NRC PRESCHOOL CATEGORY
(ARTec Challenge)

CHALLENGE BOOKLET

Version: 23 March 2023

Organiser:

Sponsored by:

Supported by:

NRC 2023 PRESCHOOL (ARTec Challenge)

CHALLENGE BOOKLET CHANGE LOG

Version	Release Date	Description
1.0	10 March 2023	Official Challenge Booklet release
1.1	23 March 2023	Addition: Section 9 – Assembly of Game Objects (page 22)

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1. General Information

1.1. National Robotics Competition (NRC) 2023

National Robotics Competition (NRC) has been an ongoing competition organised annually by Science Centre Singapore for the past 24 years with support from the Ministry of Education, various partners and sponsors. This competition has attracted more than 62,500 participants and 250,000 supporters to date.

NRC spurs students' interest and innovation in Science, Technology, Engineering and Mathematics (STEM). Students will be able to put their knowledge to practice and engage in hands-on STEM learning. With NRC as a stage for students to develop kinaesthetic learning and collaboration, it encourages students to develop problem solving skills, entrepreneurial skills, creative thinking skills and team spirit among the participants.

This year, NRC marks its 25th Anniversary and it promises to be filled with exciting challenges that will ensure a fun and meaningful learning experience for the participants. NRC is also an excellent opportunity for students to interact with their peers, teachers and judges from the various industries during the course of the competition.

NRC 2023 tournaments comprise:

- NRC Regular Category
- NRC Open Category
- NRC AI Maker Series
- **NRC Preschool Category**
  - Kubo Challenge
  - **ARTec Challenge**
- NRC CoderZ Coding Challenge
- NRC RoboCup Singapore CoSpace Coding Challenges **NEW*
  - Autonomous Driving Category
  - Rescue Category

Registration for these category challenges will be via https://www.gevme.com/NRC2023.

Competition registration opens from **24 February to 1 July 2023.**

Note: Registration will be on a first come, first serve basis. If the category is full, your registration will be rejected and refunded.

1.2. Theme for NRC 2023

Every year, NRC revolves around a specific theme and this year, the theme for NRC is "**Sustainable Solutions**". Climate change is a global challenge, and Singapore is taking firm actions to do our part to build a sustainable future. This year, the challenges will revolve around Singapore's national agenda on sustainable development.

2. Team and Age Group Definition

2.1. Team Definition

Each team will have a minimum of 2 members and up to 5 members, accompanied by up to 2 coaches.

The age group in NRC Preschool (ARTec Challenge) is:

- 5 - 6 years old (as of 31 Dec 2023)

2.2. Expectations on Teams

Teams should behave fairly and be respectful towards other teams, coaches, judges and competition organizers. Teams are to adhere to the competition rules to ensure fair competition.

The construction and coding of the robot may be done only by the team. The task of the coach is to accompany them, help them with organizational and logistical matters and support the team in the case of questions or problems. The coach cannot be involved in the construction and programming of the robot.

On the competition day, during mission runs, coaches may offer students advice and guidance. However, all work related to the preparation and submission, and the actual competition must be performed by the student members of the team.

If any of the rules mentioned in this document are broken or violated, the judges or chief referees can decide on one or more of the following consequences. Before a decision is reached, a team or individual team members may be interviewed to find out more about the possible violation of the rules. The interview can include questions about the robot or the program.

- A team may get up to a 50% reduced score for one or more judging rounds.
- A team may be disqualified completely from the competition immediately.

2.3. Rules Hierarchy

On the competition day, the following rule hierarchy applies:

- General Rules for NRC Regular Category provides the basis for rules in this category.
- Questions & Answers (Q&As) can override rules in the general rule document.
- **The Chief Referees have the final say in any decision.**

During a season, NRC may publish additional Question & Answers (Q&As) that can clarify, extend, or re-define rules in game and general rule documents. Teams should read these Q&As before the competition.

3. Tournament Format and Procedure

In this category, there are 2 rounds:

- An online presentation round (including a Q&A session with each team) on **23 August 2023**.
- An onsite competition round on **30 August 2023**.

3.1. Competition Format

Presentations and Q&A sessions will be conducted on the same day for the participants. These will be held online via Zoom on 23 August 2023.

The Competition Round will be conducted on 30 August 2023 for all participants. This will be held at Annexe Hall 2 & 3, Science Centre Singapore.

Scores from the Presentation (30%) and Competition Round (70%) will be combined for the Overall Championship.

3.2. Competition Schedule

Dates	Components	Mode
23 August (Wednesday)	NRC Preschool Category (ARTec Challenge) Presentation	Online (Zoom)
30 August 2023 (Wednesday)	NRC Preschool Category (ARTec Challenge) Competition	Onsite Science Centre Singapore (Annexe Hall 2 & 3)

*Teams will be notified of their scheduled presentation date and time
**The Organiser reserves the right to amend the competition schedule and mode of the competition. Participants will be notified of any changes via email.

3.3. Presentation Format

Presentations and Q&A sessions will be conducted on the same day for the participants. These will be held online via Zoom on 23 August.

- Each presentation shall not exceed a duration of 5 minutes (excluding Q&A).
- Each Q&A session will take approximately 3 minutes.
- Presentation format shall not exceed 10 PowerPoint Slides.
- Slides may include photos and/or videos to showcase the students' learning process.
- Students are encouraged to take an active role during the presentation.

Refer to Section 7 for the Scoring Rubrics.

3.4. Robot Run

The competition will be held onsite on 30th August 2023.

- Teams will get 1 practice run (30 minutes) before the actual attempt.
- Teams shall complete all the ARTec missions within 60 minutes on the day of the Competition Round.
- There will be 4 missions to complete. Refer to Section 5 for the duration of each mission.
- All teams will begin the same mission simultaneously.

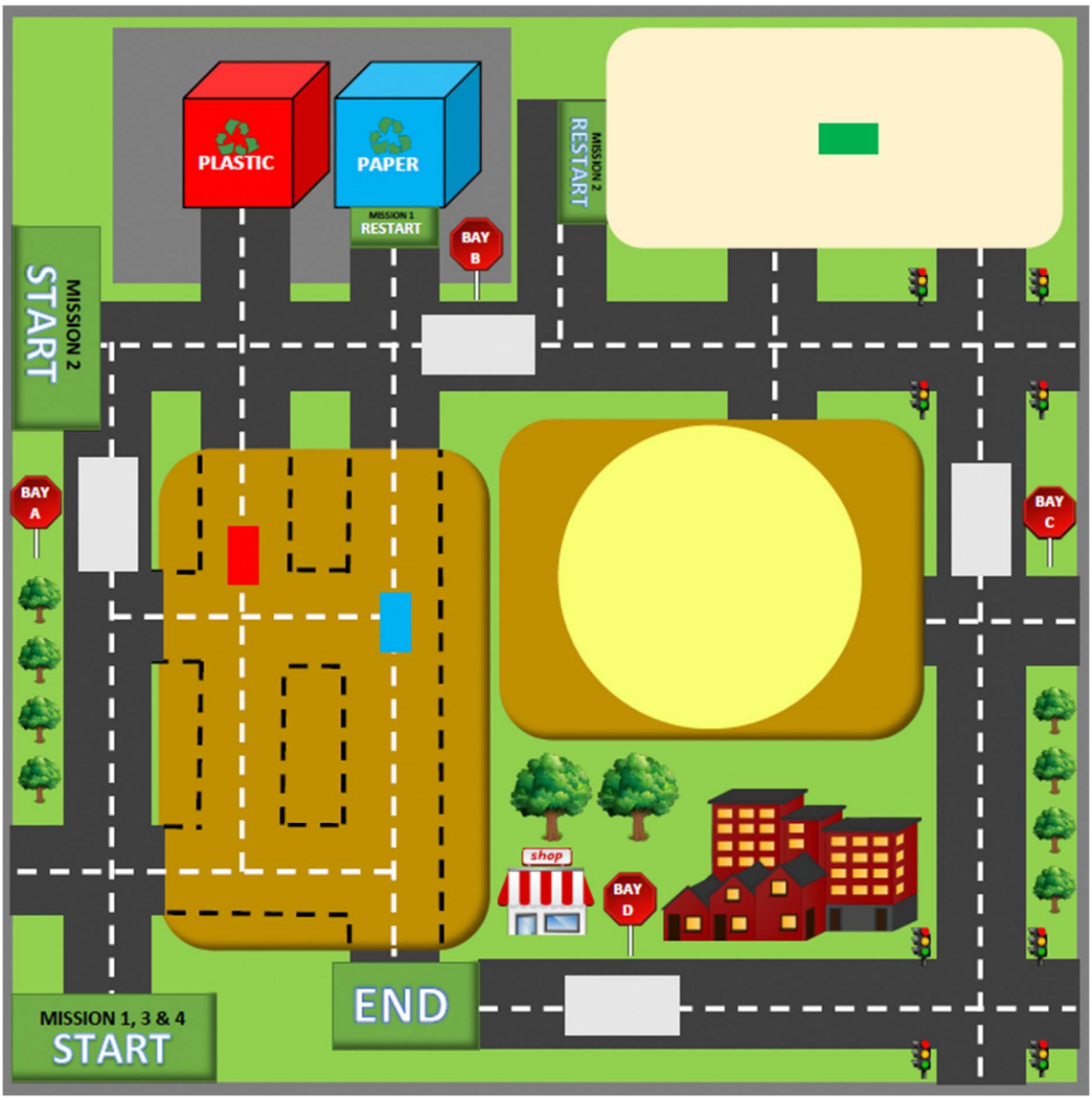
Points to note about the Competition:

- The game field mat will be provided to each participating team, together with a set of ARTec Coding+ set prior to the competition.
- Instructions will also be given to download the Icon Programming software to the participating team's laptop (not provided)
- Participating teams must bring along the game field mat, of ARTec Coding+ set and the team's laptop on the day of the Competition Round on 30th August 2023.
- Participating teams that fail to return the game field mat, of ARTec Coding+ set will be liable to make full payment of the items listed above to Wow! Education.
- In the event that overall scores are tied, the team with the shortest overall time (during the competition) wins the Competition Round.
- Scoring rubrics for the Competition Round can be found in Section 7.

4. Game table and equipment

4.1. Game Field

The game field mat will be provided to each participating team, together with a set of game field objects.

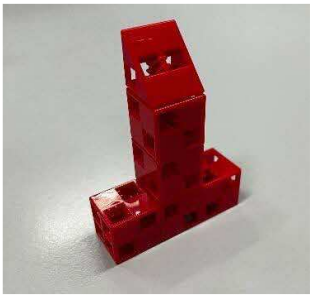
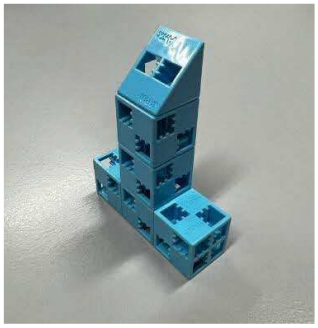
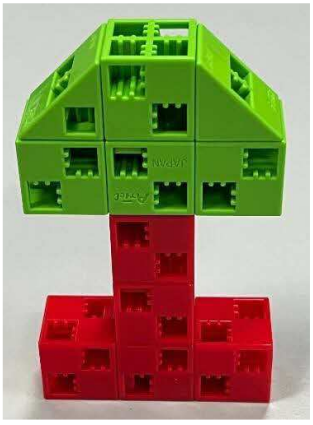


Participating teams are required to bring along the game field mat, game field objects, ARTec Coding set and the team laptop on the day of the Competition Round on 30th August 2023.

The dimensions of the game field mat are 1 m (Length) x 1 m (Breadth).

4.2. Game Objects, Positioning, Randomization

The ARTec Robot must start from the playable area labelled as “START”.

Mission	Game Object
1. Sustainable Living - Recycle to reduce waste There will be **2 pieces** of recyclable waste placed upright in the garden. The Blue piece represents paper waste and the Red piece represents plastic waste. The wastes are to be transported to the Recycling Bin/ Recycling Centre.	 
2. City in Nature - Restoring Nature There will be **2 trees** placed upright in the Nursery. One tree at a time, the tree is to be transported to the Restoration Area in the Nature Park.	
3. City in Nature - Decorating our Garden Robot shall transport the “Decoration item” from the “START” to be placed on the designated area within the neighbourhood Garden and to move back to the “END” position	To release on the day of the competition
4. Green Energy - Self Drive Electric Vehicle	NA

Modify the robot to resemble an electric vehicle to self drive around the neighbourhood. Stop at the designated bays to alight and board residents and stop at the “END”.	

5. ARTec Missions

This section will explain the missions.
The order of the missions is fixed and every team will start simultaneously and the maximum duration for completing each mission is as follow:

Mission	Preparation (Minutes)	Robot Attempt (Minutes)	Total Duration (Minutes)
Sustainable Living - Recycle to reduce waste	3	12	**15**
City in Nature - Restoring Nature	3	12	**15**
City in Nature - Decorating our Garden	3	7	**10**
Green Energy - Self Drive Electric Vehicle	10	10	**20**

Refer to Section 7 for scoring rubrics.

5.1. Sustainable Living - Recycle to reduce waste

Team to build a Robot to collect two waste (made of ARTec blocks) from the neighbourhood Garden and transport them to the Recycling Bin located in the Recycling Centre.

- 2 pieces of waste will be placed upright along the path in the Garden.
- Robot shall commence from the “START” to first transport the Blue waste (representing Paper waste) to the Recycling Bin located in the Recycling Centre. Robot shall then transport the Red Waste (representing Plastic waste) to the Red Recycling Bin located in the Recycling Centre.
- If the BLUE waste is not transported to the Recycling Bin successfully, Team can decide to re-attempt the mission again by starting from the “START”.
- After completion of the BLUE waste, if the RED waste is not transported to the Recycling Bin successfully, Team can decide to re-attempt to transport the RED waste ONLY again by starting from the “RESTART” below the Blue Recycling Bin.
- Robot shall transport the waste, one at a time to the respective Recycling Bin. Teams shall have no physical contact with the manipulatives throughout the run (hands free).

- The mission will end when the Robot moves out of the Recycling Centre after depositing both pieces of waste, or when the allocated time for this mission expires.

5.2. City in Nature - Restoring Nature

Team shall collect 2 trees (made of ARTec blocks) from the Nursery and transport them to the Restoration Area in the Nature Park. The planting of trees will bring nature closer to our neighbourhood to cool our surrounding, improve our air and create more homes for the birds and animals.

- The first tree will be placed upright in the Nursery prior to the start of the mission. Second tree will be placed after the Robot has moved the First tree out of the Nursery.
- Robot shall commence from the “START Mission 2” position and move to collect the first tree from the Nursery and plant the tree at the Restoration Area in the Nature Park.
- Upon completion, the Robot shall move back to the Nursery to collect the second tree to the Restoration Area.
- Teams can decide to re-attempt the transport of the first tree by starting from the “START Mission 2” position.
- After completion of the first Tree, Team can decide to re-attempt the transport of the second tree by starting from the “RESTART” position outside the Nursery.
- Robot shall transport the trees one at a time. Teams shall have no physical contact with the manipulatives throughout the run (hands free).
- The mission will end when the Robot moves out of the Nature Park after placing the second tree or when the allocated time for this mission expires.

5.3. City in Nature - Decorating our Garden

Robot shall transport the “Decoration item” from the “START” to be placed on the designated area within the neighbourhood Garden and move back to the “END” position.

- The “Decoration item” will be placed upright on the “START” point prior to the start of the mission.
- Robot shall transport the “Decoration Item” to the designated area (hands-free). The designated area will be announced on the day of the competition.
- The mission will end when the Robot moves back to the END position after placing the item or when the allocated time for this mission expires.

5.4. Green Energy - Self Drive Electric Vehicle

The teams shall modify their existing Robot and build a Self Drive Electric Vehicle to go around the neigbourhood in advocacy for clean energy public transport. The vehicle to be equipped with LED lights and Buzzer to represent blinking lights and sound to help the hearing and visually impaired to identify their transport.

- The vehicle shall commence from the “START” position.
- The vehicle shall follow the road and stop for 4 seconds at the designated bays. The blinking lights and sound shall be activated.
- The vehicle shall make 4 stops along the route.
- Teams can decide to re-attempt the mission. The re-attempts shall start from the “START” position.
- The mission will end when the Robot moves back to the “END” position after completing the journey around the neighbourhood or when the allocated time for this mission expires.

6. Specific Game Rules

6.1. Specific Rules about Materials

For this competition, there are some specific rules as mentioned below:

- The ARTec robot must be assembled using the complete set of ARTec Coding+ Set provided to each participating team by Science Centre Singapore.
- The ARTec Icon Programming softwares to be used for all coding. System Requirement as below (Laptop **Not** Provided):

Windows OS : Vista/ 7/ 8/ 8.1/ 10 (32 bit/ 64 bit) CPU : Pentium 4, 2 GHz or higher (or equivalent) recommended Memory : 256 MB or higher USB : USD 2.0 port
Mac OS : Mac OS X 10.6 to 10.13 Hardware : Minimum required by OS (Please check the Apple website to confirm) USB : USD 2.0 port

- Teams are encouraged to use the ARTec blocks to decorate and enhance their ARTec robot for the various missions.

6.2. Specific Rules about the Missions

Team can bring the ARTec robot assembled to the competition. They do not need to re-build the robot on the competition day.
Prior to each mission attempt, the team may touch the ARTec robot to equip it and update the coding for the selected mission.

The team is only allowed to move the ARTec robot, not the game objects. **Game objects not attached to or not in contact with the ARTec robot cannot be moved to another Mission Area.**

During a mission attempt, while the ARTec robot is running its program, members of the team are:

- *Not allowed to touch any game object*. If a participant touches a game object, the referee will give a verbal warning to the team and reset the game object to its original position and orientation. A total of 2 verbal warnings will be given. After which, the Organisers reserve the right to not score for that mission.

- *Not allowed to touch the game field mat while the ARTec robot is completing its mission*. If a participant touches the game field mat while the ARTec robot is running its programme, the referee will give a verbal warning to the team. A total of 2 verbal warnings will be given. After which, the Organisers reserve the right to not score for that mission.

- The team can decide to stop the current robot run and re-attempt the mission. In this event, they shall raise their hand to inform the referee. Team can handle the robot only upon receiving the verbal acknowledgment from the referee. The referee shall reset the game object to its original position and orientation. Final score will be based on the last attempt.

6.3. Specific Rules about the Competition

Each mission is completed when either:
The robot achieves the mission goals and the team communicates to the referee that the mission is complete.
OR
The time limit has expired for the mission.

Missions will be considered successful if the mission goals have been achieved.

7. Scoring

The overall scoring of the teams is based on the sum of two scores:
Presentation Score: up to 30 points scored as described in the table below.
Competition Score: up to 70 points scored as described in the table below.

7.1. Presentation Score

Criteria	Score
Coding and Design of ARTec Robot ● The design and coding of ARTec robots to carry out the missions	10
Reflection ● What the team have learnt during the process ● What was their favorite part of the process	10
Presentation ● Clarity of the presentation ● Creativity of the presentation ● Q&A	10

7.2. Competition Score

Mission	Score
Mission 1: Sustainable Living - Recycle to reduce waste	
Transport the BLUE Waste to the BLUE Recycling Bin (hands-free)* ● BLUE waste placed entirely within the boundary of the BLUE Recycling Bin (6 pts) ● BLUE waste placed within the boundary of the Recycling Centre (4 pts) ● Any part of the BLUE waste placed outside the boundary of the Recycling Centre (2 pts) ● BLUE waste is placed completely outside of the Recycling Centre (1 pt) For re-attempts on the Blue waste, Robot shall start from the START position+	6
Transport the RED Waste to the RED Recycling Bin (hands-free)* ● RED waste placed entirely within the boundary of the Red Recycling Bin (6 pts)	6

• RED waste placed within the boundary of the Recycling Centre (4 pts) • Any part of the RED waste placed outside the boundary of the Recycling Centre (2 pts) • RED waste is placed completely outside of the Recycling Centre (1 pt) For re-attempts on the RED waste, Robot shall start from the RESTART position below the BLUE Recycling Bin[+]	
Robots to move out of the Recycling Centre (hands-free)* upon completion of the mission goals	1
Achieve mission goal within duration: <8 minutes: 5 pts >8-9 minutes: 4 pts >9-10 minutes: 3 pts >10-11 minutes: 2 pts >11-12 minutes: 1 pt	5
No interference from coaches[#]	2
Total	**20**
Mission 2: City in Nature - Restoring Nature	
Transport 1st TREE to the Restoration Area (hands-free)* • Tree planted within the boundary of the Restoration Area (6 pts) • Tree planted within the boundary of the Nature Park (4 pts) • Any part of the tree planted outside the boundary of the Nature Park (2 pts) • Tree planted completely outside of the Nature Park (1 pt) For re-attempts on the 1st Tree, Robot shall start from the START position[+]	6
Transport 2nd TREE to the Restoration Area (hands-free)* • Tree planted within the boundary of the Restoration Area (6 pts) • Tree planted within the boundary of the Nature Park (4 pts) • Any part of the tree planted outside the boundary of the Nature Park (2 pts) • Tree planted completely outside of the Nature Park (1 pt) For re-attempts on the 2nd Tree, Robot shall start from the RESTART position outside the Nursery[+]	6

Robot to move out of the Nature Park (hands-free)* upon completion of the mission goals	1
Achieve mission goal within duration: <8 minutes: 5 pts >8-9 minutes: 4 pts >9-10 minutes: 3 pts >10-11 minutes: 2 pts >11-12 minutes: 1 pt	5
No interference from coaches#	2
Total	**20**
Mission 3: City in Nature - Beautifying our Garden	
Transport the "Decoration item" from START to a designated **secret** location and move to the END . For any re-attempts, Robot will be placed to the START position+	3
Achieve mission goal within duration: <3 minutes: 3 pts >3-5 minutes: 2 pts >5-7 minutes: 1 pts	3
No interference from coaches#	2
Total	**8**
Mission 4: Green Energy - Self Drive Electric Vehicle	
Modification of robot to a Self-drive Electric Vehicle	2
Travel along the road from START position to Bay A *Any part of the vehicle's motor is within the boundary of the bay (2 pts)* *Any part of the vehicle is within the boundary of the bay (1 pt)*	2
Stop for 4 seconds and flash Red LED 2 times & beep 4 times at Bay A	1

Travel along the road to Bay B *Any part of the vehicle's motor is within the boundary of the bay (2 pts)* *Any part of the vehicle is within the boundary of the bay (1 pt)*	2
Stop for 4 seconds and flash Red LED 2 times & beep 4 times at Bay B	1
Travel along the road to Bay C *Any part of the vehicle's motor is within the boundary of the bay (2 pts)* *Any part of the vehicle is within the boundary of the bay (1 pt)*	2
Stop for 4 seconds and flash Red LED 2 times & beep 4 times at Bay C	1
Travel along the road to Bay D *Any part of the vehicle's motor is within the boundary of the bay (2 pts)* *Any part of the vehicle is within the boundary of the bay (1 pt)*	2
Stop for 4 seconds and flash Red LED 2 times & beep 4 times at Bay D	1
Travel along the road to "END" Position For any re-attempts, Robots will be placed to the START position[+]	1
Achieve mission goal within duration: <6 minutes: 5 pts >6-7 minutes: 4 pts >7-8 minutes: 3 pts >8-9 minutes: 2 pts >9-10 minutes: 1 pt	5
No interference from coaches[#]	2
Total	**22**
Maximum Score	**70**

**No physical contact with any manipulatives throughout the code run*

 # Coaches may offer students advice and guidance during the competition. However, all work during the competition must be performed by the student members of the team.

^MIssion 3 game object and designated location will be announced on the day of the Onsite Competition

7.3. Best ARTec Robot Design (Additional Prize)

Scoring for the Best ARTec Robot Design will be based on the following:

Criteria	Score
Creativity ● Imagination used to develop and create the robot design	10
Innovation ● Original solution and application to add significant value to the robot	10

* Note that the Best ARTec Robot Design score is an additional prize category, and the scores will not be counted towards the overall championship score.

7.4. Best Teamwork Score (Additional Prize)

Scoring for the Best Teamwork will be based on the following:

Criteria	Score
Team Play ● Organise teammates toward a positive common goal with teamwork	10
Attitude ● Demonstrate participation and show enthusiasm throughout the competition	10

* Note that the Best Teamwork score is an additional prize category, and the scores will not be counted towards the overall championship score.

8. Awards

Overall Championship

Teams are considered for the Overall Championship Award based on the total scores of their Presentation and Competition Rounds.

Score tables can be found in Section 7.

The top team will receive the following:

$400, trophy, banner, and one medal for each participant.

Best Robot Performance
1st Place: Trophy, medals (per participant)
2nd Place: Medals (per participant)
3rd Place: Medals (per participant)

Best Presentation

Awards will be based on scores given during the Presentation Round.

The top 3 teams will receive one medal for each participant.

Best ARTec Robot Design

Award will be based on scores given during the Competition Round.

The best team will receive one medal for each participant.

Best Teamwork

Award will be based on scores given during the Competition Round.

The best team will receive one medal for each participant.

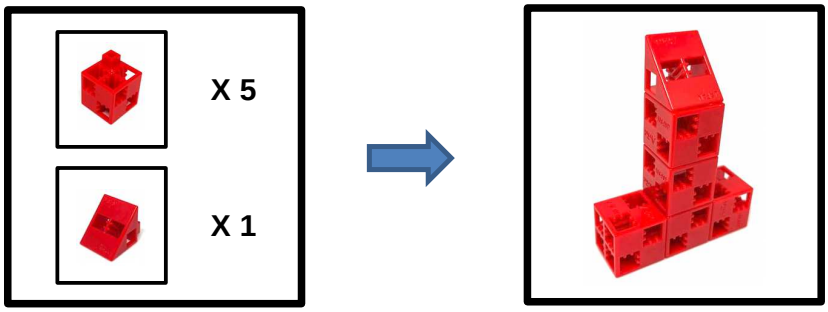
Certificate of Participation
All participants will also be presented with a Certificate of Participation for taking part in the competition.

The Organiser reserves the right to amend the prizes without prior notice.

9. Assembly of the Game Elements

A. RED WASTE

1.



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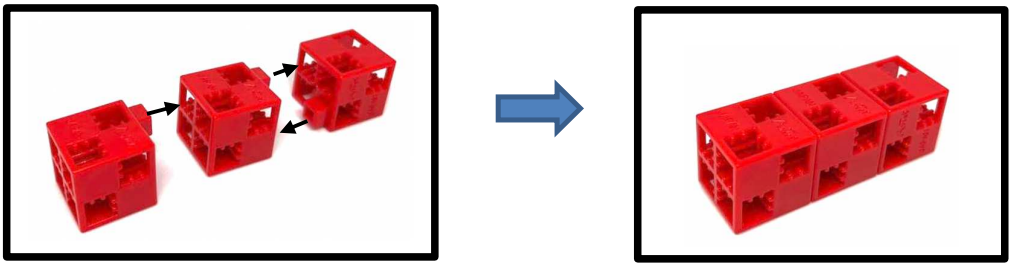

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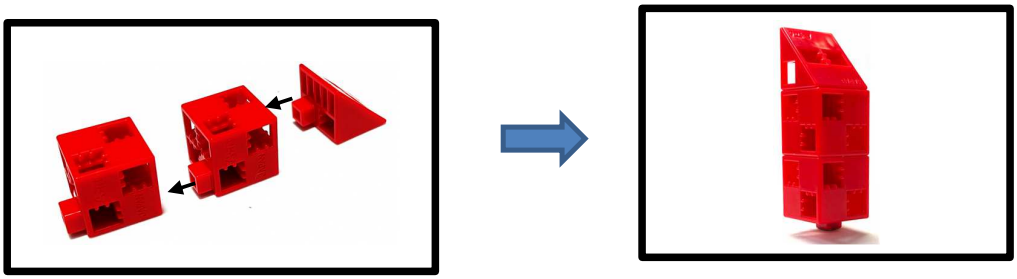

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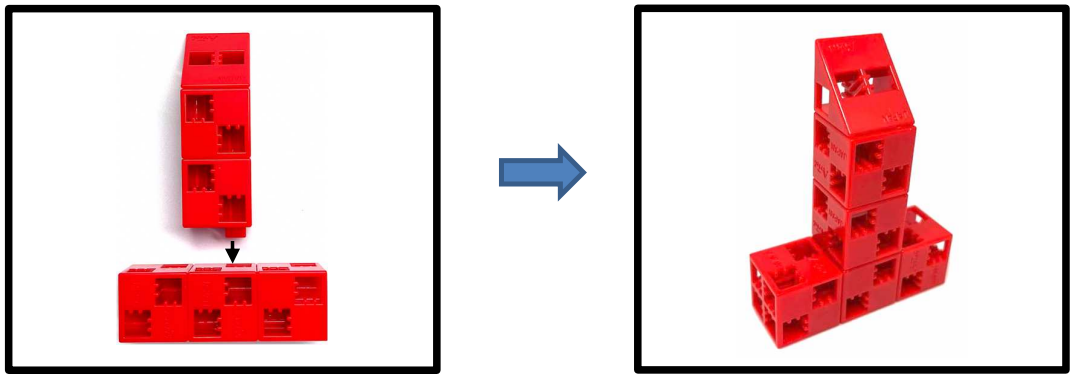
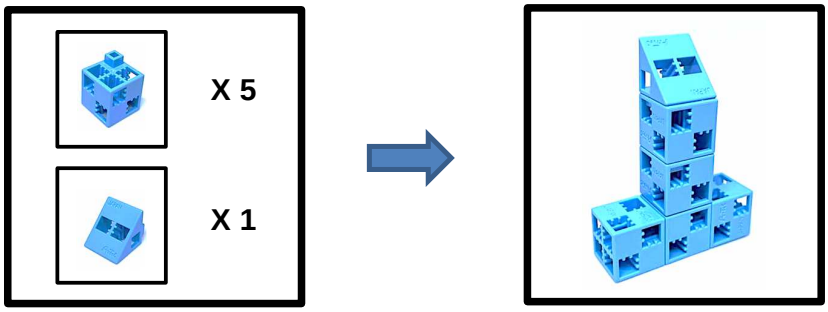


B. BLUE WASTE

1.



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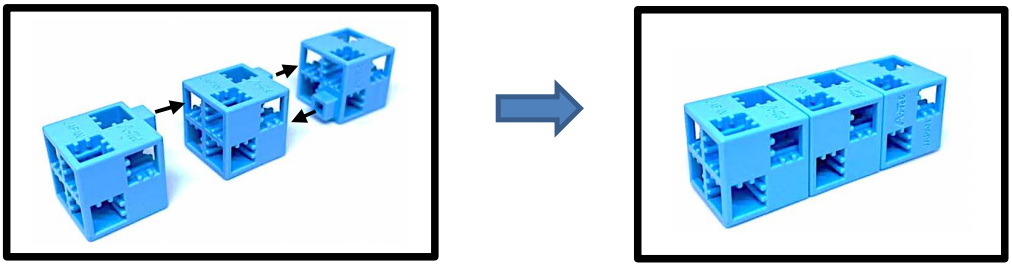

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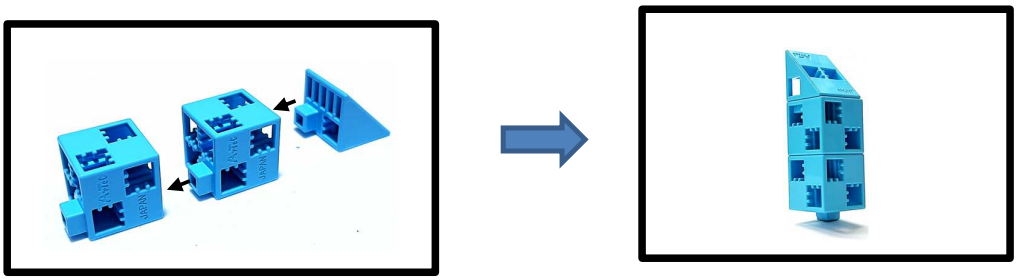

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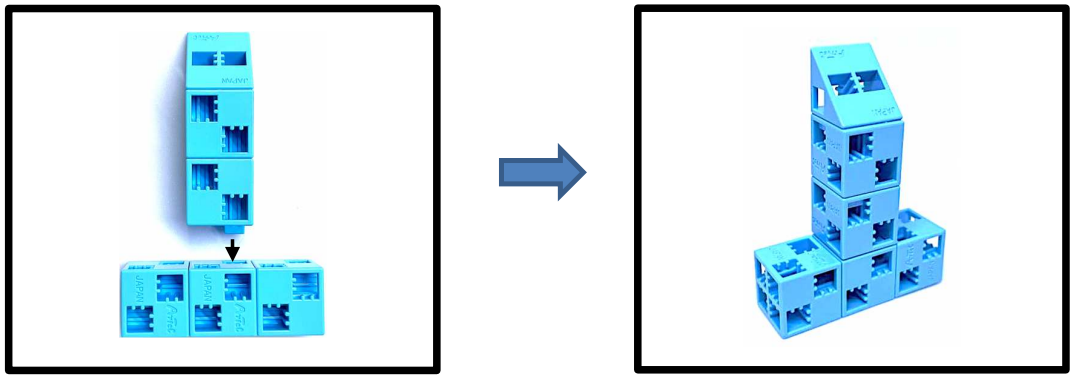
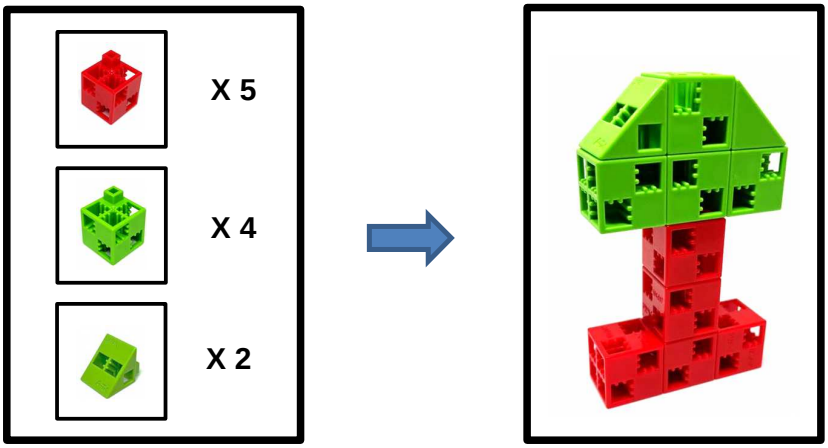
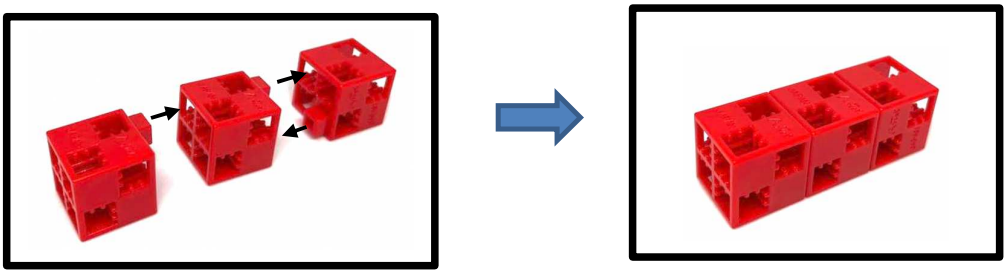


C. TREE

1.



2.



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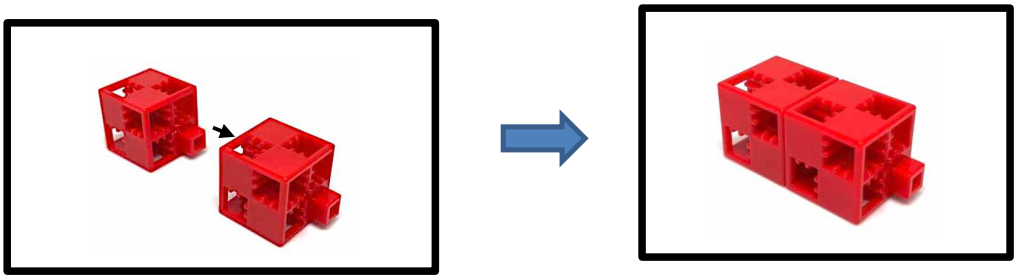

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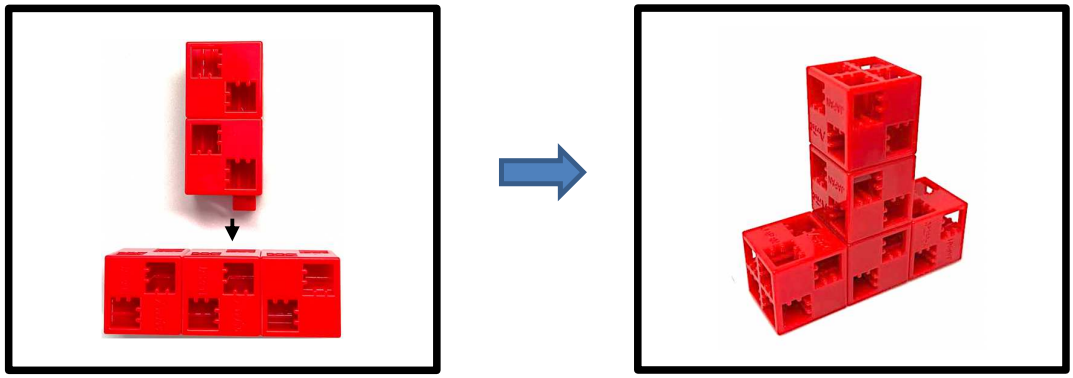

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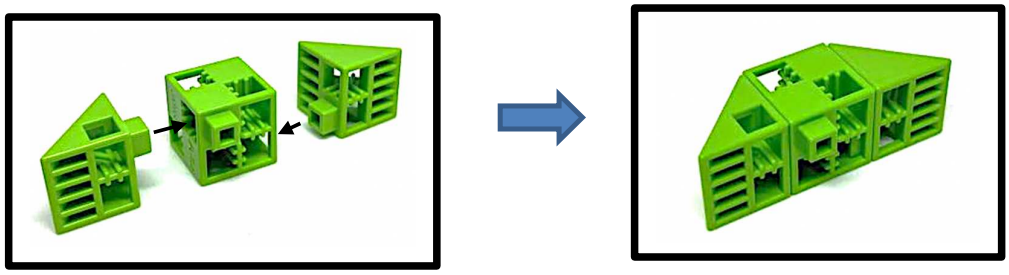

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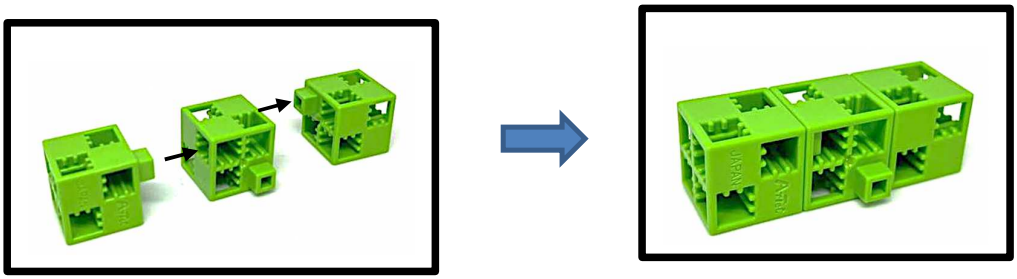

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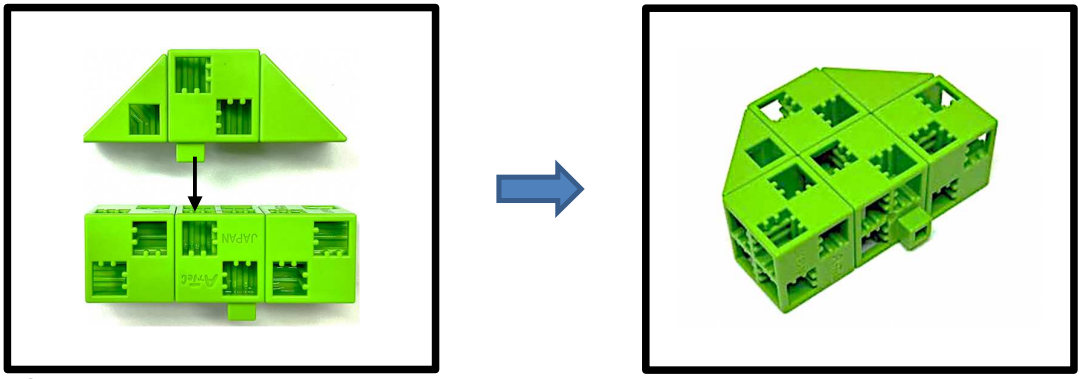
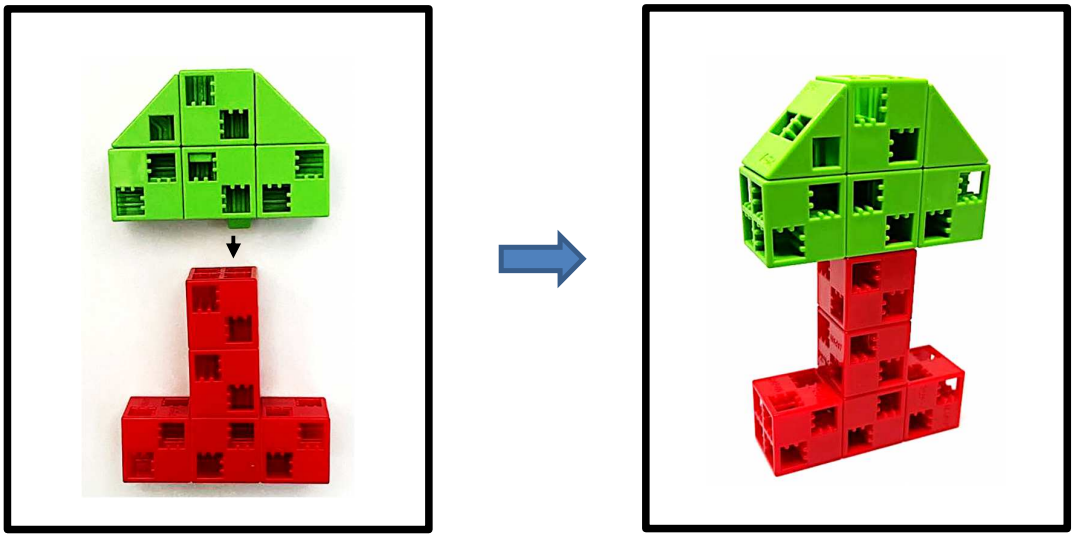
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