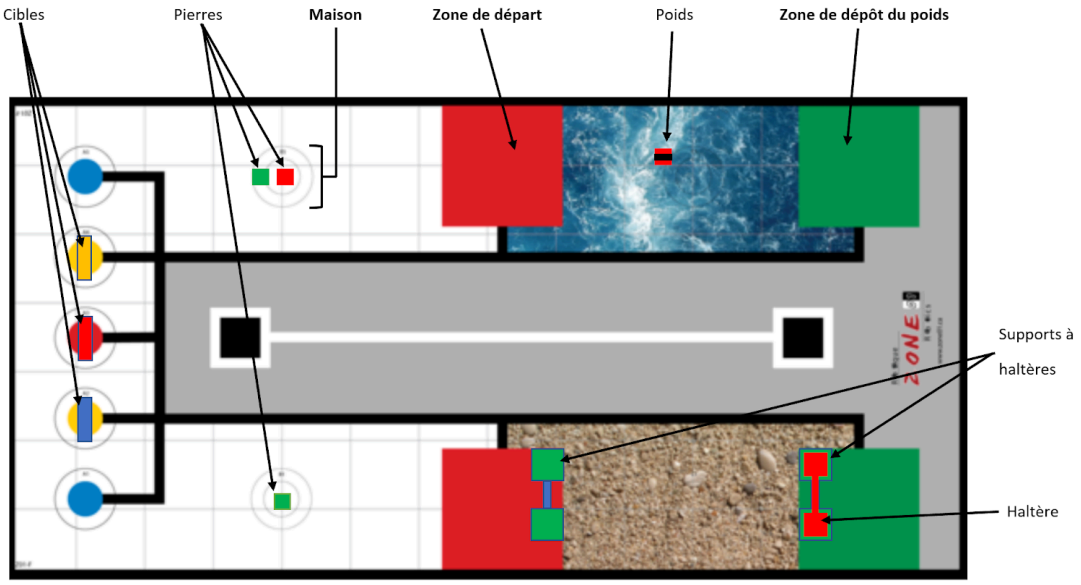
The robots participating in the challenge must respect the following constraints:

1. Maximum robot dimensions at the start : 30 X 30 cm
2. One single controller (e. g. EV3 brick)
3. All LEGO sensors are authorized

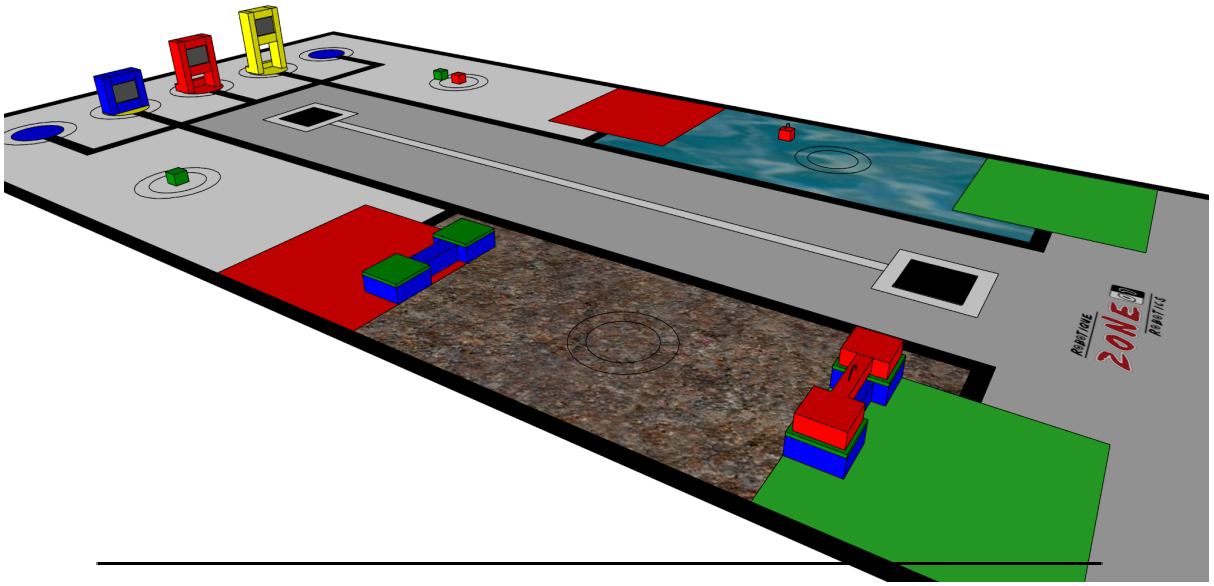
Description of the playing field

Surface used: Z01-F Mat

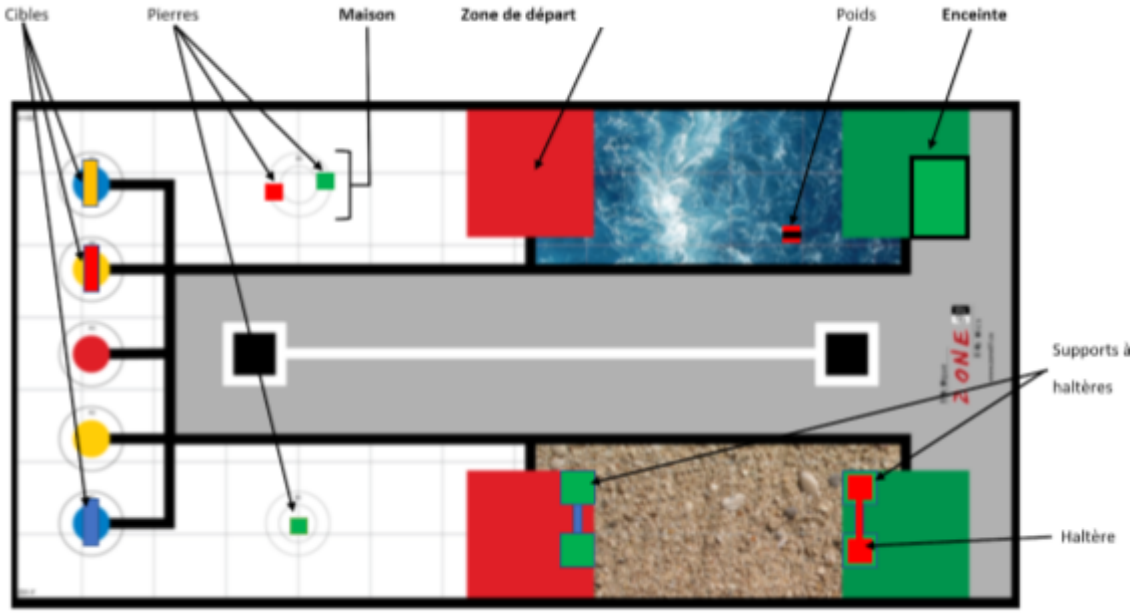
2-dimensional view, white level **(one of the possible configurations)**



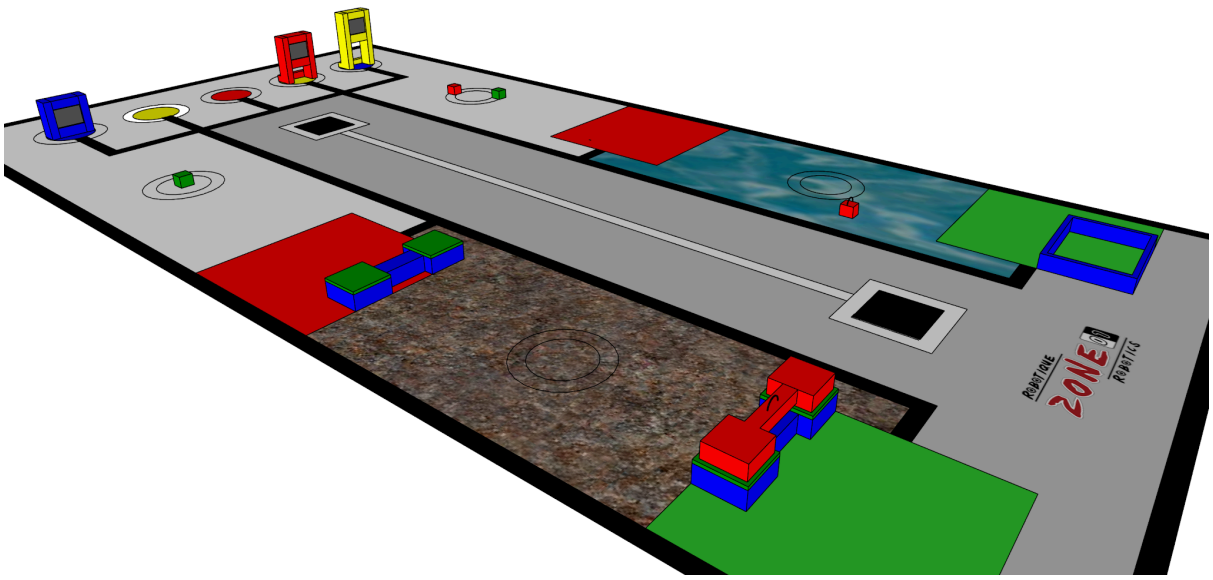
3-dimensional view, white level **(one of the possible configurations)**



2-dimensional view, black level **(one of the possible configurations)**



3-dimensional view, black level **(one of the possible configurations)**

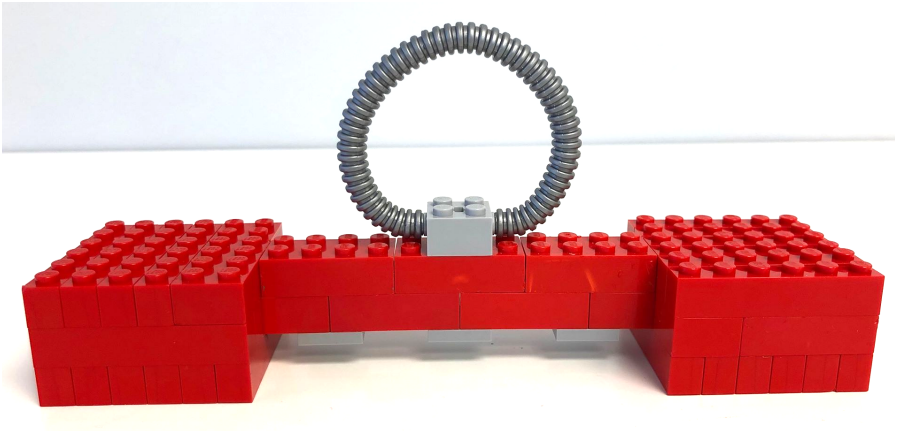


Description of accessories

Building instructions : https://www.dropbox.com/s/ffrvi1pp0hfestr/Quadrathlon.lxf?dl=0
Download LEGO Digital Designer: https://www.lego.com/en-us/ldd

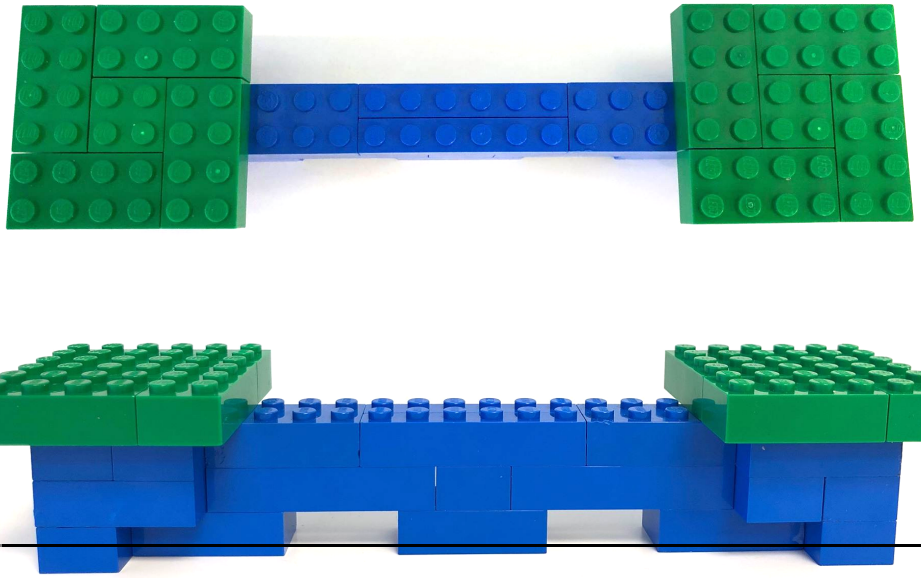
Dumbbell:

The dumbbell has the following dimensions: 19 x 5 x 3cm (excluding the ring).



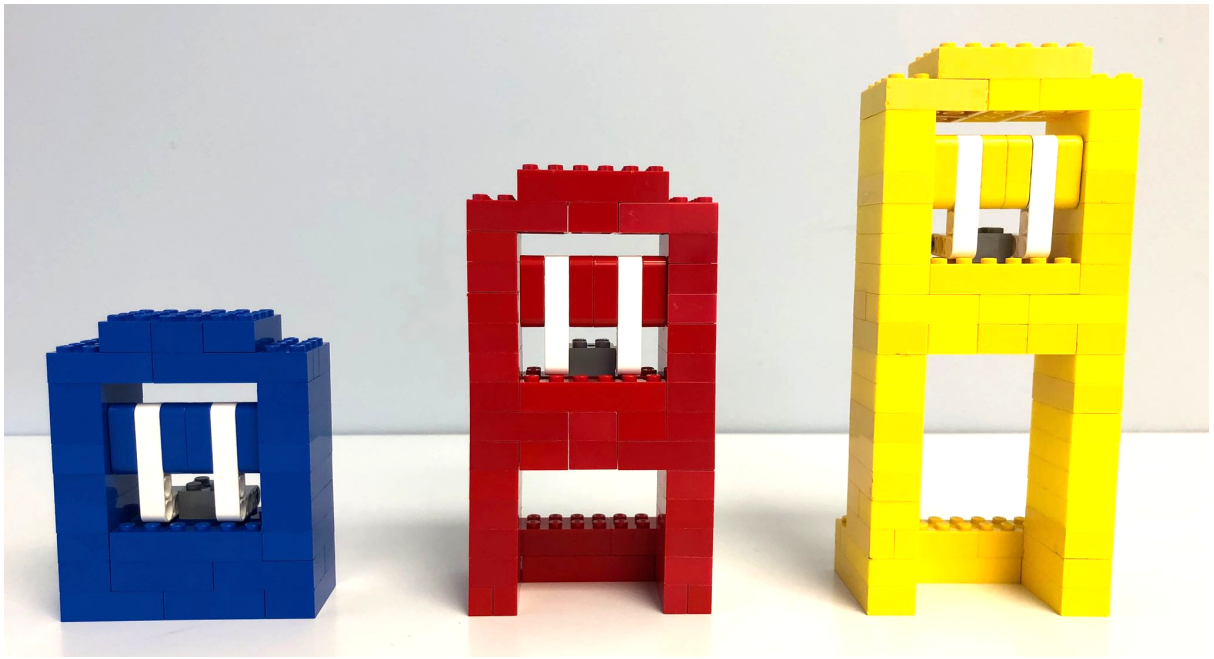
B. Dumbbell stand :

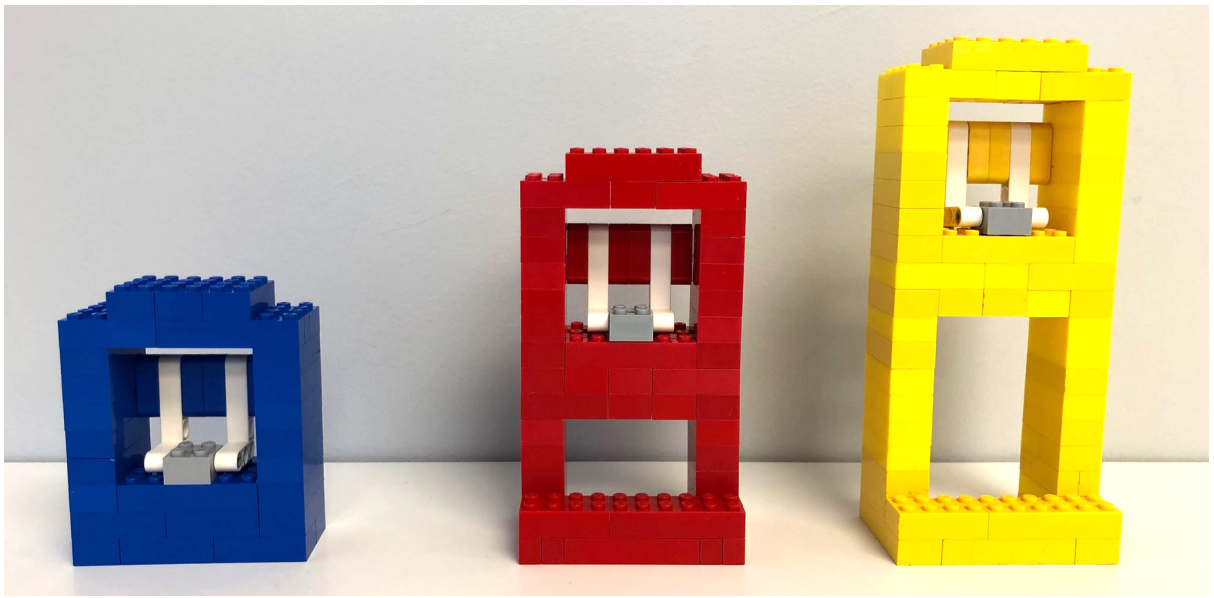
The dumbbell stand has the following dimensions: 21 x 6.5 x 4 cm. Two are needed for the challenge.



C. Targets :

There are 3 targets: a low, a medium and a high one. They are mainly made of 2X4 and 1X6 LEGO bricks as well as some LEGO Technic® parts.

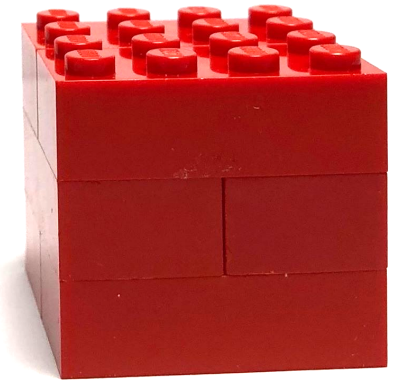




D. Curling stones:

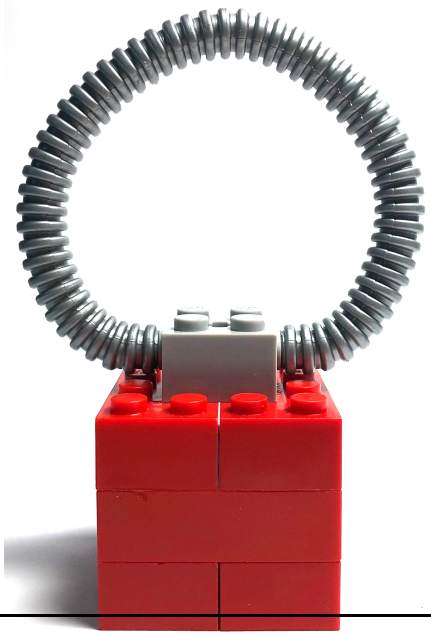
Curling stones are made of 6 2X4 red bricks (opponent's stone) or green bricks (your team's stone). To meet the challenge, 2 green stones and 1 red stone are needed.





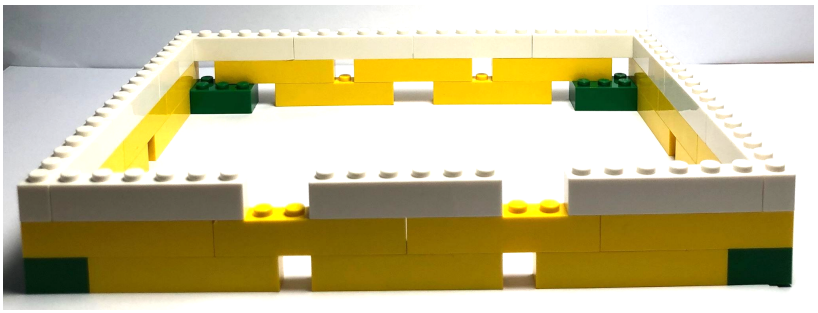
E. Weight

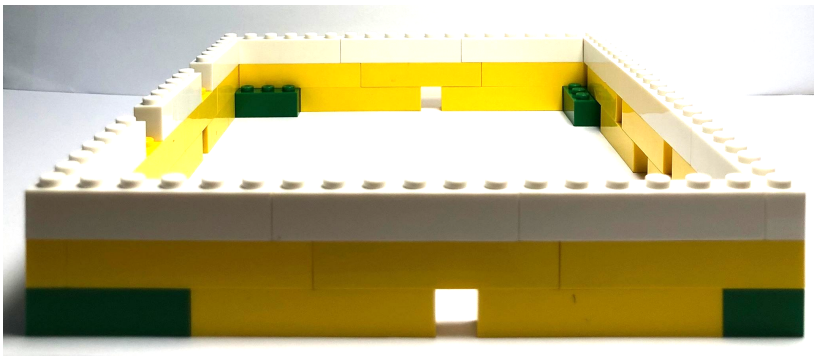
The weight has the same structure as the stones (a cube made up of 6 2X4 blocks) except that it has a ring on its upper side.

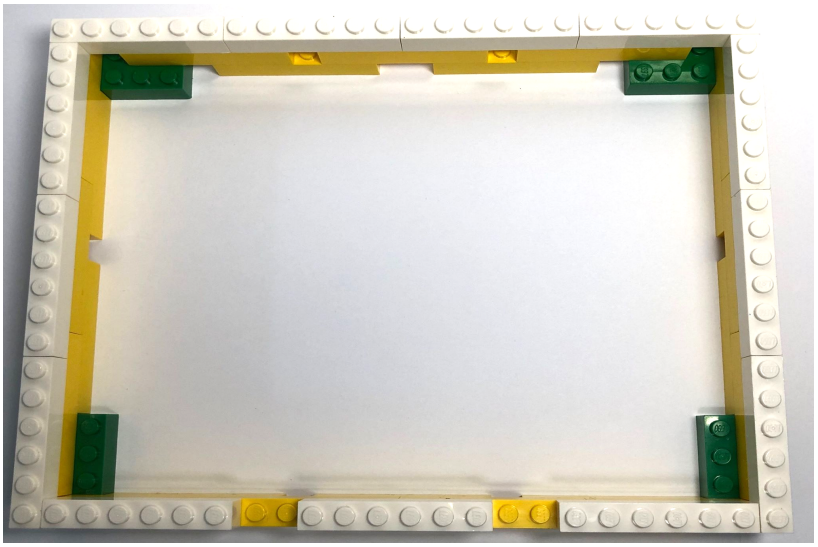


F. Enclosure

The enclosure, made of 1X6 and 2X4 blocks whose colors are not important, has the following dimensions: 19 x 15 x 3 cm.







Detailed description of the challenges

Challenge 1 - Snorkeling -

A weight is in the bottom of the Olympic pool (blue area of the mat). The robot must "dive" to retrieve it, then place it in the green area adjacent to the pool (white level) or inside the enclosure located in this green area (black level).

Important fact: the position of the weight is randomly changed between each round regardless of the level. More precisely, it will be placed on one of the many crossings of the grey lines present in this area.

Challenge 2 - weightlifting -

The robot must show its Herculean strength by lifting a dumbbell off its stand, moving it a short distance and finally placing it on another stand.

The two stands are placed on either side of the beige section of the mat. The robot must avoid moving the dumbbell stands during the mission.

Challenge 3 - Precision shooting -

Precision shooting, a difficult discipline, has been present for several years at the Olympic Games, particularly through the biathlon. For the Robolympics, the level of difficulty has been raised a notch! Three targets of different heights must be hit by the robot. In the white level, the targets are placed on the same three coloured circles, while in the black level, they are randomly placed on 3 of the 5 coloured circles, but always in the same order.

The robot must avoid moving the target supports during the mission.

Challenge 4 - Curling -

The robot must make the decisive move in a curling round. A stone belonging to the opposing team and a stone belonging to your own team are already in place. In the white level, the opponent's stone is located in the center of the house (the concentric rings) and your team's stone is between the 2 rings. In the black level, the 2 stones are randomly placed in the house.

The robot must completely remove the opponent's stone from the house, then place a new stone inside the house, as close as possible to the center of the central circle.

Surprise rule

A surprise rule will be announced to the teams on the morning of the competition. It will allow them to accumulate additional points.

Scoring table

	Max points
Weight placed completely in the green zone (white level) or in the enclosure completely in the green zone (black level)	**15**
Dumbbell out of its starting stand	**6**
Section of the dumbbell on a pillar of the second stand (7)	**14**
Target down, support still standing (8)	**24**
Red opponent stone completely out of the house	**7**
Green stone in the house (5)	**10**
Additional points for a green stone completely in the central circle of the house	**4**
Surprise rule	**20**
Total	**100**

Penalties

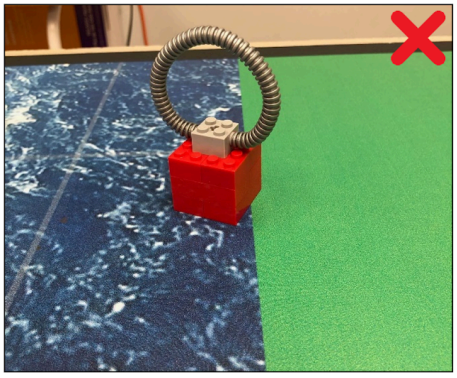
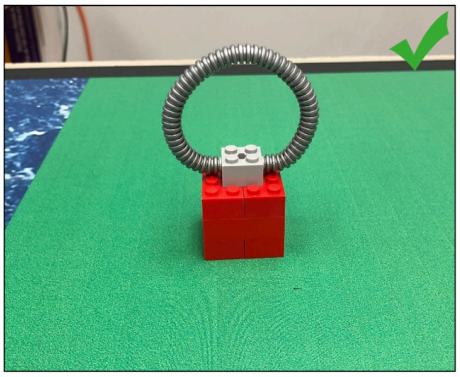
	Maximum penalty
Displaced or damaged target (-5)	-15
Dumbbell stand moved or damaged (-4)	-8

Visuals of the scoring system

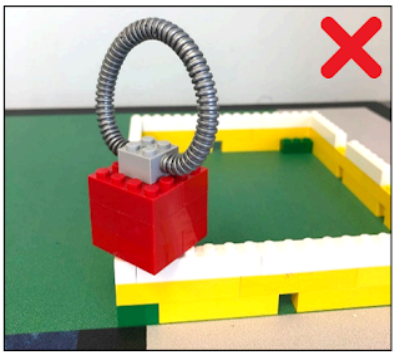
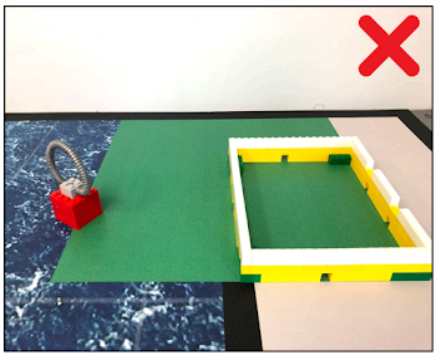
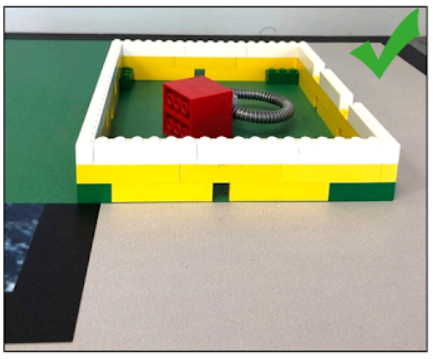
Legend: [W] = white level only [B] = black level only [W,B] = white and black levels

Snorkeling

➢ [W] Place the weight completely in the green area adjacent to the Olympic pool.

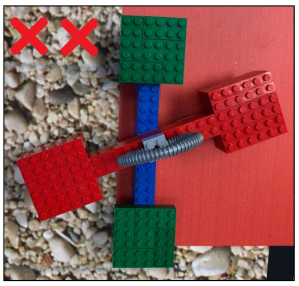
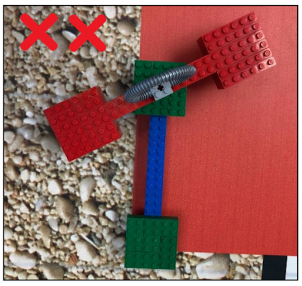
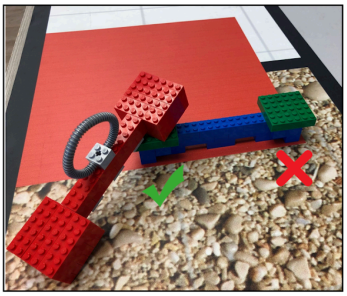
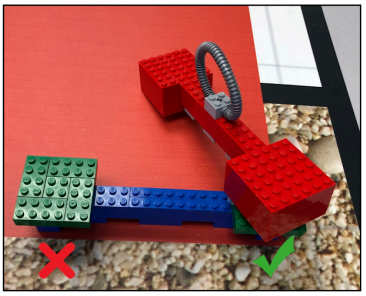
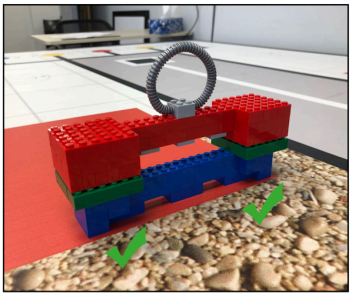



➢ [B] Place the weight in the enclosure in the green area adjacent to the Olympic pool.

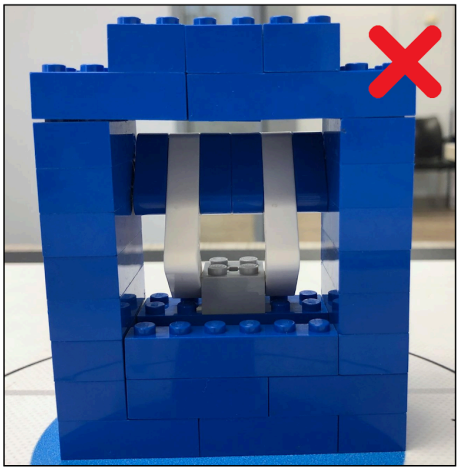
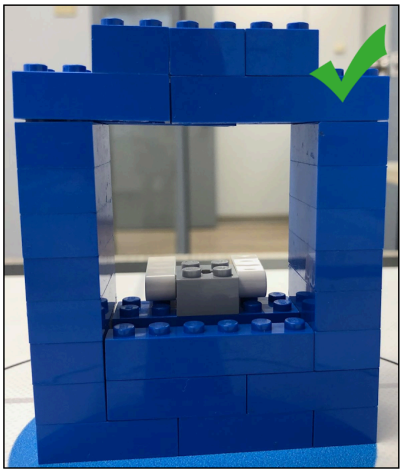
Weightlifting

➢ [W,B] Place each section of the dumbbell on one of the pillars of the second support.

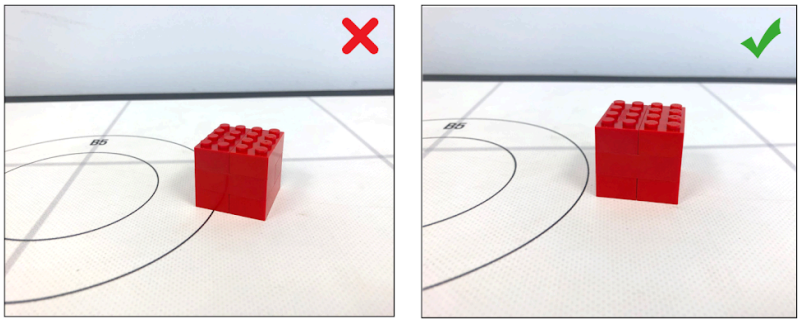
Precision shooting

➢ [W,B] Lower the 3 targets.

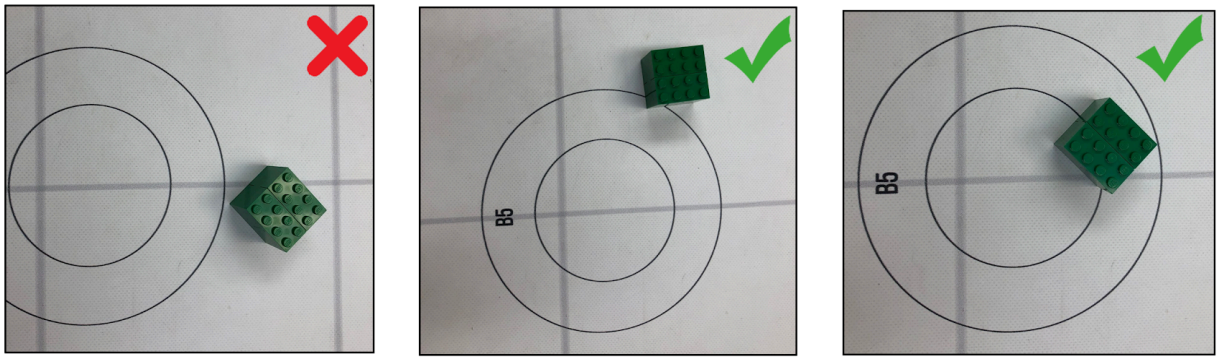



Curling

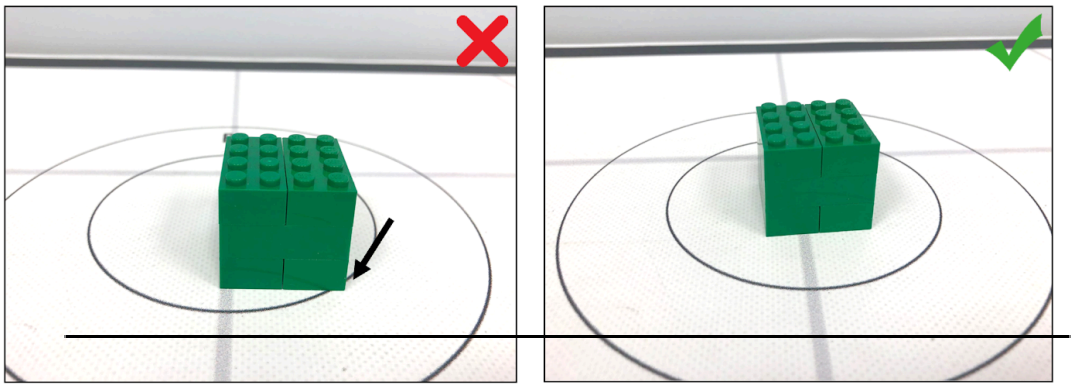
➢ [W,B] Completely remove the opponent's stone from the house.



➢ [W,B] Place/ keep a stone of your own team in the house.



➢ [W,B] Bonus for placing a stone in the center of the house.



Frequently asked questions

Q1. In which orientation will the weight in the pool be placed at the start?
A1. The orientation will be at the team's discretion

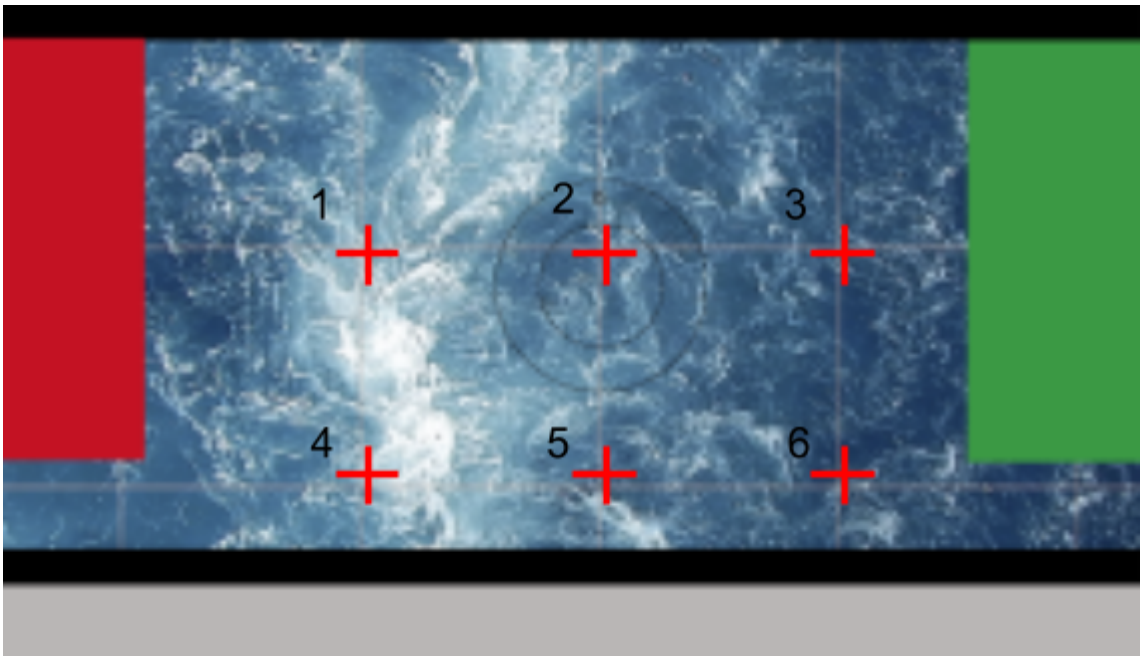
Q2. Can the stone that must be removed from the house be pushed completely out of the playing surface?
A2. Yes

Q3. How are the dumbbell stands aligned with the surface?
A3. The projection of the stands must be aligned (green bricks) and not blue bricks

Q4. In the White level, does the weight need to be standing up in the green area?
A4. The weight can be standing or not, but can only touch the green area to earn points

Q5. Where will the green stone be placed in the Quadrathlon White level challenge?
A5. The green stone will be placed as shown in the rules.

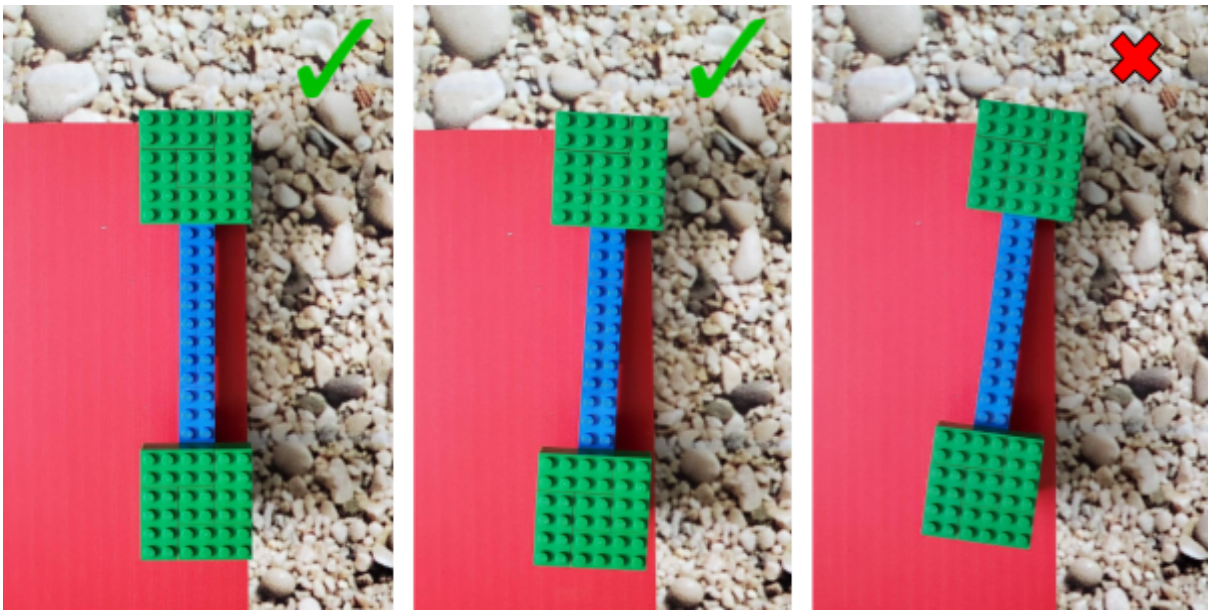
Q6. Where will the weight be placed at the start?
A6. The weight will be placed randomly on one of these 6 positions in the pool (blue area).

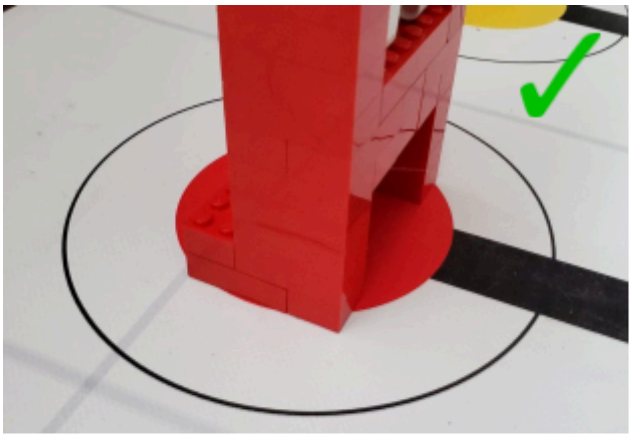


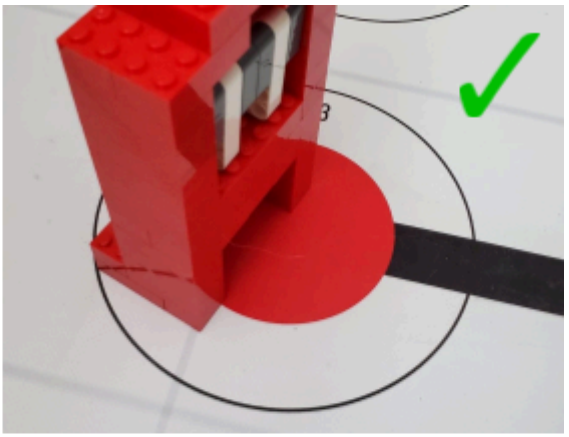
Q7. If the weight is placed completely inside the green area into the enclosure but the enclosure is moved, do we get a penalty?
A7. No, this is acceptable.

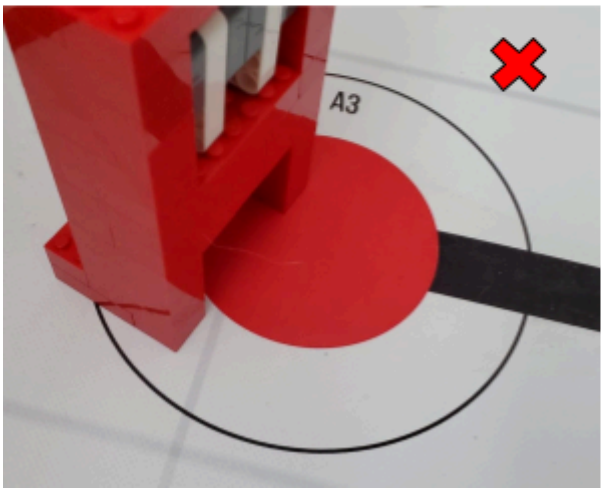
Q8. Can the robot extend outside of the start area at the start?
A8. No, the robot must fit completely within the start area

Q9. Please clarify the penalties for moving a target or a support?
A9. Please see below








A3

