

The Universal Robotics Challenge 2021

Online Robotics Rulebook

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Competition Overview

Automated Industry

There are lots of robots which can do human jobs, and one of those jobs is to transport objects. Robots which can transport materials and products are already used in factories, and research is progressing on automated delivery robots which can deliver packages to your front door and even robots which can automatically set tables in restaurants. This competition challenges you to create an automated transport robot which can carry cargo exactly where you tell it to! Your mission is to get your robot to carry multiple pieces of cargo between two platforms within a set time limit.

1. The Competition

○ The Challenge

◇ Mission

The robot will carry pieces of cargo (represented by blocks) from one platform to another. It will have to transport as many pieces as possible within the 60-second time limit. Cargo will come in two colors, and the robot will have to follow the rules to transport it.

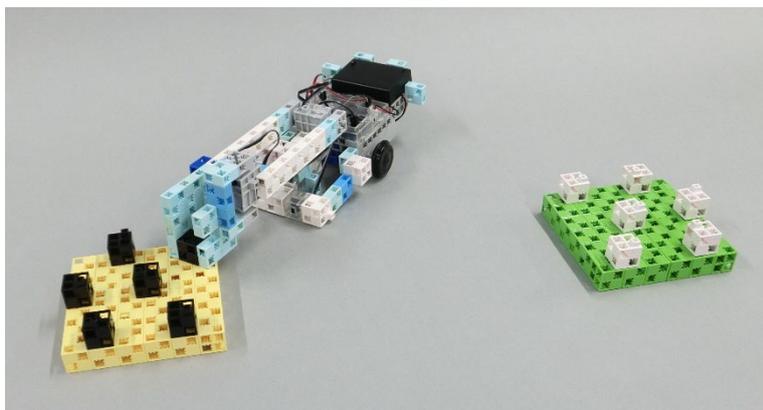


Fig 1. Competition in progress

2. The Competition Field

○ Setup and Placement

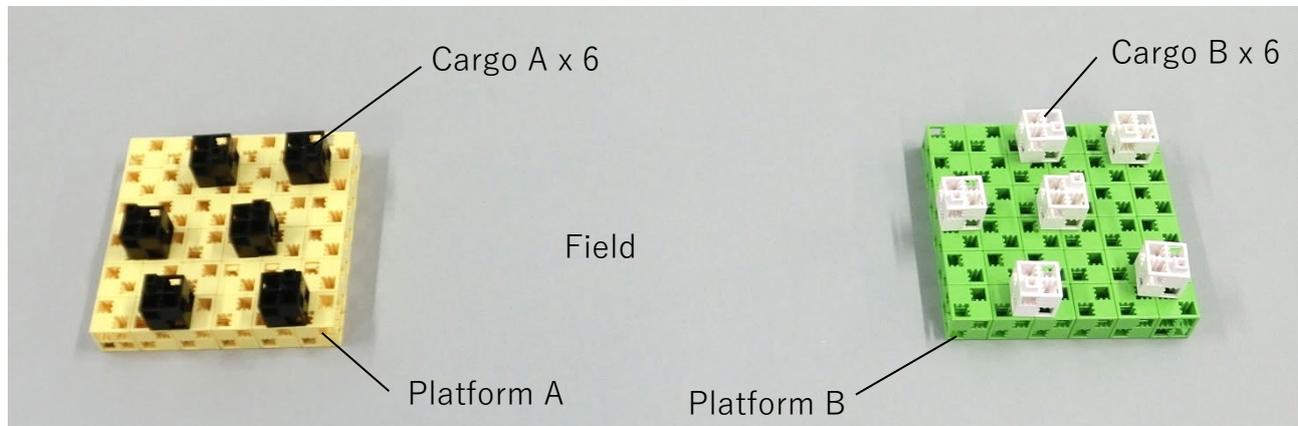


Fig 2. The Competition Field

◇ Platforms

Platforms are made up of 6 x 6 squares of Artec Blocks each for a total of 72 blocks. See **Building the Platforms** in **Appendix 1. The Competition Field** in order to build the platforms.

◇ Cargo

Each piece of cargo to be transported by the robot during the competition is made up of six Artec Blocks. Six pieces of Cargo A will be placed on Platform A and six pieces of Cargo B will be placed on Platform B. Platforms and cargo can be made from Artec Blocks of any color, as long as the colors are distinct for each type of cargo and platform.

Ex) Platform A: Light Yellow

Platform B: Yellow Green

Platform A: Black

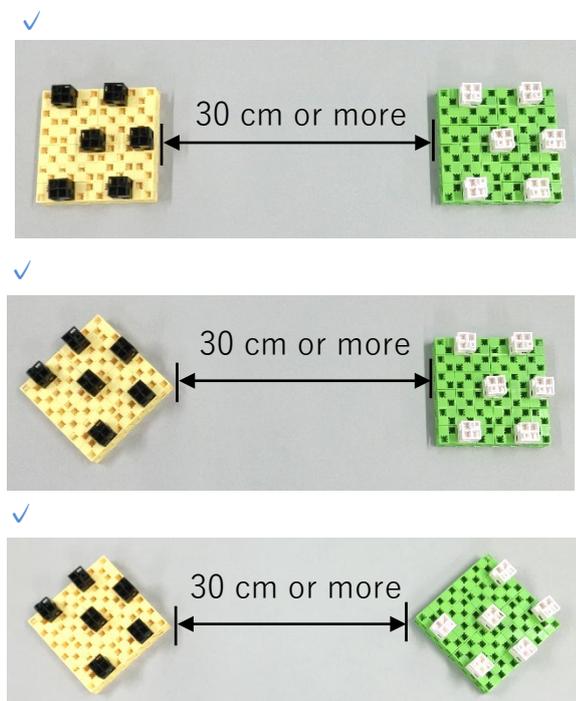
Platform B: White

◇ The Field

Competitors will place their robot, platforms, and cargo on this field.

○ Rules on Placement

- 1) Platforms must be set at least **30 cm** apart. They don't need to be set facing a specific direction.
- 2) Use adhesive tape or other methods to keep platforms from moving during the competition.
- 3) The field does not have to be made of a specific material or have a specific design.
- 4) Any other structures placed on the field must be no taller than **1 mm**. Any lines on the field can be made from tape **under 1 mm** in thickness.
- 5) No tall structures can be placed in between the platforms.
- 6) Six pieces of cargo each must be placed on Platforms A and B. These can be placed anywhere on the platform. Cargo must not be connected to either other pieces of cargo or the platform itself.



1) Platform placement

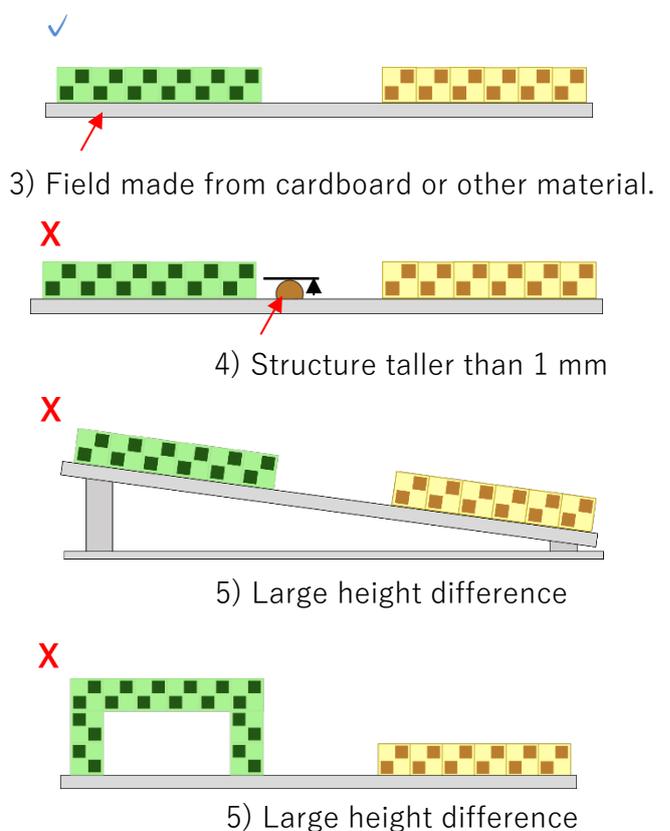
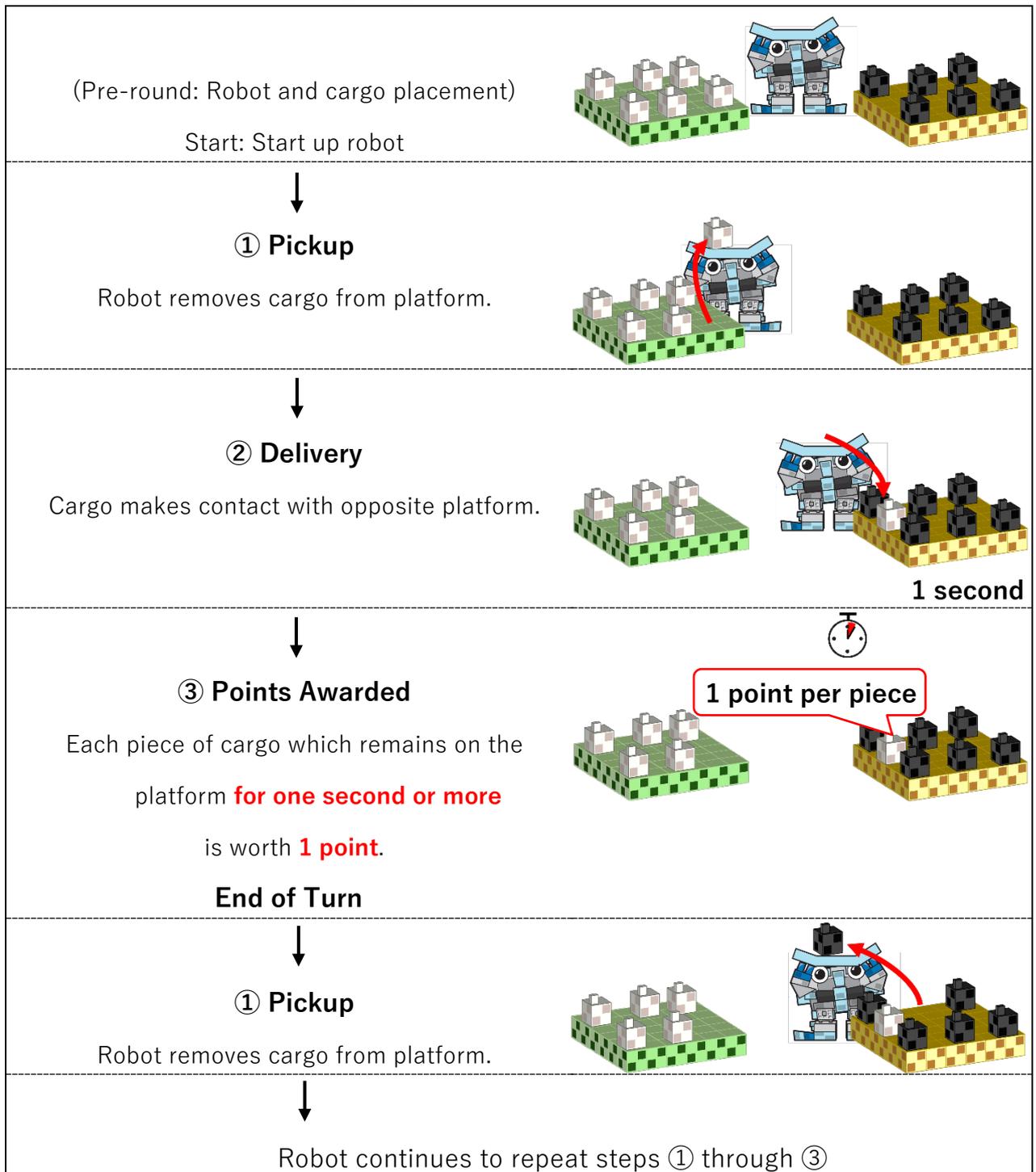


Fig 3. Placement do's and don'ts

3. Competition Rules

- Start of Round
 - 1) Cargo and robot must be set down before starting the round.
 - 2) Robot can be placed anywhere as long as it doesn't touch platforms or cargo.
- Progress
 - 3) Competition has the following stages:



- 4) Robot will take cargo from the top of one platform and move it to the other. Points are awarded for every piece of cargo which stays on the platform for **one second or longer** once released. Each piece of cargo is worth **one point**.
- 5) The process from the start to the end of transporting a piece of cargo counts as one turn. There is no limit on the number of turns during the round.
- 6) The next turn starts once a piece of cargo has been transported, and the color of the next piece of cargo must be different than the last.
- 7) Once points have been awarded for a piece of cargo, no points will be deducted if it falls from the platform.
- 8) Cargo which has already been transported can be transported again on another turn.
- 9) Any piece of cargo dropped after a successful pickup, but during transport will still be awarded points if successfully delivered to the next platform (see **Fig. 4**)

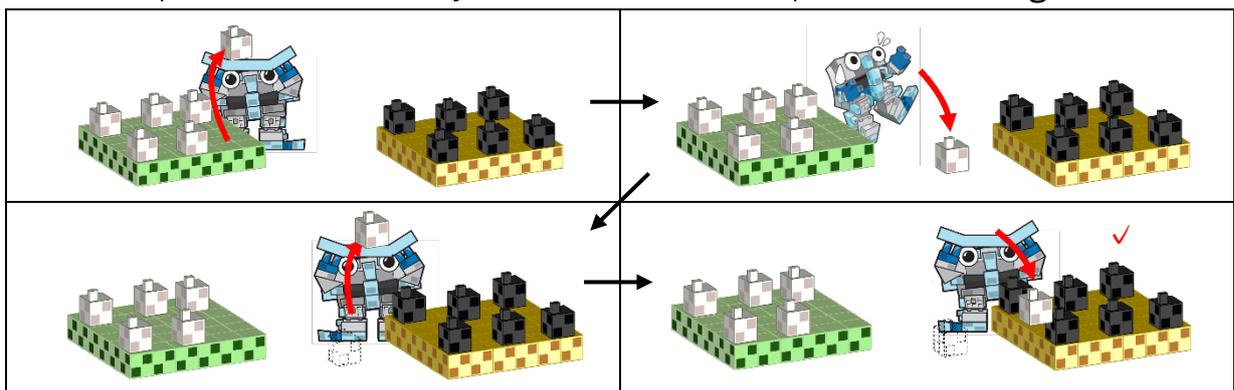


Fig 4. Dropping cargo during transport

- 10) Multiple pieces of cargo can be transported during one turn, as long as they're of the same color. The next turn will begin once this cargo has been transported, meaning that the robot will have to transport cargo of a different color. The robot will still be allowed to set down any cargo it is currently transporting (see **Fig. 5**)

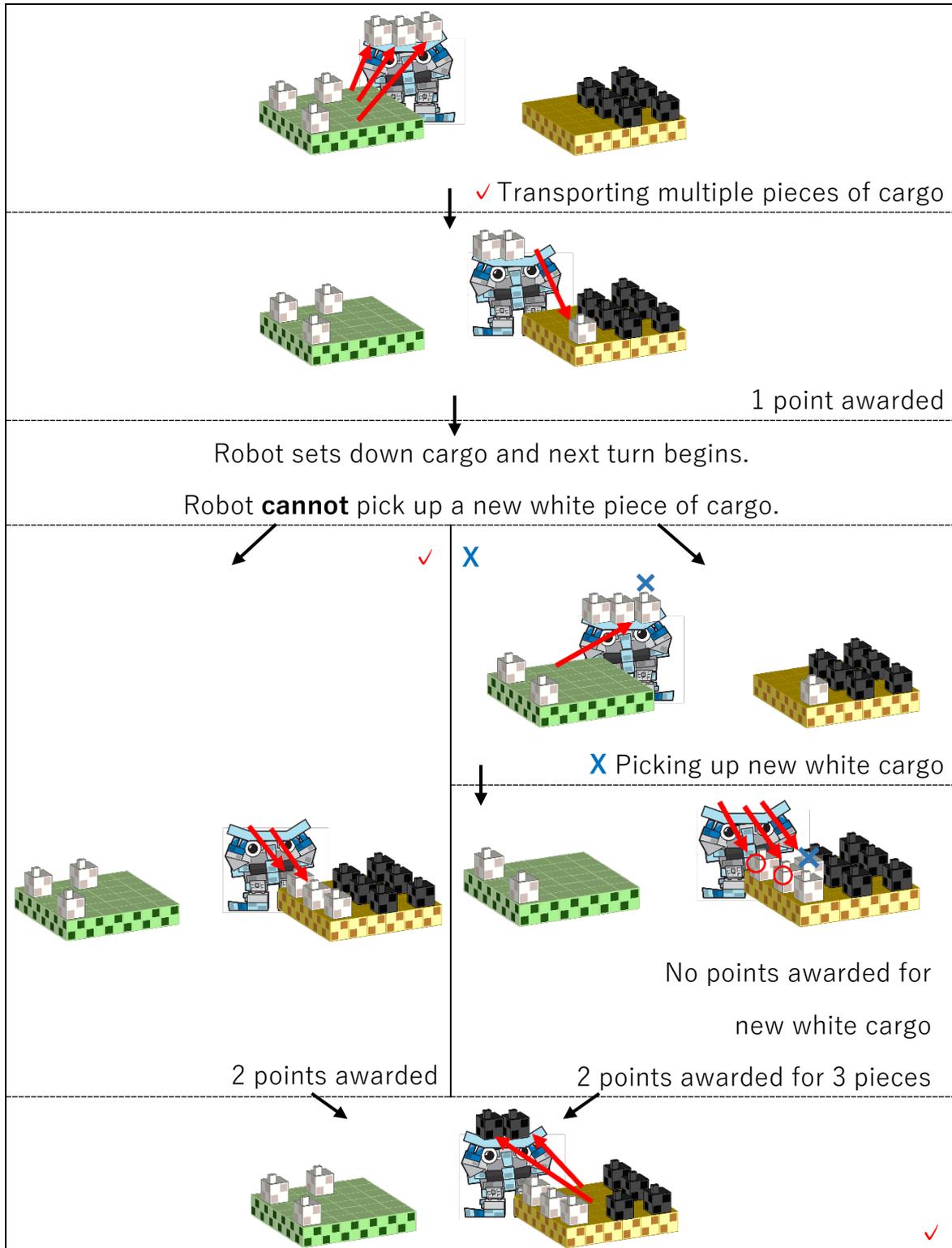


Fig 5. Delivering multiple pieces of cargo

◇ Invalid Delivery

No points will be awarded for cargo transported under these conditions:

- 11) Transporting pieces of identically-colored cargo for multiple turns in a row (robot must transport Cargo B if Cargo A was transported on the previous turn).
- 12) Transporting different types of cargo on the same turn (no points will be awarded for the turn).
- 13) Transporting cargo which has fallen from the platform during pickup.
- 14) Cargo which has fallen from the platform under one second after delivery.

○ End of Round

- 15) The round is considered over once **60 seconds** have passed, and all points awarded will be the score used to determine the results of the competition.

4. Competition Video Rules

- 1) To ensure that both platforms and the robot are built to competition specifications, **part A** of the video can include cuts, movement, and other edits, but must include footage or stills of competitor measuring the length, width, and height of the robot as well as the distance between platforms with a ruler or measuring tape prior to the start of the round. Video must pause for three seconds or longer at each point of measurement.
- 2) **Part B** of the video must include stopwatch or clock with a second hand used to count the time for the round.
- 3) **Part B** must also include no cuts and the camera must not move for the 60 second duration of the round (see **Fig. 6**).

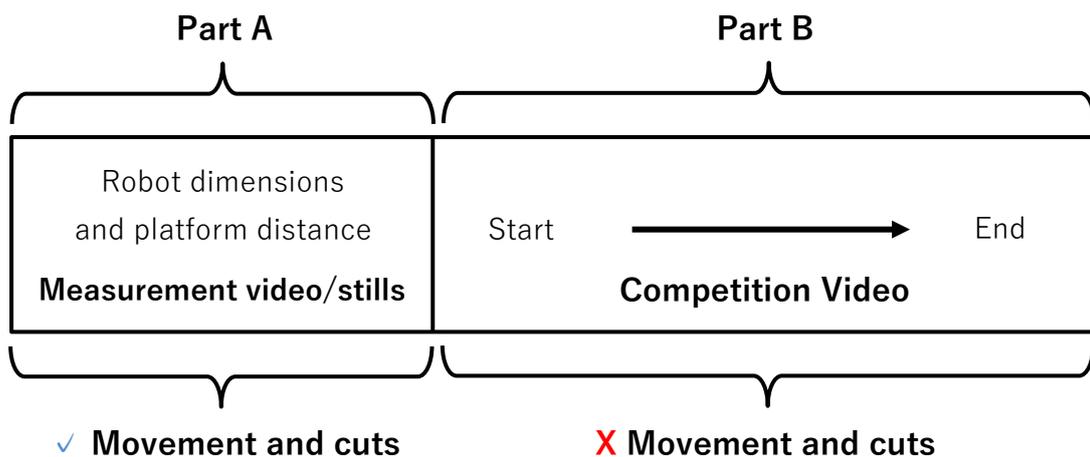


Fig 6. Competition Video Content

5. Robot Specifications

- 1) Only one robot is allowed.
- 2) See **Appendix 2** for the ArtecRobo parts and **Appendix 3** for the Artec Blocks competitors can use to build their robots.
- 3) Competitors may use **one** Studuino, **one** Studuino:bit Core Unit, **or one** BBC micro:bit to build their robot. There are no restrictions on the number of other parts.
- 4) Any parts from 2) can't be modified.
- 5) Competitors may not use rubber bands, glue, or any other materials to reinforce their blocks. Bundling cables together using rubber bands or cable ties is permitted.
- 6) Robots must not exceed **30 cm** in width, **30 cm** in length, and **30 cm** in height at the start of the round.
 - ★ Wired controllers which use sensors will not be counted as part of the robot.
- 7) There are no weight restrictions on robots.
- 8) While robots are allowed to transform at the start of the round, they must stay in one piece.
- 9) Robots can be controlled either by transferring the program or from a distance using a USB or Bluetooth connection. However, competitors are not allowed to touch the robot during the round.
 - ★ Wired controllers which use sensors will not be counted as part of the robot.
- 10) Robot may not use power sources (including power banks) other than the official Battery Box.

6. Scoring

- 1) Referees will calculate score based on the uploaded video.
- 2) Points will be awarded for successfully transporting cargo from one platform to another as well as the number of pieces transported.
- 3) The final score will be calculated as the total number of points after 60 seconds has passed.

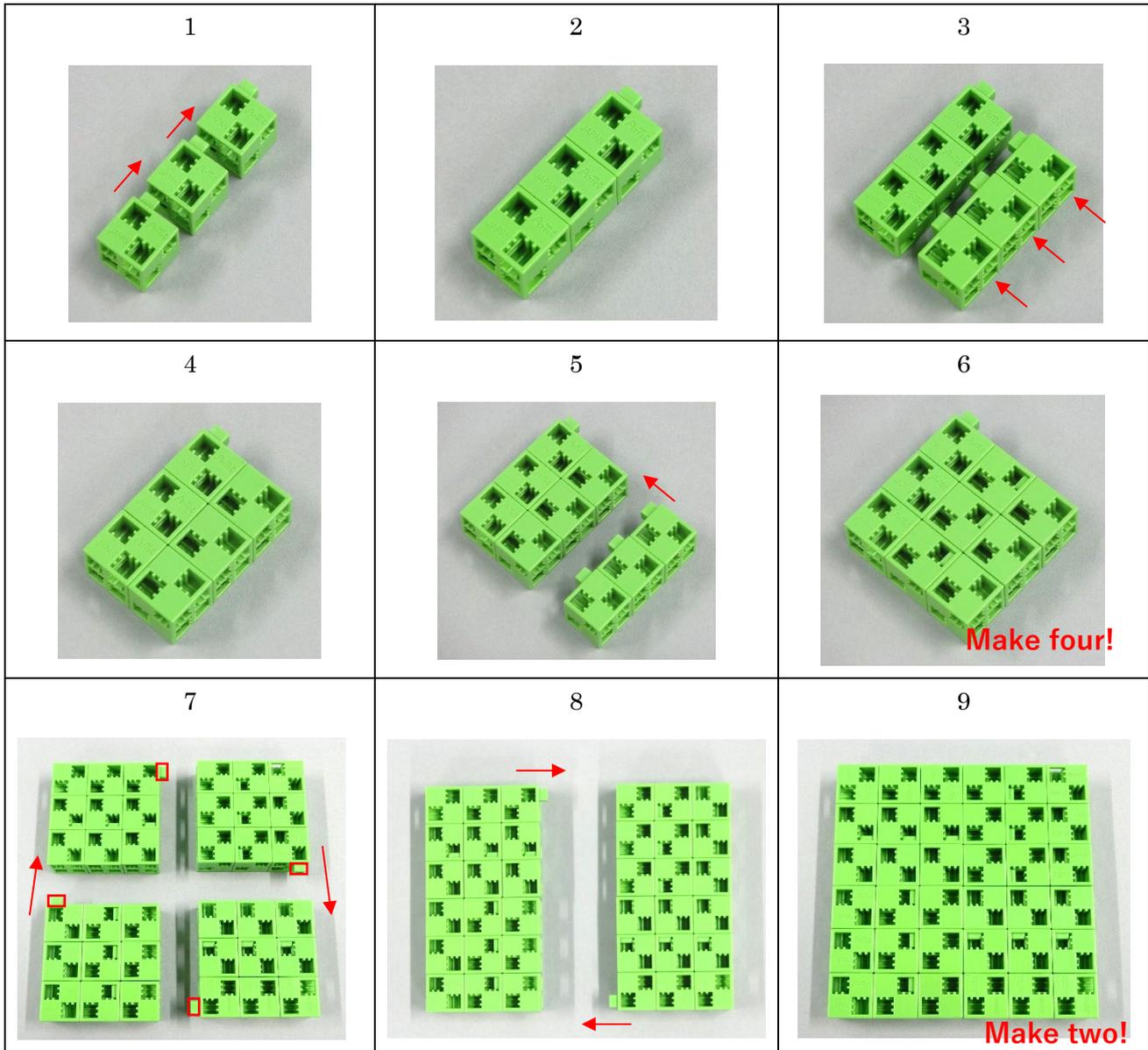
7. Disqualifying Conditions

- 1) Fast forwarding, editing, or clipping out any part of video **part B** during the round.
- 2) The platforms moving at any point during the round.
- 3) The robot not meeting the specifications in part **5. Robot Specifications**.
- 4) The robot, platforms, or cargo being moved by a person during the round.

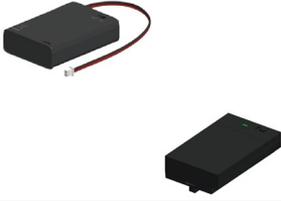
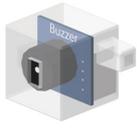
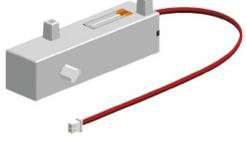
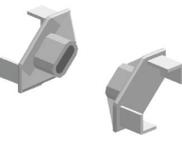
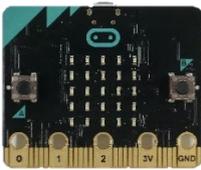
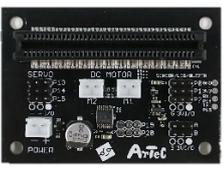
Appendix 1: The Competition Field

○ Building the Platforms

- Artec Blocks Basic Cube x 36 (36 x 2 platforms = 72 blocks)

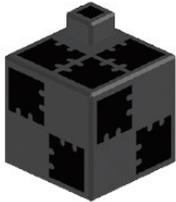
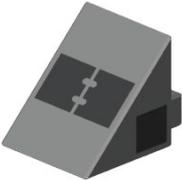
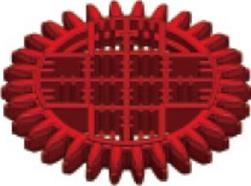


Appendix 2: Permitted ArtecRobo Parts

<p>Stduino</p>  <p>★ Stduino may have a faceplate sticker attached.</p>	<p>Battery Box</p> 	<p>LEDs (Red, Blue, Green, White)</p> 	<p>Buzzer</p> 
<p>Touch Sensor</p> 	<p>IR Photoreflexor</p> 	<p>Accelerometer</p> 	<p>DC Motor</p> 
<p>DC Motor Parts</p> 	<p>Servomotor</p> 	<p>Sensor Connecting Cable (all types)</p> 	<p>Extension Cable for Servomotors</p> 
<p>Core Unit</p> 	<p>Stduino:bit Battery Box</p> 	<p>Robot Expansion Unit</p> 	<p>Bluetooth 4.0 (BLE) Module for Robots</p> 
<p>micro:bit</p> 	<p>micro:bit Expansion Board</p> 		

Appendix 3: Permitted Artec Blocks

★ Blocks may be of any color.

Basic Cube	Triangle	Half A	Half B
			
Half C	Half D	Axle	Wheel
			
Beam	Disk	Gear (L)	Gear (S)
			
Rack Gear	O-ring	★ Tires are not permitted.	
