



World Robot Olympiad 2020

Regular Category

WeDo

CLIMATE SQUAD FOREST FIRE RESCUE

Version: January 15th



WRO International Premium Partners



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1. Introduction

Forest fires are a problem in Canada every summer. Fires regularly destroy big parts of the forest. And sometimes the fire comes close to a village so people have to be rescued to safe areas. Fires start and spread in hot, dry weather. Climate change causes longer summers that are very dry. Canada has to deal with the growing danger.

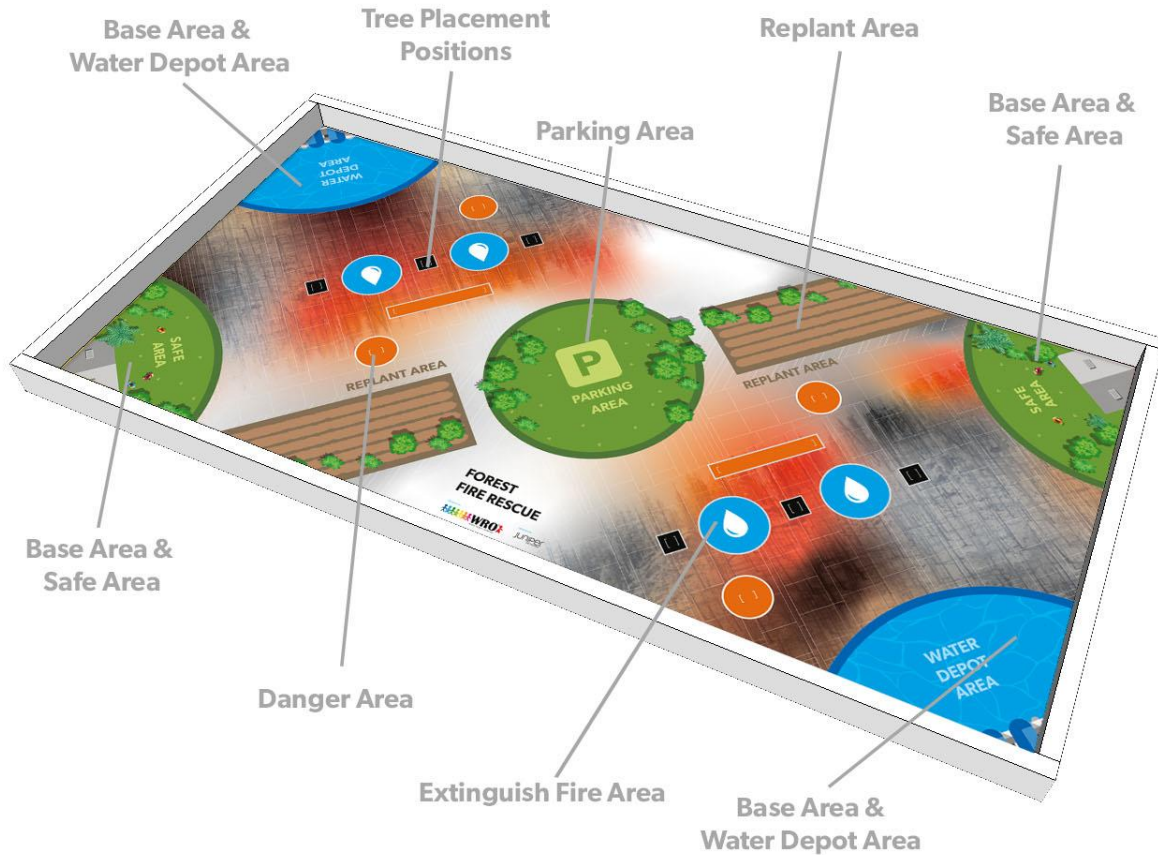


Photos from: <https://wildfiretoday.com/2015/12/11/firefighting-robots/> and <https://autonomicvehicles.eu/2018/11/01/autonomous-robot-planting-trees-assist-environmental-protection/>

This year, the challenge is to make a robot that can fight forest fire and rescue people to safe areas. Furthermore, the robot must also plant new trees to replace the burned-out trees.

2. Game Field

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



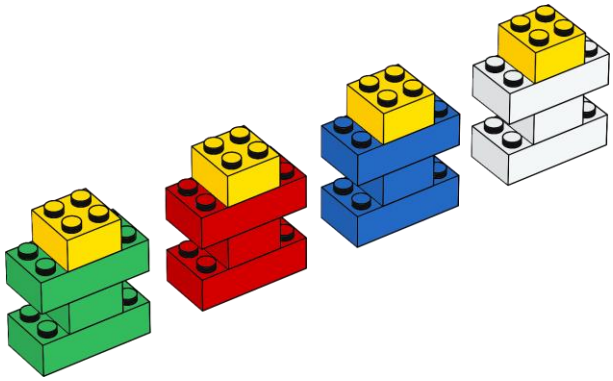
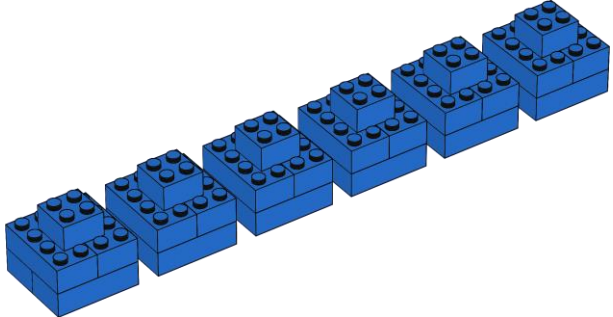
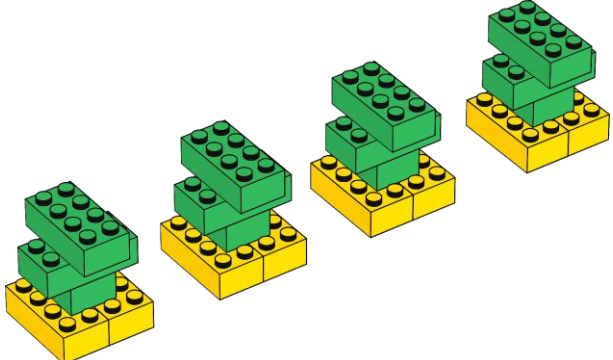
If the table is larger than the game mat, the mat will be centered in all dimensions. Possible space between the mat and the wall will be counted towards the area on the mat.

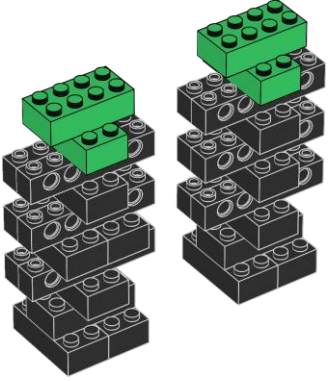
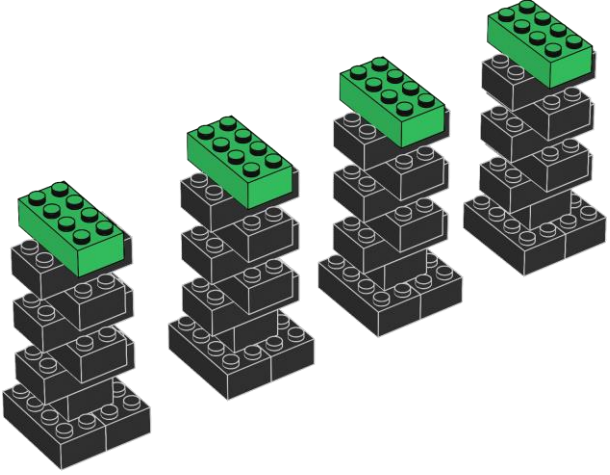
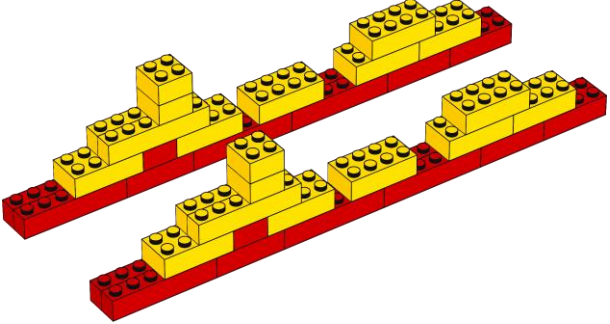
For more information about the table and game mat specifications, please take a look at WRO Regular Category General Rules Rule 4. The printable file of the mat and a PDF with the exact measurements are available on www.wro-association.org.

Information on the start area

The robot must start from within one of the four Base Areas inside the green line/blue line.

3. Game Objects, Positioning, Randomization

<p>4 People</p> <p>On the game field, there are four people represented by four different colored LEGO figures. The four people are placed in the four circular Danger Areas on the game field, one in each circle. The people are standing inside the danger area circles oriented as defined by a square in the circle.</p>	
<p>6 Water Buckets</p> <p>There are six water buckets in the two Water Depot Areas, three in each area. The water buckets are standing inside the area in any location and orientation.</p>	
<p>4 Young Trees</p> <p>There are four young trees in the two Safe Areas, two in each area. The young trees are standing inside the areas in any location and orientation.</p>	

<p>2 Large Burned-out Trees</p> <p>Two large burned-out trees are placed on two middle black squares between the blue squares.</p>	
<p>4 Small Burned-out Trees</p> <p>Four small burned-out trees are placed in the outer positions on the black squares.</p>	
<p><i>For burned-out-trees: It does not matter if a burned-out tree or a fire is pushed out of its initial location or knocked over. They just become obstacles on the game field that can only be moved by a robot.</i></p>	
<p>2 Fires</p> <p>In two places on the game field fire has broken out. Fire is represented by two LEGO objects that are placed within the two rectangle orange marks in front of the two blue circles.</p>	

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 Rescue people

The four persons must be rescued by transporting the persons from their Danger Areas to one of the Safe Areas by the robot. A person is correctly rescued to a Safe Area if it is placed completely within the Safe Area.

4.2 Transport water buckets

Four of the six water buckets in the two Water Depot Areas must be transported from the Water Depot Area to the four Extinguish Fire Areas by the robot, one bucket in each area. A water bucket is correctly transported to an Extinguish Fire Area if it is placed completely within the area.

When four water buckets are correctly placed in the four Extinguish Fire Areas the two fires are removed from the game table.

At least one of the times the robot transports a water bucket the robot should repeatedly sound a water bubbling sound and show a picture of a fire on the screen of the device controlling the robot.

4.3 Plant trees

Each of the four young trees must be transported from the two Safe Areas to the Replant Area by the robot.

4.4 Park the robot

The robot should finish in the parking area.

5. Specific WeDo Game Rules & General Rules

For the WeDo competition, the normal WRO Regular Category General Rules apply. There are some specific rules just for the WeDo age group. These specific rules are mentioned here:

Specific rules about material

1. The controllers, motors and sensors used to assemble the WeDo robot must be from the LEGO Education WeDo 2.0 Core Set. Any number and combination of controllers (Smarthubs), motors and sensors are allowed. Any LEGO branded non-electrical/non-digital elements can be used in the construction of the robot.

Specific rules about the game

2. During the attempt, the robot may be moved/operated under programmed control autonomously or under remote control, or using a combination of the two methods. The robot can be controlled by any compatible device using WeDo 2.0 compatible software or with a remote controller build from WeDo 2.0 elements.
3. During an attempt, the team is allowed to touch/grab the robot when any part of the robot, e.g. a wheel, touches a Base Area.
4. During an attempt, the team is also allowed to move a robot from one Base Area to another Area Base. It is only allowed to move the robot, not the game objects.
5. During an attempt, members of the team are:
 - *Not allowed to touch any game object outside of Base Areas.* If a team touches a game object outside a Base Area, the judge will place the touched item at the location on the field where it was located when the team touched the item and, in the state, it was when touched.
 - *Not allowed to touch the robot unless the robot is touching a Base Area.* If a team touches a robot which is not touching a Base Area, the judge will place the robot in the nearest Base Areas.
6. The mission is completed when either:
 - The robot moves to the parking Area, stops, the chassis of the robot is completely within the Area (cables are allowed to be outside of the area) and the team communicates to the judge that the robot has finished.
 - A team member shouts “STOP” and the robot does not move anymore.
 - The 2-minute time limit has expired.

Specific rules about the competition

7. A National Organizer decides about the format of the WeDo competition and communicates this format to the participants. Please remember that a competition day for our youngest should make fun. It is also important that all teams have the same number of attempts to solve the challenge.
8. WRO advises National Organizers to add one or multiple Surprise Task to the competition. This boosts the creativity of the teams. A surprise task could be added to the official task. However, WRO advises to design Surprise Tasks that are separate tasks, that should be solved in a separate attempt. The game objects and the game field will be the same as in the Game Field Score. For Surprise Tasks you can award up to 50 points.
9. Teams can bring the WeDo robots assembled to the competition. They do not need to re-build the robots on the competition day.

Here is an example for a competition day:

Please note that it is the National Organizer that decides about the schedule in the country!

- a) Opening Ceremony: 15min – 30min
- b) Test & Attempt time: 120min – 180min: During this time teams can test their robots and do their official runs (e.g. 3 runs per team).
- c) Lunch / Break: 30min – 60min
- d) Surprise Task Challenge(s): 80min – 120min: During this time teams can solve one or more Surprise Tasks to score additional points.

6. Scoring

The overall scoring of the teams is based on the sum of two scores:

- **Game field Score:** up to 150 points scored as described in the table below.
- **Surprise Tasks Score:** up to 50 points scored when a team performs additional tasks on the game field.

Game Field Score

Tasks	Each	Total
Rescue people		
A person is completely removed outside of its Danger Area by the robot.	5	20
A person is completely within one of the two Safe Areas.	5	20
A person is completely within the Replant Area.	3	12
Transport water buckets		
Buckets of water are completely within an Extinguish Fire Area, one in each area. More points are scored at each successive delivery, one bucket 5 points, two is 15 points, three is 30 points and four is 50 points.	1 = 5 2 = 15 3 = 30 4 = 50	50
At least once during the transportation of a water bucket the robot is sounding a bubbling water sound and a picture of fire is shown on the screen of the device controlling the robot.		10
Plant trees		
A young tree is completely removed outside of the Safe Area by the robot.	5	20
A young tree is completely within the Replant Area	5	20
Park the robot		
Robot completely stops within the Parking Area. (Only gets these points if other points are assigned)		10
Get bonus points and avoid penalties		
If a team illegally touches the robot or a game object, a penalty of 1 point is subtracted from the score unless the score becomes negative.	-1	
Maximum Score		150

Scoring Sheet

Team name: _____

Round: _____

Tasks	Each	Max	#	Total
Rescue people				
A person is completely removed outside of its Danger Area by the robot.	5	20		
A person is completely within one of the two Safe Areas.	5	20		
A person is completely within the Replant Area.	3	12		
Transport water buckets				
Buckets of water are completely within an Extinguish Fire Area, one in each area. More points are scored at each successive delivery, one bucket 5 points, two is 15 points, three is 30 points and four is 50 points.	1 = 5 2 = 15 3 = 30 4 = 50	50		
At least once during the transportation of a water bucket the robot is sounding a bubbling water sound and a picture of fire is shown on the screen of the device controlling the robot.		10		
Plant trees				
A young tree is completely removed outside of the Safe Area by the robot.	5	20		
A young tree is completely within the Replant Area	5	20		
Park the robot				
Robot completely stops within the Parking Area. (Only gets these points if other points are assigned)		10		
Get bonus points and avoid penalties				
If a team illegally touches the robot or a game object, a penalty of 1 point is subtracted from the score unless the score becomes negative.	-1			
Sum of Game Score		150		
Surprise Task(s)				
Total Score in this run				
Time in full seconds				

Signature Team

Signature Judge

Examples for Surprise Task

The following text contains examples for surprise tasks for the WeDo competition. National Organizers can choose other surprise tasks in their country, at international WRO events we could have different tasks as well.

The starting point is the same game mat and the same game objects as in the WeDo Regular challenge. Just as in the WeDo Regular challenge the robot may be moved/operated under programmed control autonomously or under remote control, or using a combination of the two methods.

An overall idea in the surprise tasks is that a team that operates the robot autonomously will get more points than a team using remote control at any time during an attempt. (See example scoring sheet.)

Task 1:

Only the six burned-out trees are placed on the game mat. Start in one of the Base Areas and bring one of the burned-out-trees into a Water Depot Area. 15 points for a large tree, 10 points for a small tree.

Task 2:

Only the four persons are placed on the game mat. Start in one of the Base Areas and bring two of the four persons to the same Safe Area. Two persons in the same Safe Area 15 points, one person in a Safe Area 10 points.

Task 3:

Only three Water Buckets are placed in one of the Water Depot Areas on the game mat and a young tree is placed in the Replanting Area. The three Water Buckets must be transported to the Replant Area. The robot must start in the Water Depot Area with the three Water Buckets. Before the robot starts a bubbling water sound must be played. The robot must be started by waving a hand in front of the motion sensor. While the robot is transporting the Water Buckets the bubbling water sound must still be played. When the robot is completely inside the Replant Area the sound may be stopped manually.

Surprise Task Score

Tasks	Operated autonomously	Remote controlled
Task 1, large tree in Water Depot	15	10
Task 1, small tree in Water Depot	10	5
Task 2, two persons in same Safe Area	15	10
Task 2, one person in Safe Area	10	5
Task 3, three Water Buckets in Replant Area, a bubbling sound is played, and the robot is started with a waving hand.	20	10
Maximum Score	50	

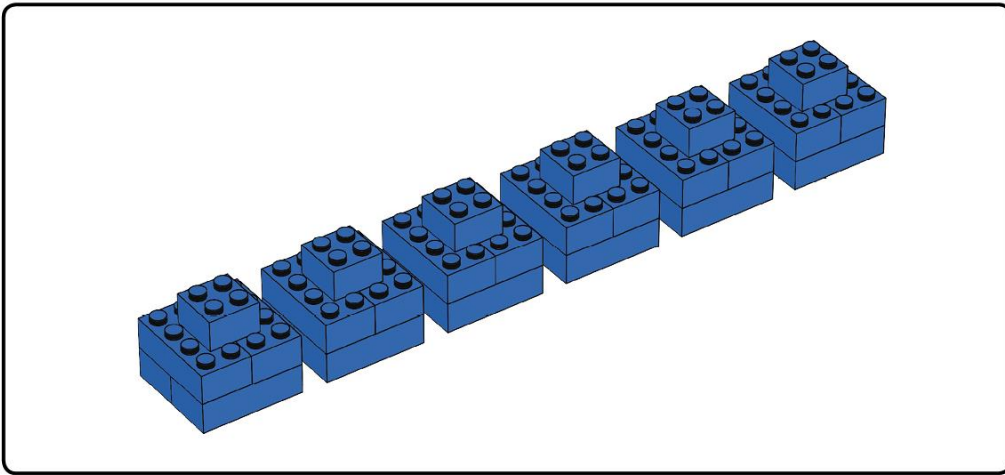
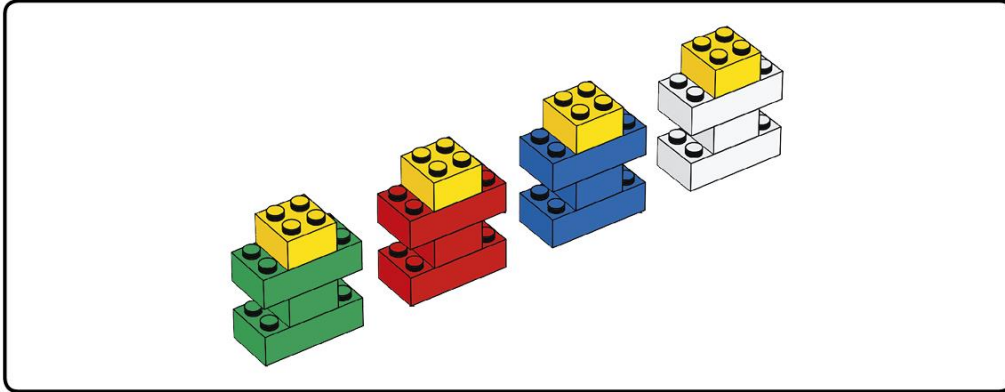
Maximum score on a competition day

Tasks	Total
Game Field Score	150
Surprise Task Score	50
Maximum Score	200

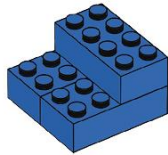
Example of determining the final ranking

- Best run of the morning / original challenge
- Best run of the afternoon / surprise task
- 2nd Best run of the original challenge
- 2nd best run of the surprise task
- Best time of 4 runs above

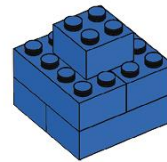
7. Assembly of Game Objects



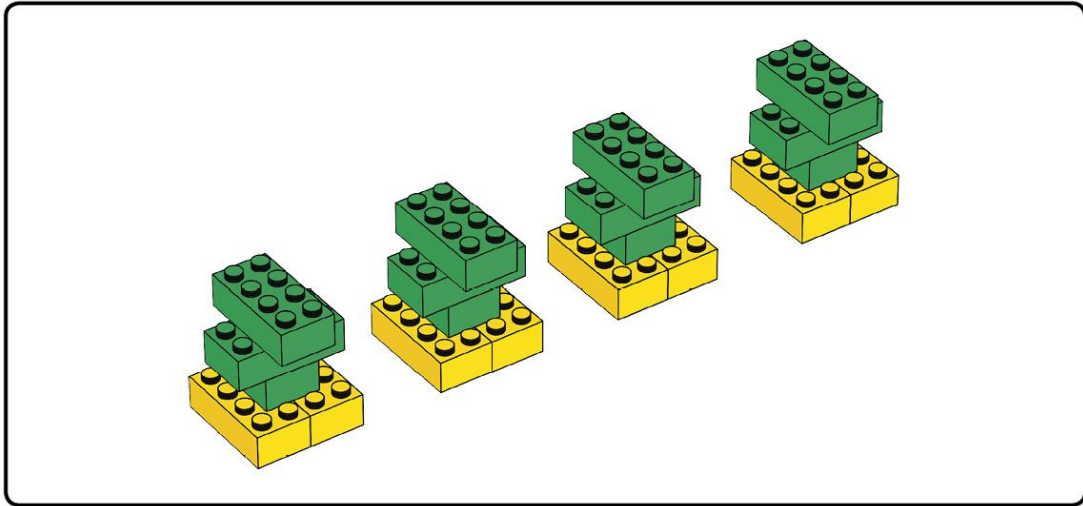
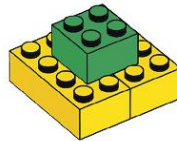
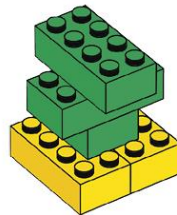
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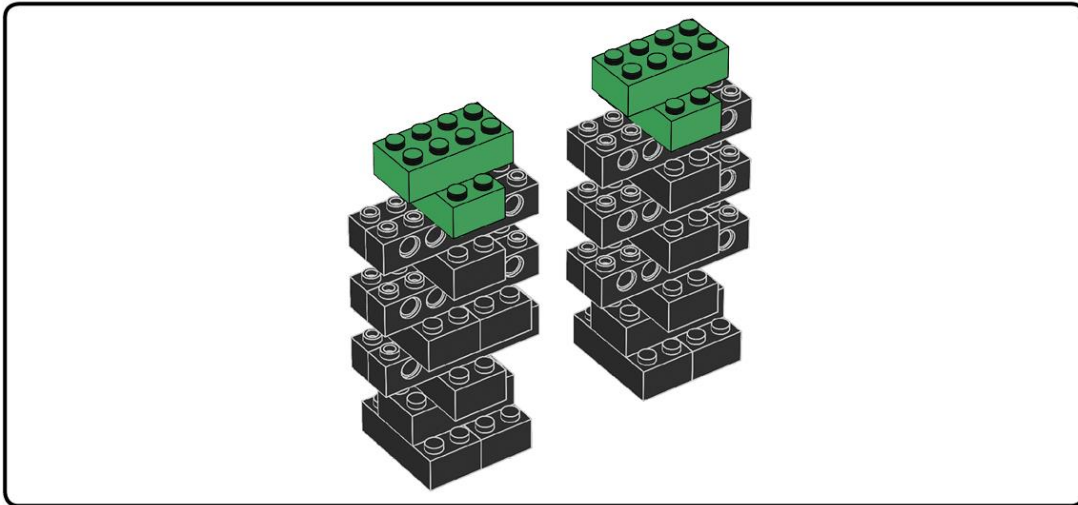


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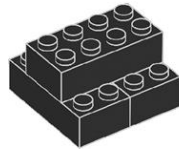


x6

**1****2****x4**



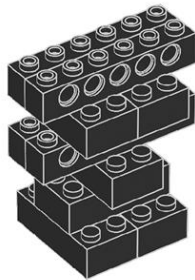
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2



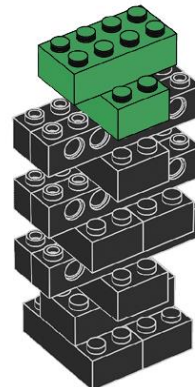
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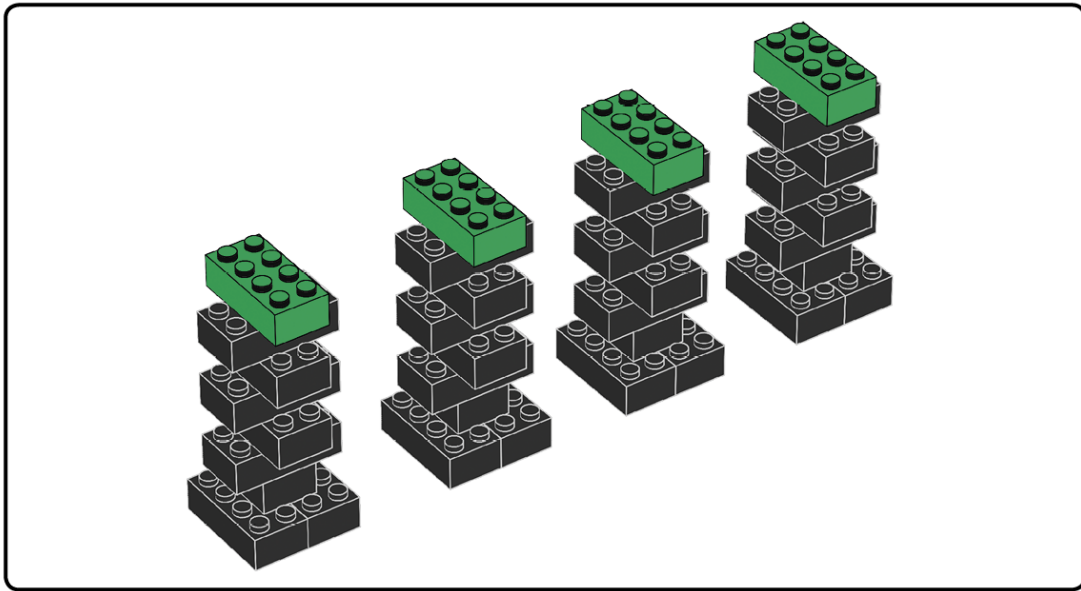
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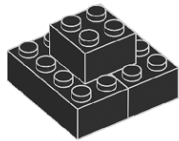
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x2



1



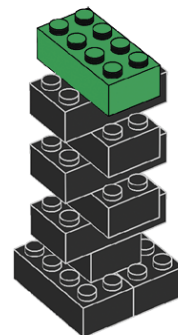
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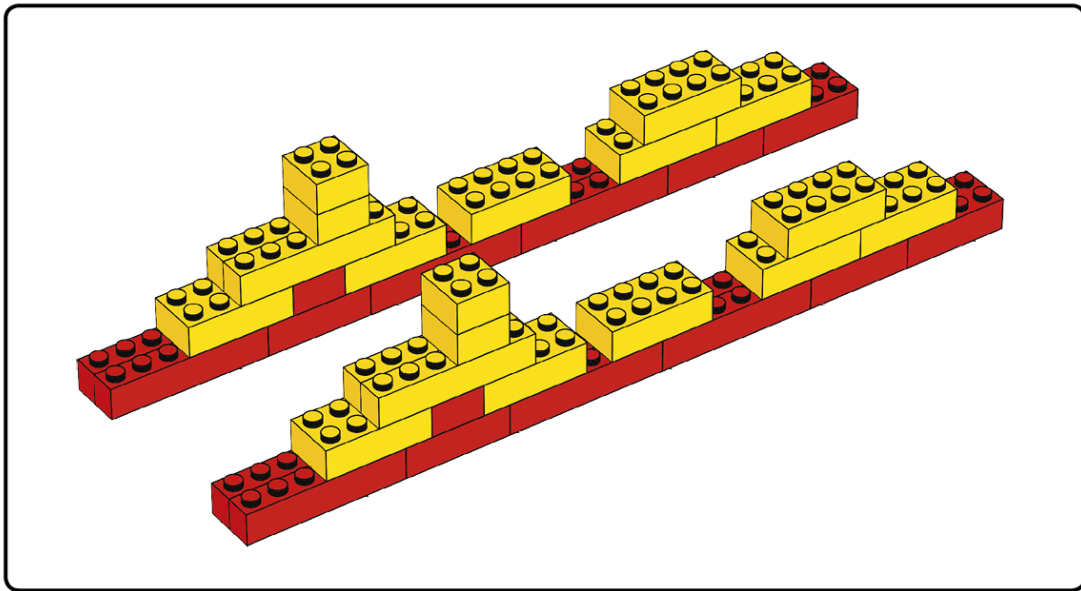
3



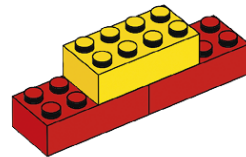
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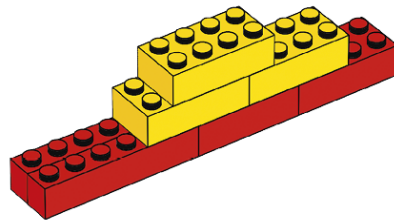
x4



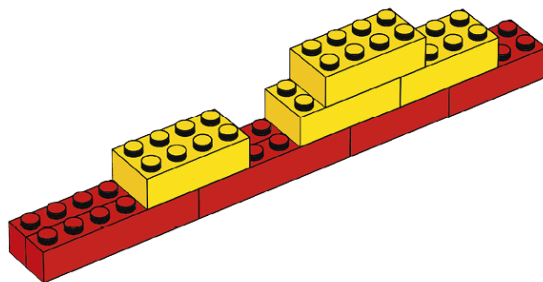
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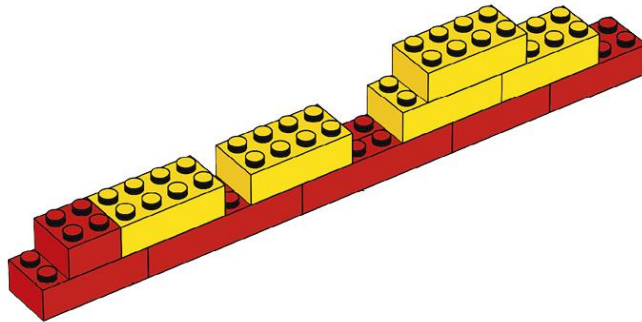
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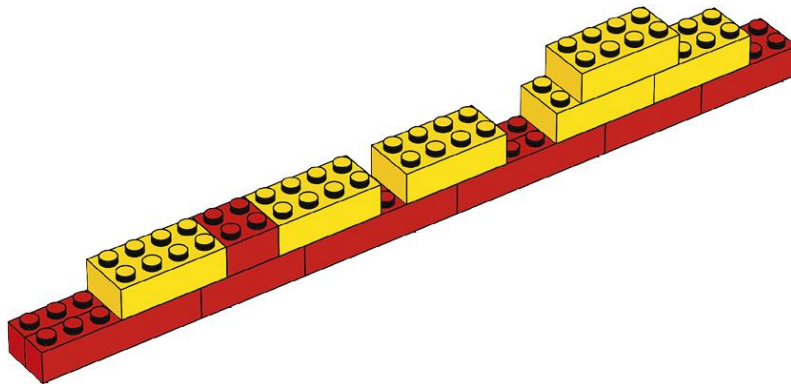
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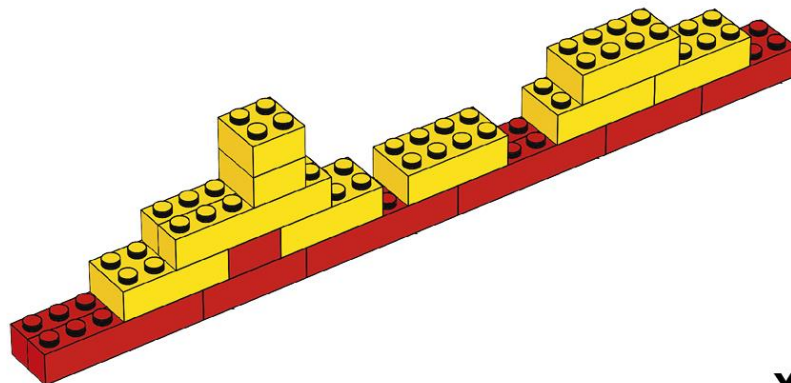
20



21



22

**x2**