World Robot Olympiad 2020

Regular Category

Senior

CLIMATE SQUAD

Rising Water

Version: January 15th

WRO International Premium Partners

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1. Introduction

Rising water is dangerously increasing pressure on the dikes that protect an area below sea level. The warning system just alerted you that water is leaking from two dikes that threaten to collapse. Your robot is parachuted into the area to fix the issues.

This year, it is the Senior mission to design a robot that will need to locate the dikes' weaknesses, find material to build reinforcement walls, install sandbags to protect houses, and notify their occupants that they have to evacuate.

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2. Game Field

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

If the table is larger than the game mat, the mat will be centered in all dimensions. Possible space between the mat and the wall will be counted towards the area on the mat.

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

Information about the start position:

This year, the Senior field does not have a typical start area. The robot starting position will be randomly selected as one of the grey circles. The robot shall be placed so that the grey circle is fully covered by the projection of the robot (top view). The team is allowed to place the robot facing in any direction.

As this starting circle is smaller than the allowed robot size, the size of the robot will be measured based on the General Rules before the run.

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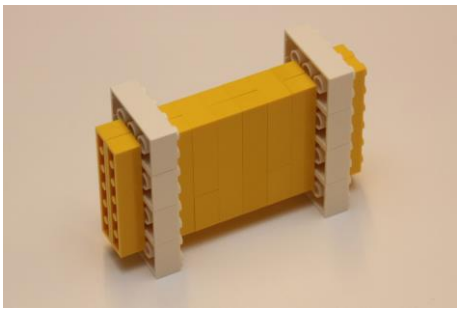
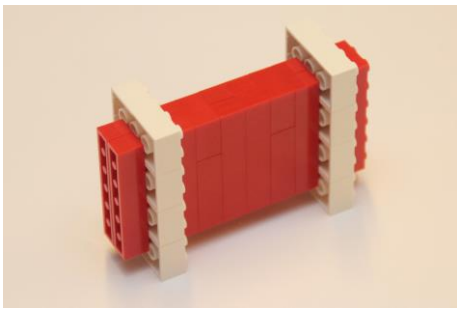
3. Game Objects

Concrete blocks

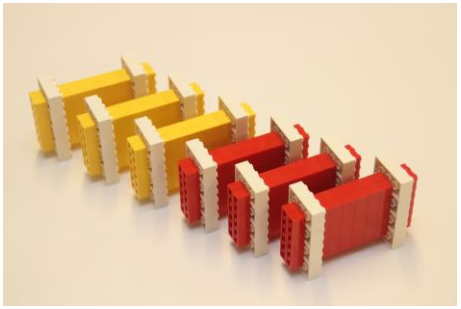
Six concrete blocks (3 yellow and 3 red) are available and can be used to build reinforcement walls. The blocks can be stacked in an intertwined way.



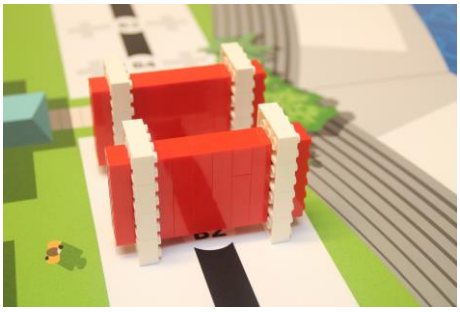
Yellow block



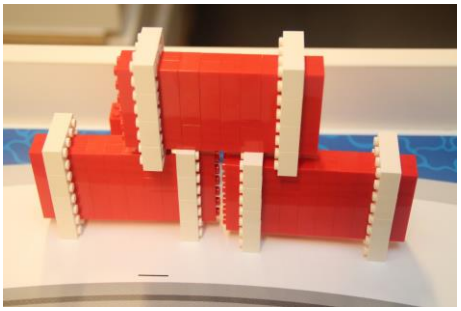
Red block



All blocks



Concrete blocks placed on the field



Blocks stacked in an intertwined way

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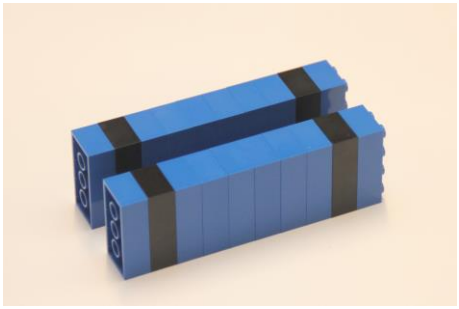
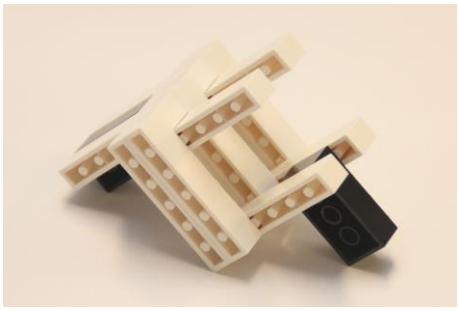
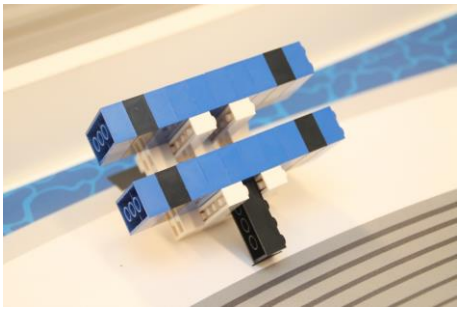
Sandbags

Four sandbags (2 green and 2 blue) are available and can be used to protect houses against water coming from the leaking dikes.

Green sandbags	 Blue sandbags

Sandbag racks

Two sandbag racks are used to store sandbags (2 per rack).

 Sandbag racks	 Sandbags are placed centered on the sandbag racks

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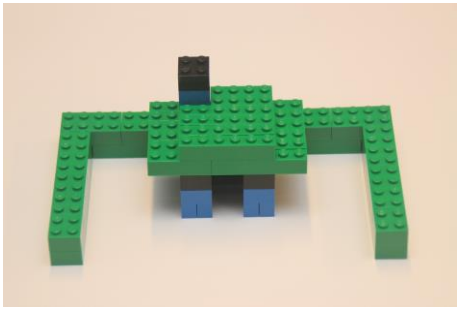
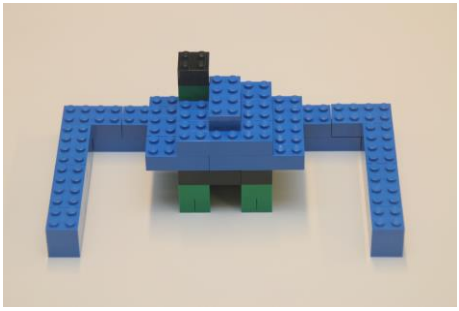
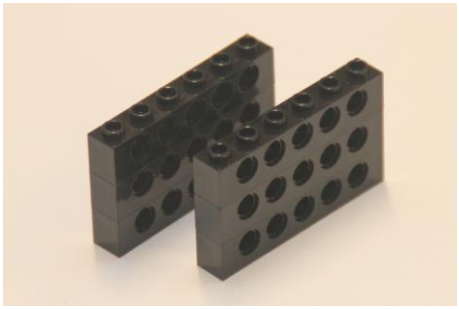
Houses

Two houses (green and blue) with surrounding walls are installed on the playing field. Houses have no wall on the front, so they are vulnerable to rising water.

 Green house	 Blue house

Evacuation notice

Two notices of evacuation shall be used to force the house occupants to evacuate. The robot can carry them at the start. One notice shall be delivered to each house.

 Evacuation notice	

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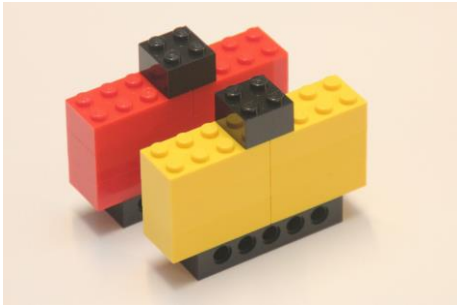
Dike status cards

A red dike status card means that a red reinforcement wall shall be built at this location, a yellow dike status card means a yellow reinforcement wall.

 Dike status cards	

Trees

A number of trees have grown in the center of the playing field since the dikes were built.

Trees are not made of LEGO parts. Cylinders of any material, color and weight can be used (cartons, soda can, toilet roll, kitchen roll, wood, metal) can be used as trees. Diameter shall be between 4 and 7 cm, height shall be at least 10 cm, weight not more than 100g each.

It is recommended to use 3 trees for regional events and up to 6 trees for a national event.

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4. Positioning of game objects & randomization

For a better understanding, the game field is divided into four areas: A (top-left), B (bottom-left), C (top-right) and D (bottom-right) – See the following graphic:

The game objects will be positioned and randomized as followed:

On the morning of the competition:

1. The position of the houses will be randomly selected. The two houses are placed in **two of the four areas** (one each) and will stay there for the competition day.
2. **Sandbag racks** are installed in the other areas, those without a house (S areas).

Before every round (same for all teams in one round):

1. Two sandbags are placed in each sandbag rack without mixing colors.
2. One red or one yellow dike status card is placed in each of the areas with a house.
3. Three concrete blocks are randomly placed on 3 of the 4 possible locations (B1, B2, B3, or B4) in the each of the other areas without a house, but always all three concrete blocks of one color in one area (no mix of colors).
4. Trees are randomly placed on the white circles (T1 to T8), at least one per column. For regional events, 3 trees are used. Organizers can decide to have more trees on national finals.
5. The start positions of the robot (the grey circles, R1 to R6) will be randomly selected.

One possible example:

- Houses are placed in A and C areas
- Sandbag racks in S-positions in B and D areas
- Blue sandbags are placed in sandbag rack in area B, green in area C
- Red dike status card is placed in area A, yellow card in area C.
- Red concrete blocks are placed on B1, B2, B3 in area B, yellow concrete blocks on B2, B3, B4 in area D.
- Trees are placed on T3, T4, T6.
- The robot should start on R3.

See the photos on the next page as an example for the setup of the field.

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<table>
<tr>
<td>

A (top-left) & B (bottom-left) AREA</td>
<td>

- Blue House in area A
- Red Dike card in area A
- Yellow concrete blocks in area B
- Blue sandbags area B
- Trees on position T3, T4
- Robot on R3 with evacuation notice lying on top

</td>
</tr>
<tr>
<td>

C (top-right) & D (bottom-right) AREA</td>
<td>

- Green house in area C
- Yellow dike card in area C
- Red concrete blocks in area D
- Green sandbags in area D
- Tree on T6

</td>
</tr>
</table>

Please note: This is <u>one possible setup</u> based on the randomization explained on the page before. Please take a close look at the explanation of the randomization!

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5. 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.**

In order to execute its missions, the robot will need to navigate in a complex environment without knowing its initial starting position and without damaging or moving any trees.

5.1 Deliver notices of evacuation

The robot must deliver a notice of evacuation to each house occupant. Notice is considered delivered if it is within the property defined by the walls surrounding the house.

5.2 Protect the houses

The robot needs to install two sandbags to close the open area in front of the houses. Each sandbag touching the black line in front of the house will earn points.

Extra points are awarded if the house is fully protected against rising water and if the sandbags of the same color as the house are used. The house is fully protected if there is no remaining opening large enough to fit the width of a 1x6 LEGO brick.

5.3 Build reinforcement walls

The robot needs to build reinforcement walls in front of the leaking dikes. Each wall should be made of concrete blocks of the same color as the dike status card.

To earn points, a concrete block must touch the target area. Extra points are awarded if building blocks of the same color as the dike status card are used and if the concrete blocks are built as a stacked construction.

5.4 Park the robot

The mission is complete when the robot returns to its starting position and stops by itself. The starting position grey circle must be at least partly covered by the projection of the robot.

5.5 Get bonus points and avoid penalties

Bonus points will be awarded for houses that are still in its original position. Penalties will be awarded for trees that are moved (no longer touching the light grey square). Penalties will never result in a negative score (see General Rules).

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6. Scoring

Definitions for the scoring

- **"Completely"** means that the game object is only touching the corresponding area (not including the black lines). "**Partly"** means that the game object is at least touching the area with one part.

Tasks	Each	Total
Deliver the notices of evacuation		
Completely within the property (max. 1 per house)	**9**	**18**
Partly within the property (max. 1 per house)	6	12
Protect the houses		
Sandbag touches the black line (2 max. per house)	**12**	**48**
• Bonus if both sandbags are the same color as the house	**8**	**16**
• Bonus for house fully protected (no gap)	**10**	**20**
Build reinforcement walls		
Concrete blocks completely inside the white target area or stacked on blocks completely inside the white target area (3 max per target area)	**4**	**24**
• Bonus for concrete block **standing and correctly stacked in an intertwined way** on two blocks	**8**	**16**
• Bonus for each block of the right color per target area	**7**	**42**
Return to starting position		
Returns to its starting position and stops by itself (partly or completely hiding the grey circle from top view)	**6**	**6**
Get bonus points and avoid penalties		
House still in its original position and not damaged	**5**	**10**
Tree moved (no longer touching the light grey square) or damaged. (*)	-7	-21
Maximum Score		**200**

(*) If more than 3 trees are used for the game, then more negative points are possible.

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Scoring Sheet

Team name: _____ **Round:** _____

Tasks	Each	Max	#	Total
Deliver the notices of evacuation				
Completely within the property (max. 1 per house)	9	18		
Partly within the property (max. 1 per house)	6	12		
Protect the houses				
Sandbag touches the black line (2 max. per house)	12	48		
• Bonus if both sandbags are the same color as the house	8	16		
• Bonus for house fully protected (no gap)	10	20		
Build reinforcement walls				
Concrete blocks completely inside the white target area or stacked on blocks completely inside the white target area (3 max per target area)	4	24		
• Bonus for concrete block **standing and correctly stacked in an intertwined way** on two blocks	8	16		
• Bonus for each block of the right color per target area	7	42		
Return to starting position				
Robot started at position:				
Returns to its starting position and stops by itself (partly or completely hiding the grey circle from top view)	6	6		
Get bonus points and avoid penalties				
House still in its original position	5	10		
Tree moved (no longer touching the light grey square) or damaged (at least one piece broken). (*)	-7	-21		
Maximum Score		200		
			Surprise Rule	
			Total Score in this run	
			Time in full seconds	

Signature Team

Signature Judge

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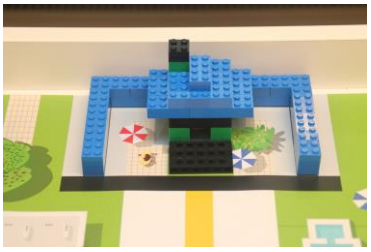
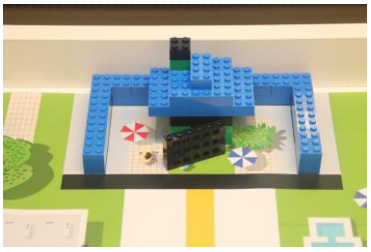
Scoring Interpretation

Completely within the property (max. 1 per house) ➔ 9 points



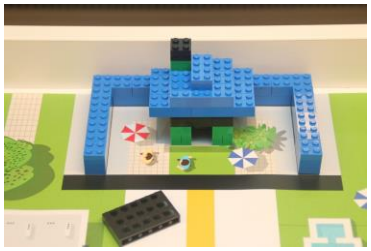
Black line belongs to the property, this is OK.



Standing is OK as well.

9 points, only one counts.

Partly within the property (max. 1 per house) ➔ 6 points



0 points, out.

Sandbag touches the black line (2 max. per house) ➔ 12 points

24 points, 2 touching.

12 points, 1 touching.

24 points, only 2 count.

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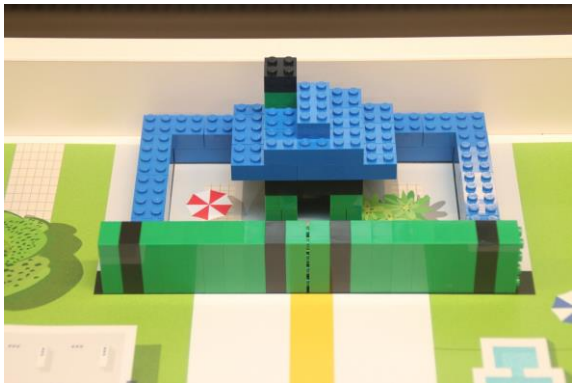
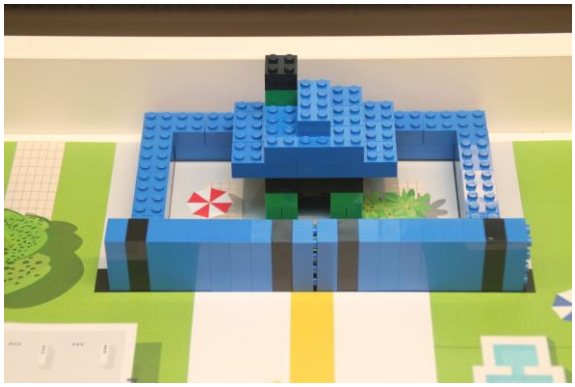
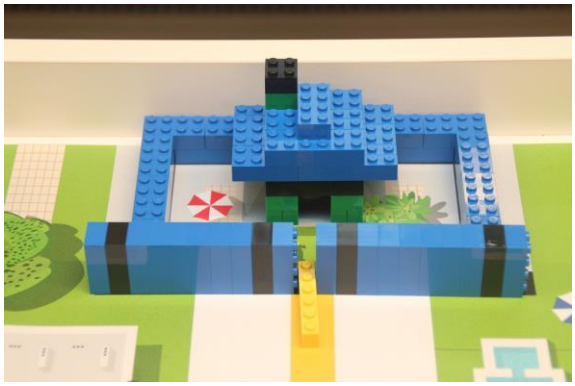
Bonus if both sandbags have the same color as the house ➔ 8 points
Bonus for house fully protected (no gap) ➔ 10 points

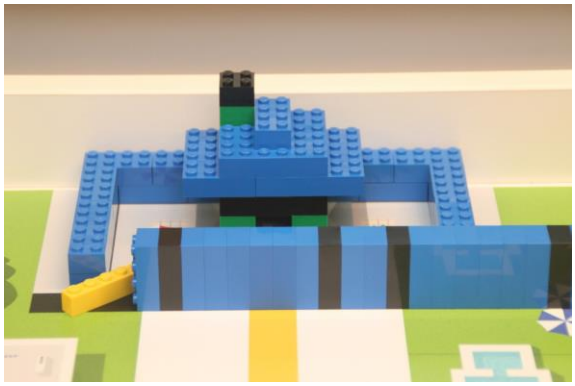


2x 12 points: Sandbags touching
+ 10 points: House fully protected



2x 12 points: Sandbags touching
+ 10 points: House fully protected
+ 8 points bonus for correct color





The house is not fully protected because
a 1x6 LEGO piece could be stacked between the sandbags:
2x 12 points: Sandbags touching
+ 8 points bonus for correct color

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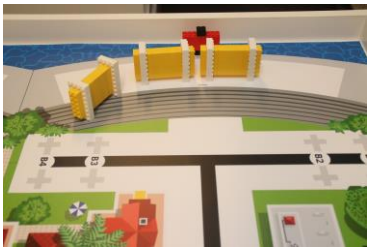
Concrete blocks completely inside the white target area or stacked on blocks completely inside the white target area (3 max per target area) ➔ 4 points



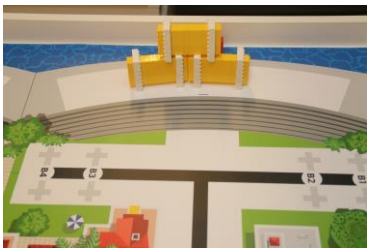
2 x 4 points = 8 points
(two completely inside)

2 x 4 points = 8 points
(two completely inside)

3 x 4 points = 12 points
(three completely inside)

3 x 4 points = 12 points
(three completely inside)

Bonus for concrete block **standing and correctly stacked** in an intertwined way on two blocks
➔ 8 points



3 x 4 = 12 points.
+ 8 bonus points.

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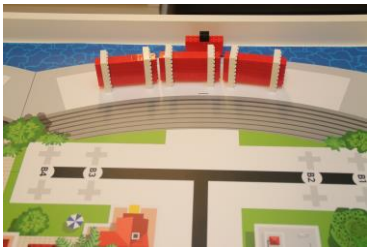
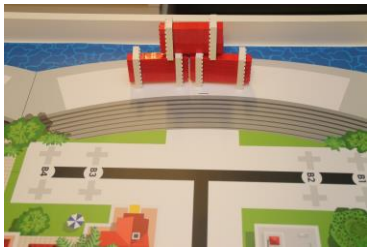
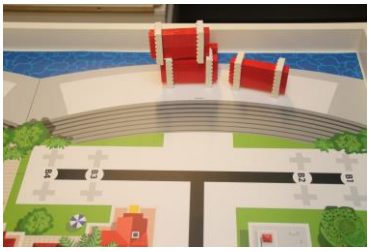
Bonus for each block of the right color per target area ➔ 7 points



3 x 4 = 12 points
+ 3 x 7 = 21 bonus points
for correct color.

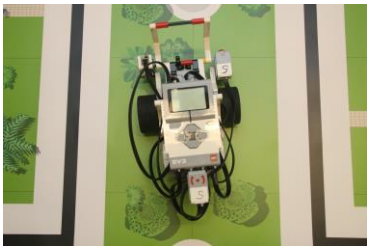


3 x 4 = 12 points
+ 8 bonus points for stacked in an intertwined way
+ 3 x 7 = 21 bonus points
for correct color.

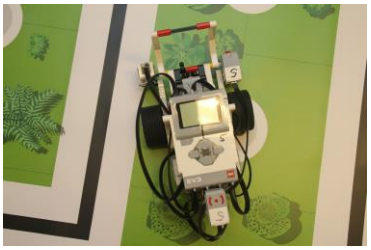


3 x 4 = 12 points
Blocks are inside but not stacked in an intertwined way.
+ 3 x 7 = 21 bonus points
for correct color.

Returns to its starting position and stops by itself (partly or completely hiding the grey circle from top view) ➔ 6 points



Covers start position completely. 6 points.



Covers start position partly. 6 points.

Returning to a wrong R1 – R6 area (that was not the start position) is worth 0 points.

House still in its original position and not damaged ➔ 5 points

OK, 5 points.

OK, not out of light grey / black area. 5 points.

OK, pushed to the wall (if table larger than mat). 5 points.

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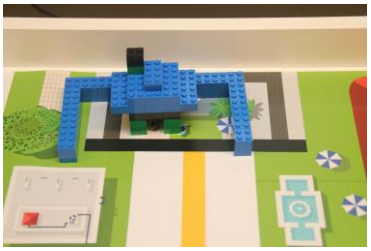

Not ok, 0 points.

Tree moved (no longer touching the light grey square) or damaged. ➔ -7 points

Still ok, Tree inside white area and light grey border.

Not ok, moved outside of the circle. -7 points.

Tree damaged, -7 points.

Note: Please be aware that the tree can look differently in your country / at your competition. Please see the information of your National Organizer which type of tree is used.

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7. Local, regional, and international events

WRO competitions take place in around 80 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.

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.

In every country, our National Organizers can decide to make the challenge easier for local, regional and / or national events. They can make their own choices, that fit their specific situation. Here we provide some ideas to make the challenges easier.

Ideas for simplifications

- Use a fixed position of the trees for the competition day
- Use a fixed start position of the robot for the competition day
- Limited the number of trees and inform the teams upfront where the trees are placed.

Special conditions at the International Final

The Host Country will inform about the dimensions of the trees for the international final no later than September 1st 2020.

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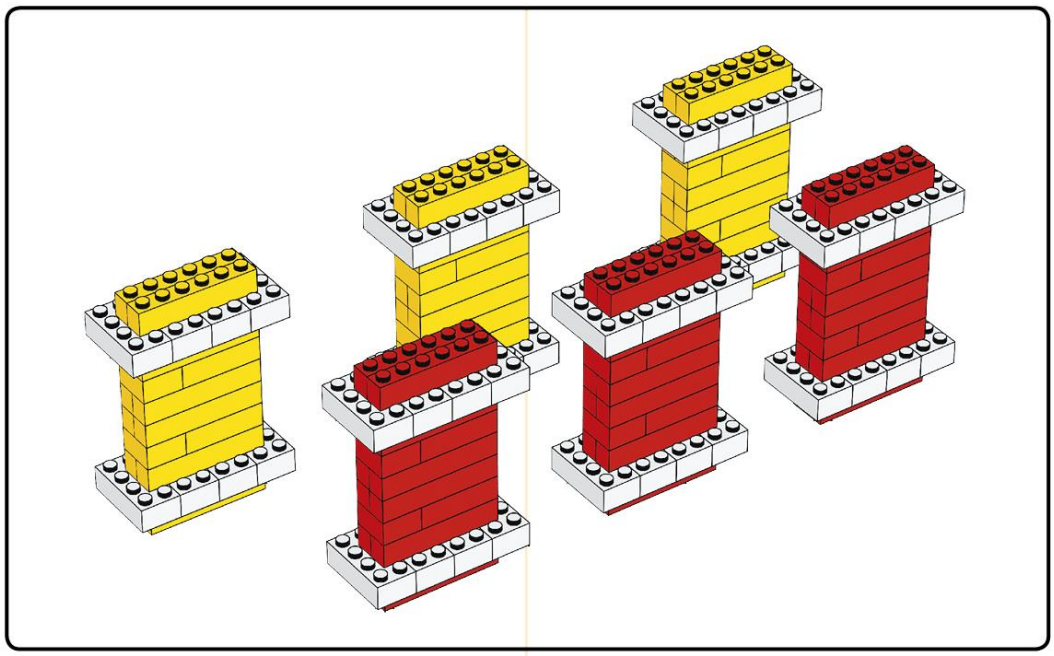
8. Assembly of Game Objects



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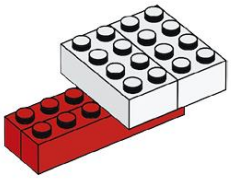

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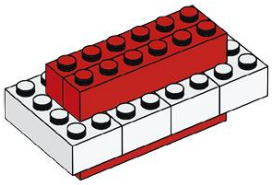

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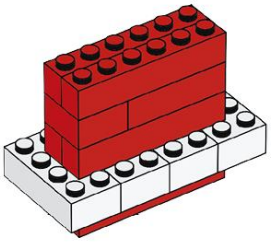

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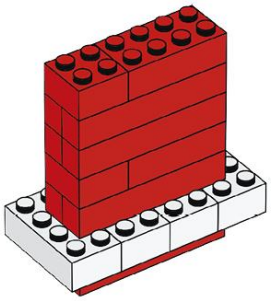

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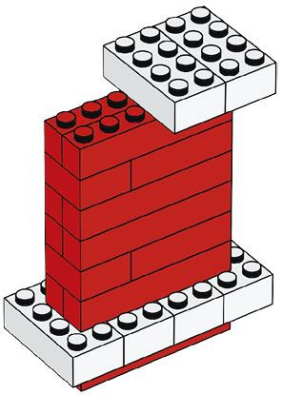

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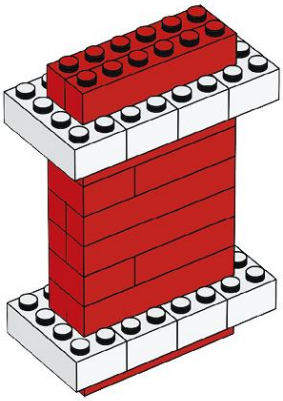

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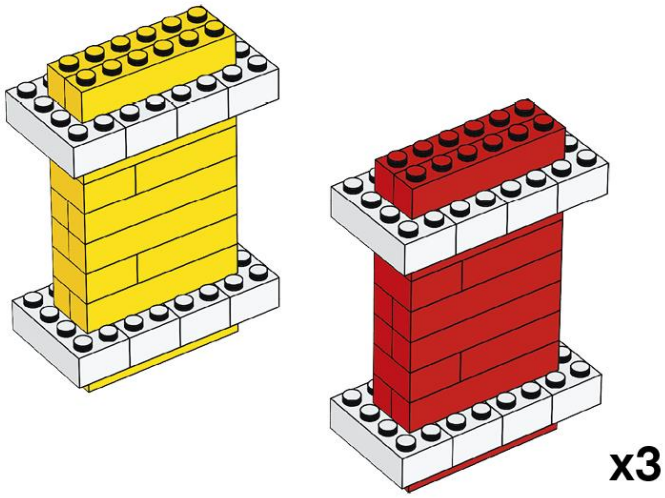

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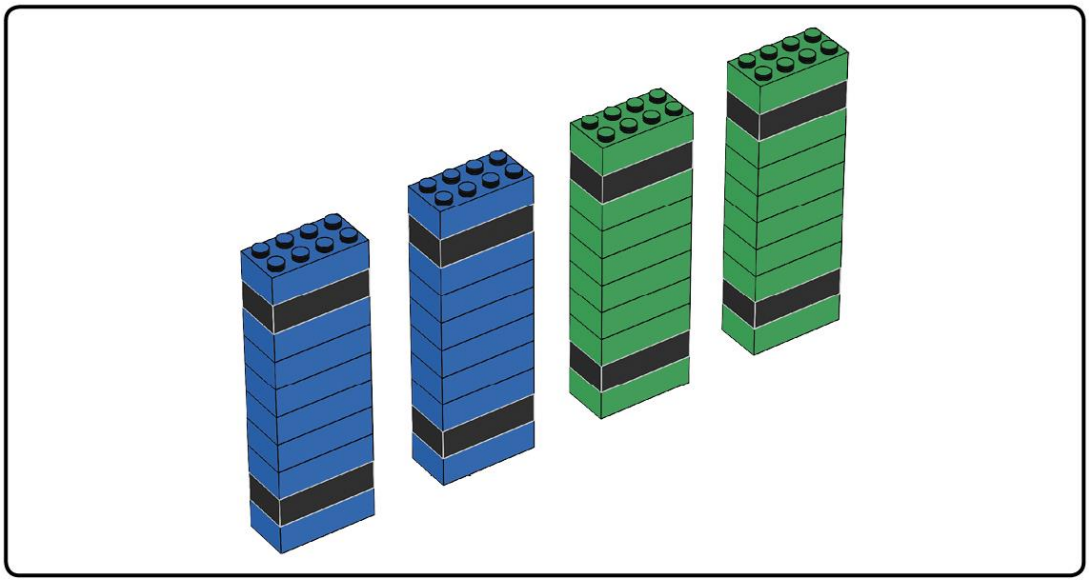

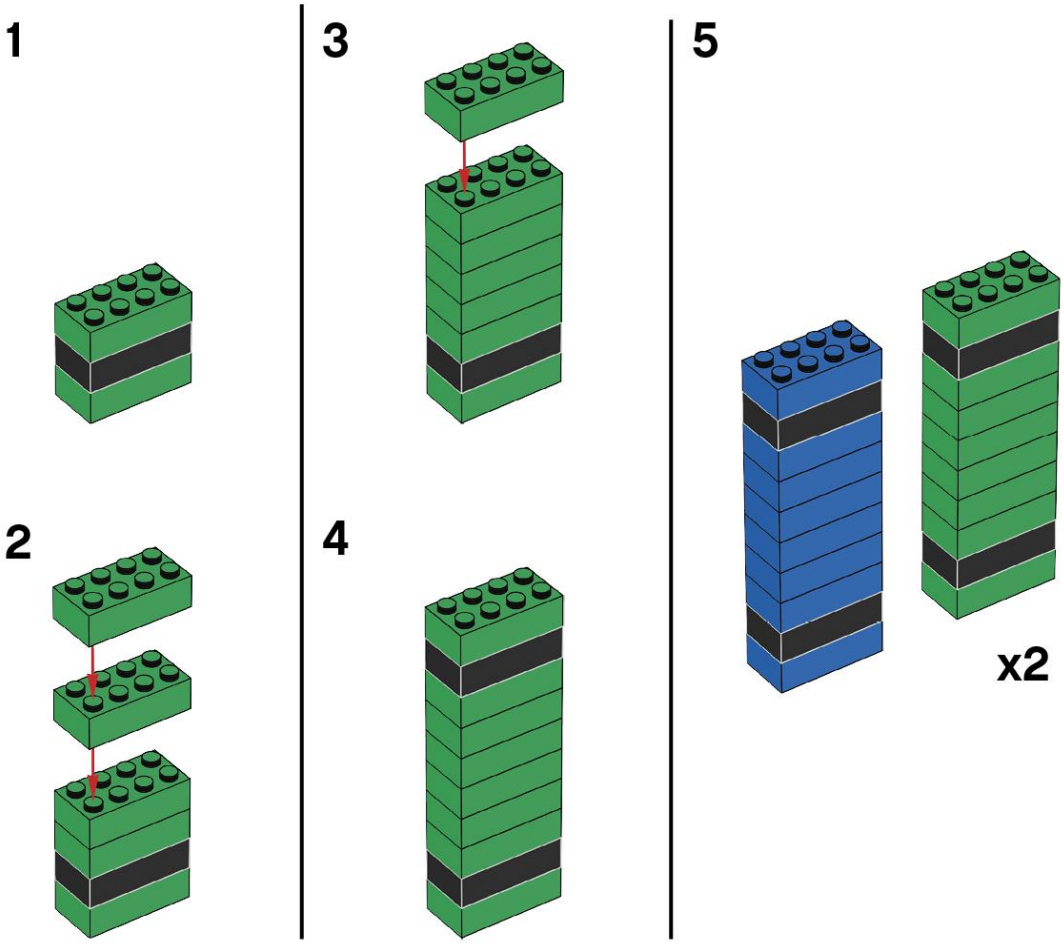

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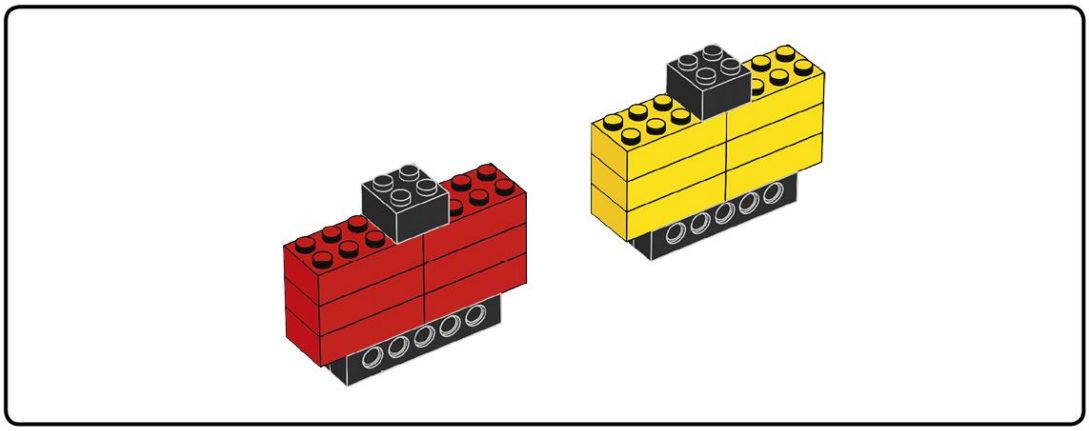

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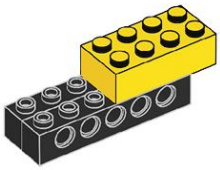

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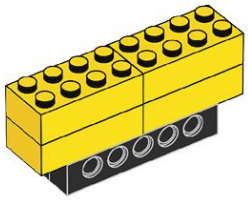

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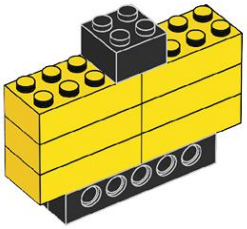

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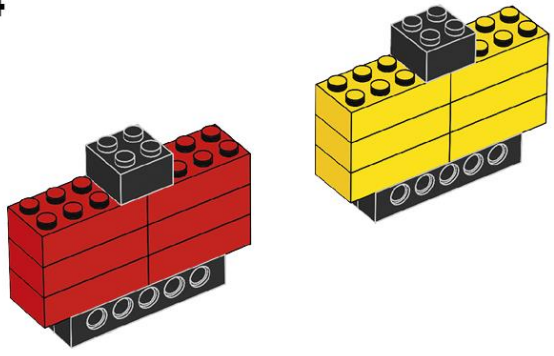

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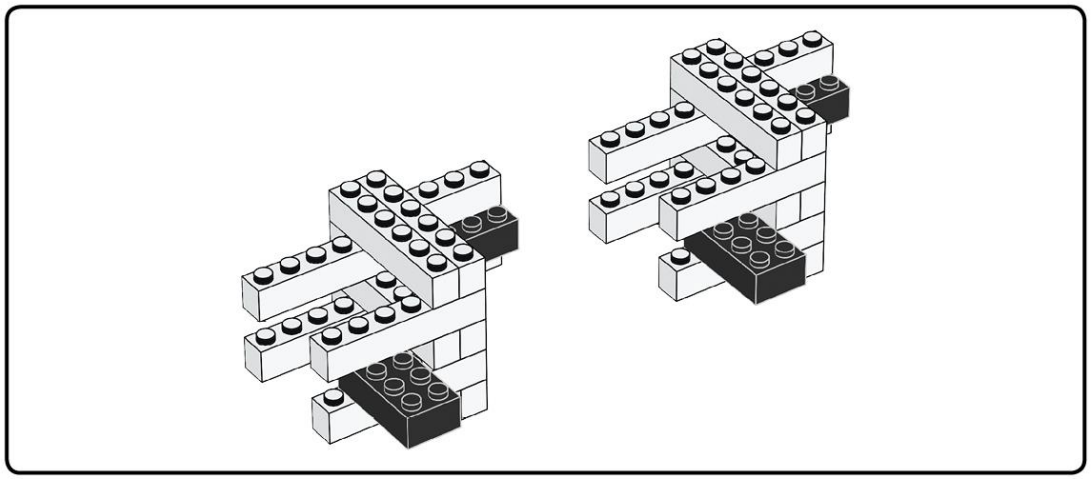

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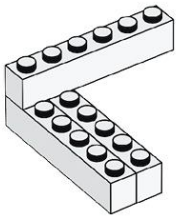

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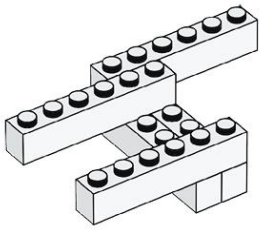

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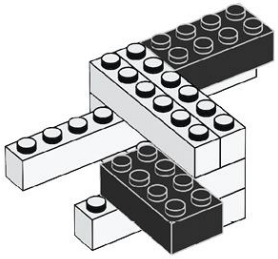

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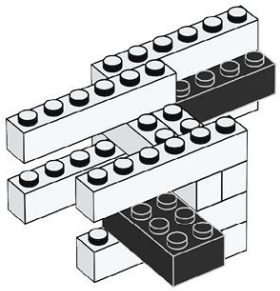

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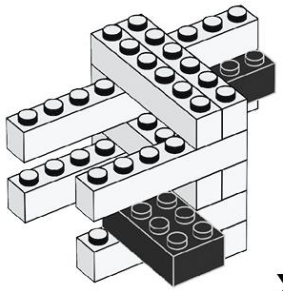

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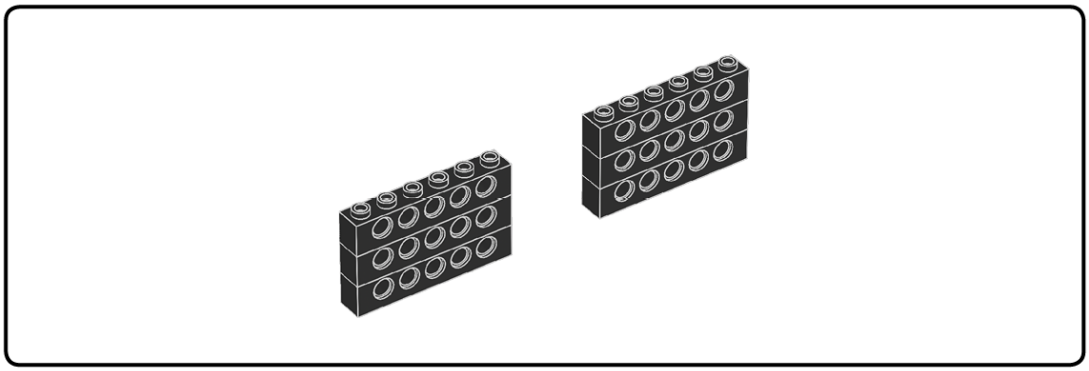

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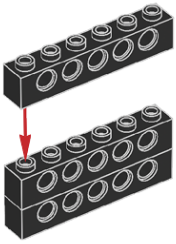

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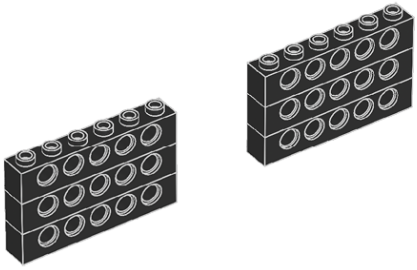

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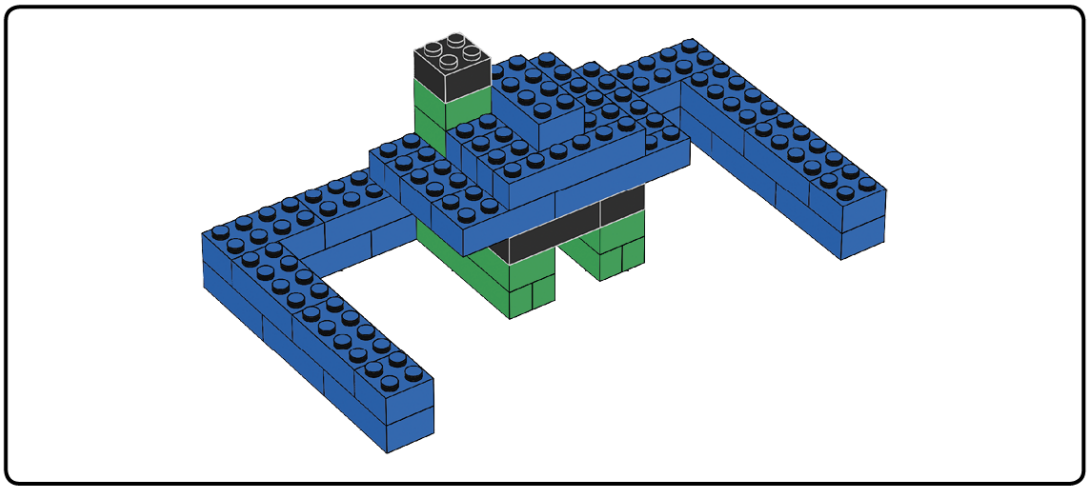

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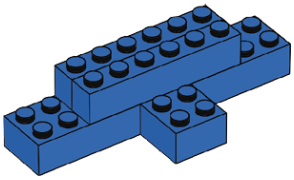

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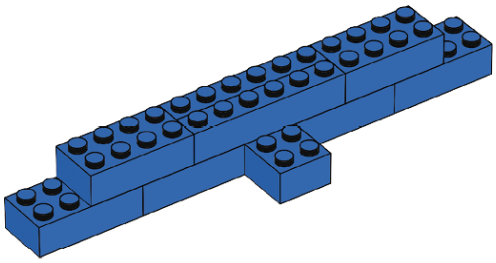

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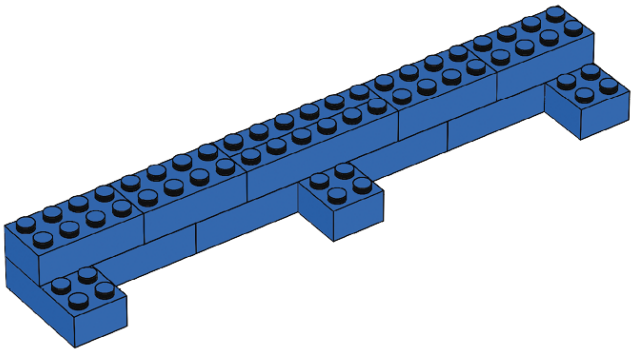

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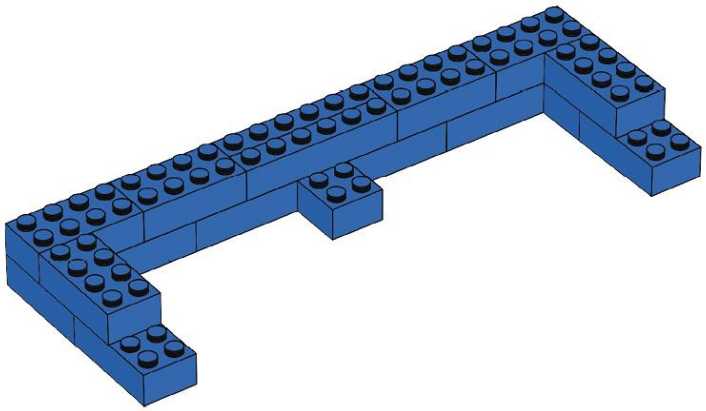

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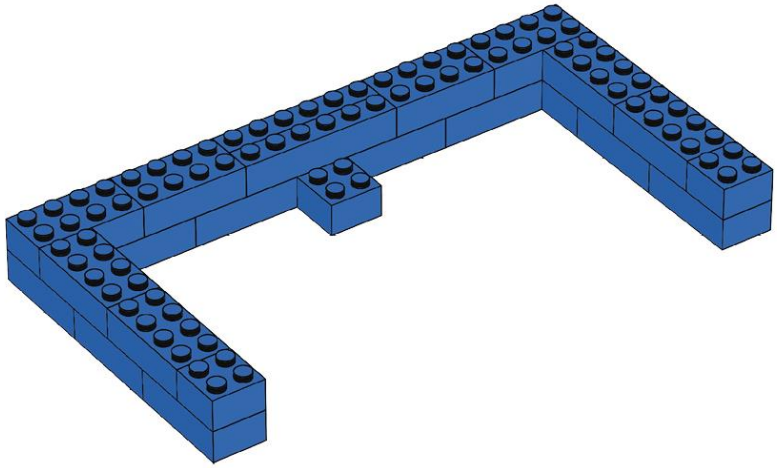

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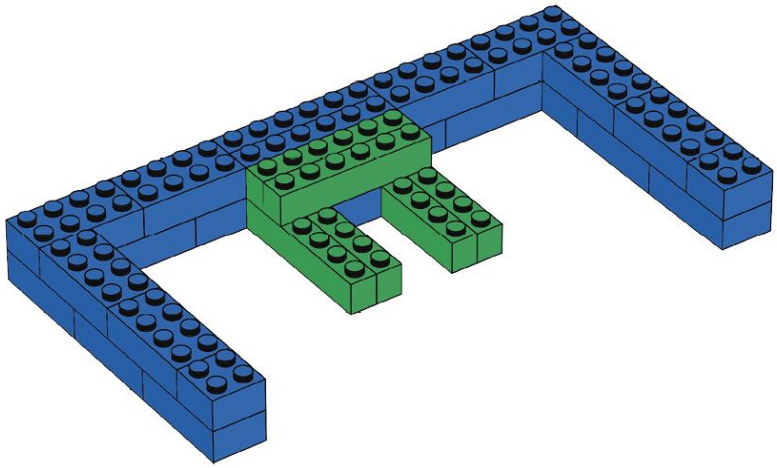

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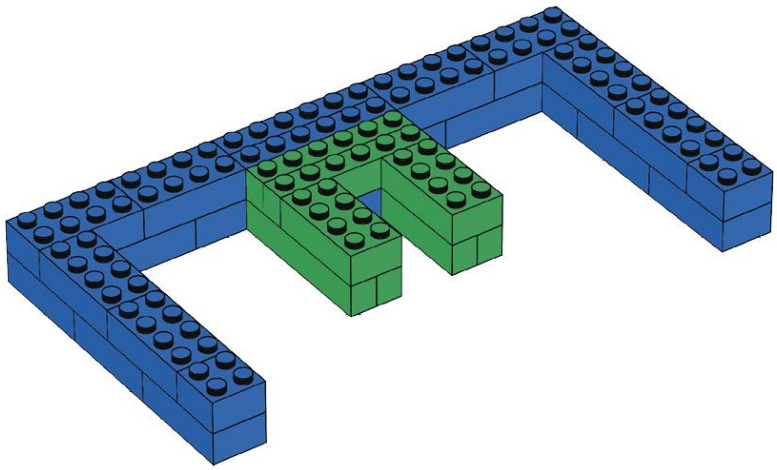

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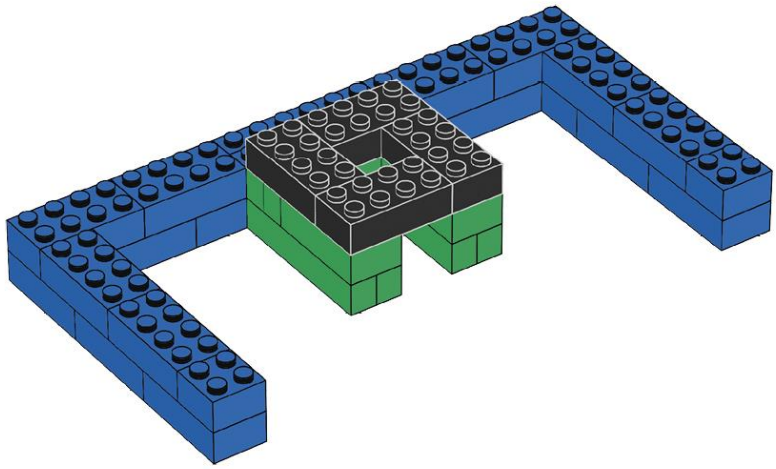

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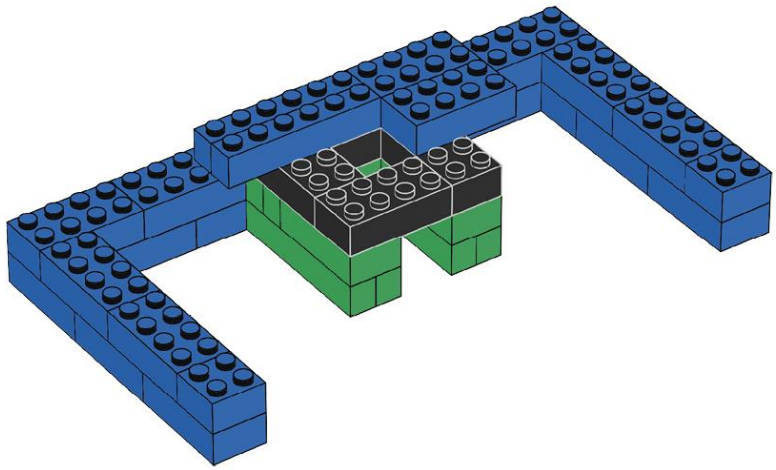

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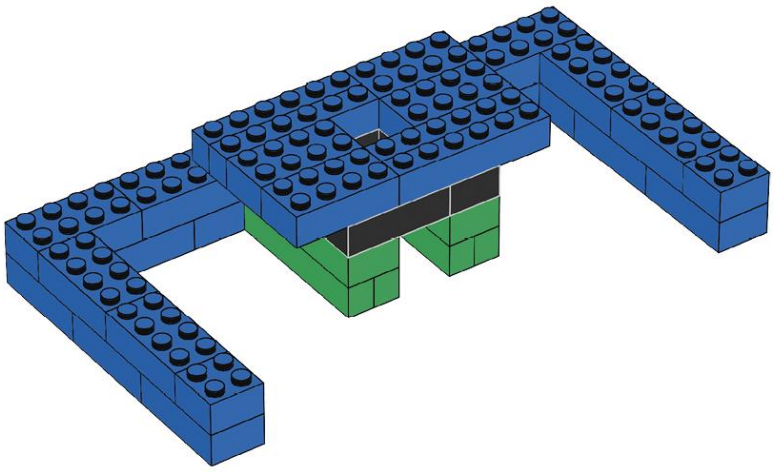

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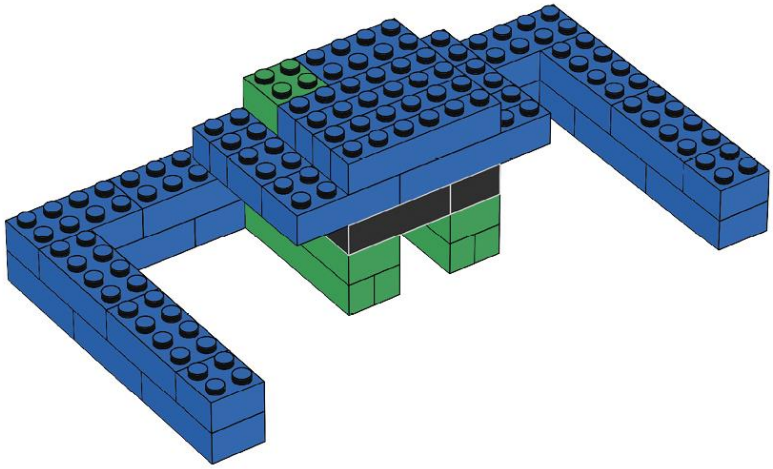

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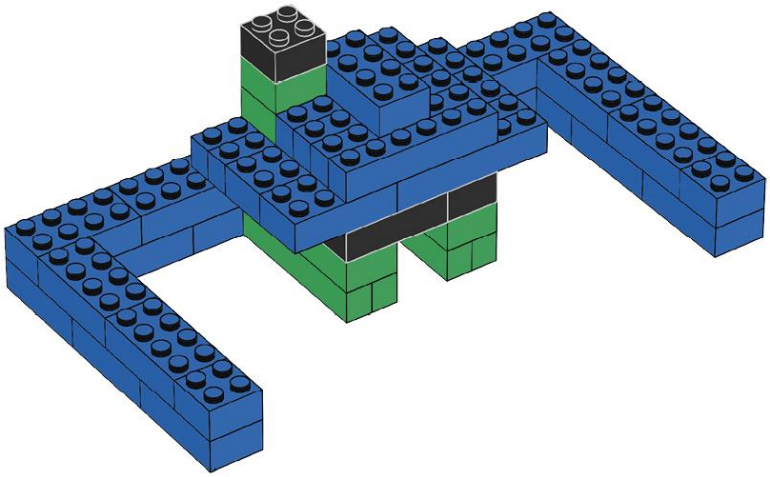

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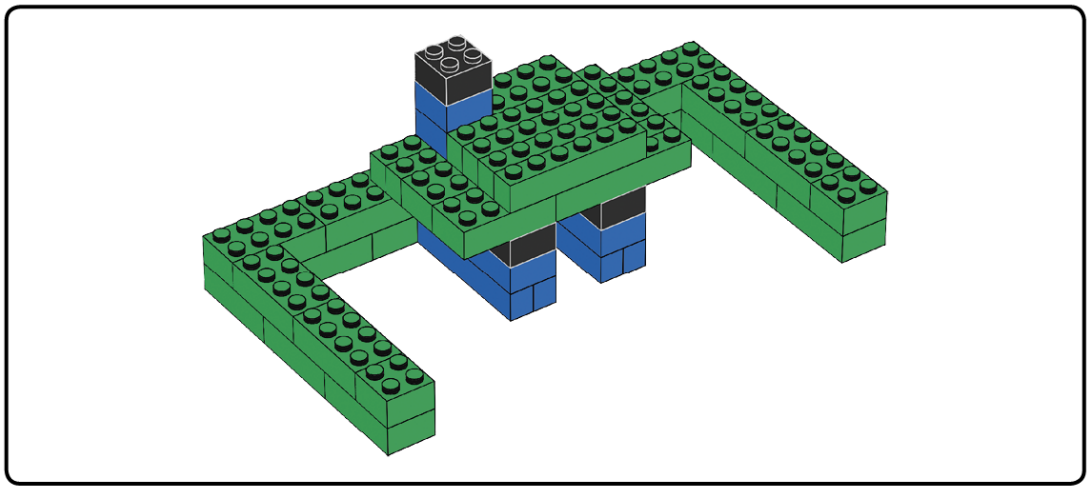

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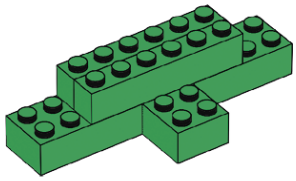

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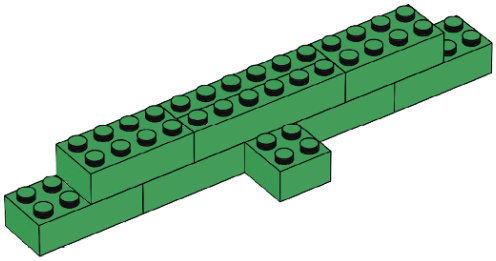

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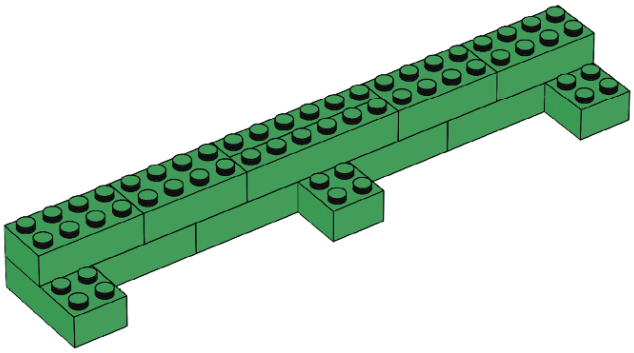

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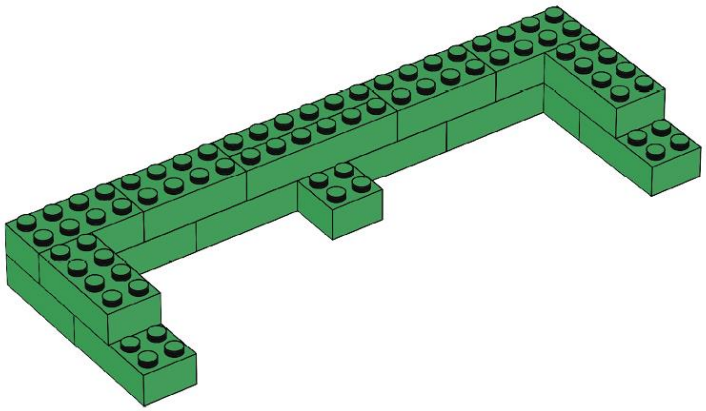

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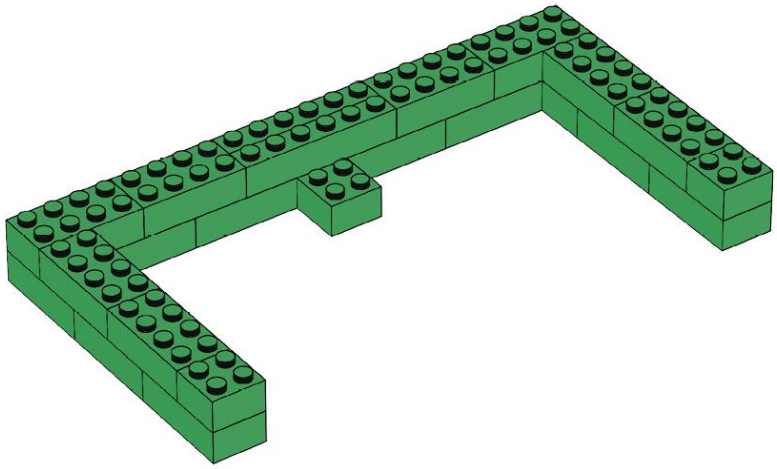

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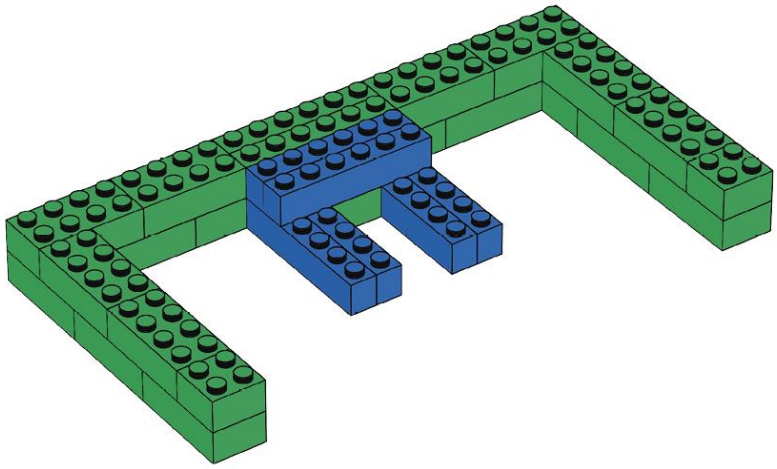

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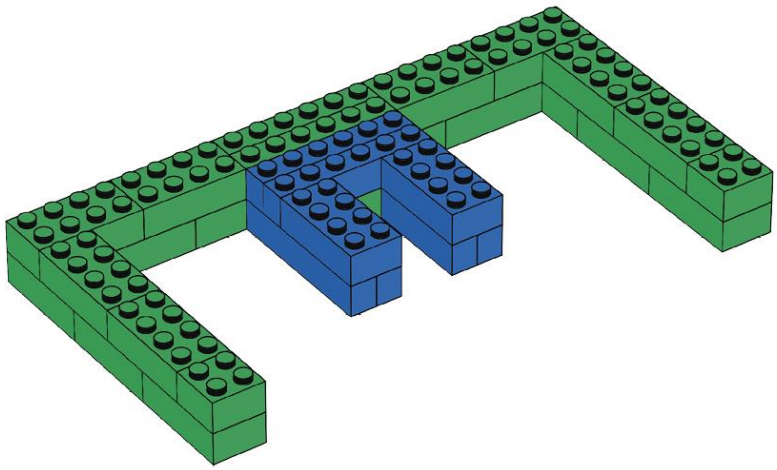

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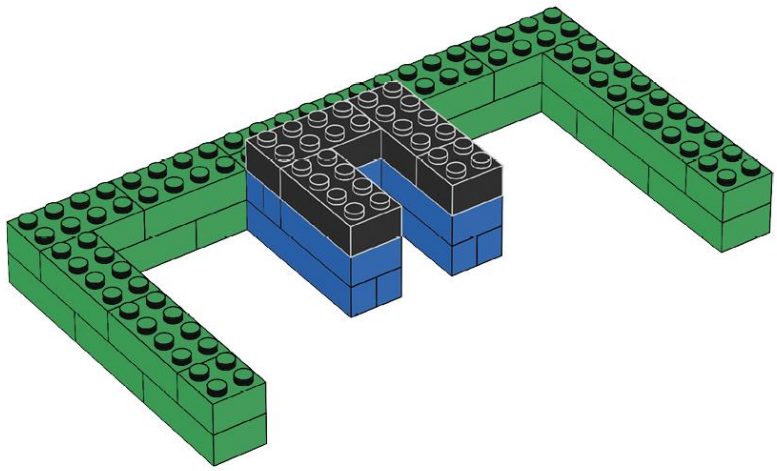

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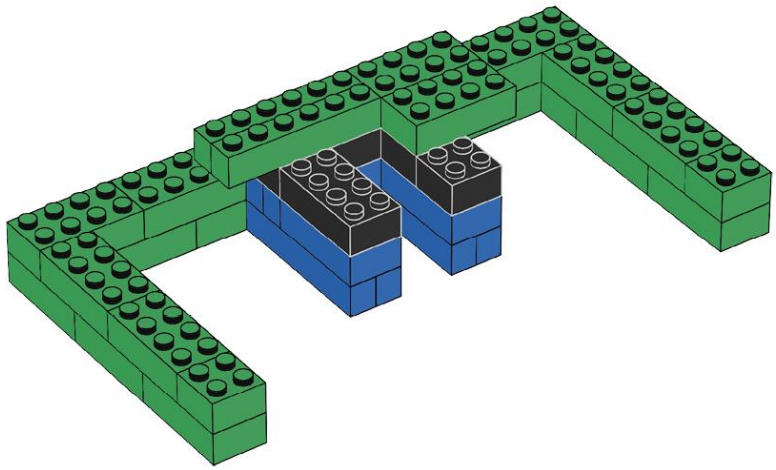

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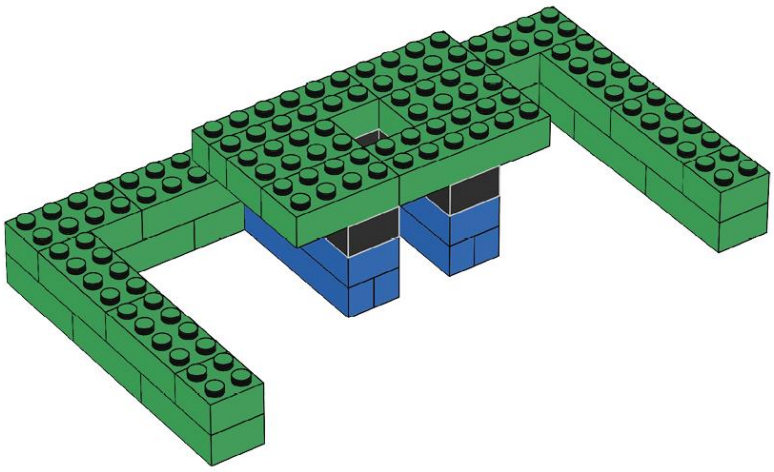

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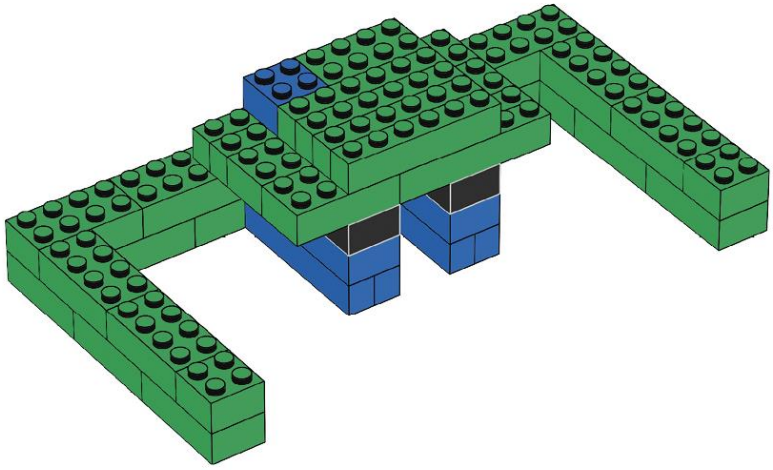

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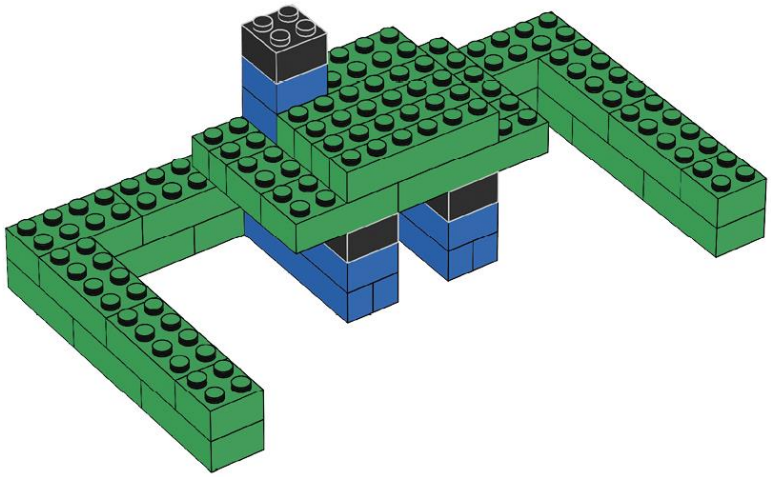

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