

## NRC (PRESCHOOL) CATEGORY

# GENERAL RULES

Version 1.0 (27 May 2022)

Main Organiser:



Sponsored by:



Ministry of Education  
SINGAPORE

Co-Organiser:



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## NRC 2022 PRESCHOOL CATEGORY CHALLENGE BOOKLET CHANGE LOG

Version	Release Date	Description
1.0	27 May 2022	Official Challenge Booklet release
1.1	6 July 2022	Updated Information on Playing Field
1.2	22 July 2022	Updated Information on Manipulatives

## Contents

<b>1. General Information</b> .....	4
<b>1.1 National Robotics Competition (NRC) 2022</b> .....	4
<b>1.2 Introduction to NRC Preschool 2022</b> .....	4
<b>1.3 Focus Areas</b> .....	4
1.4. Age-appropriate missions.....	5
1.5 Learning is Most Important.....	5
<b>2. Team and Age Group Definition</b> .....	6
<b>2.1 Team Definition</b> .....	6
<b>2.2 Coach Definition</b> .....	6
<b>3. Responsibilities and team’s own work</b> .....	7
<b>4. Tournament Format and Procedure</b> .....	8
<b>4.1 Competition Format</b> .....	8
<b>4.3 Presentation Format</b> .....	9
<b>4.4 Robot Attempt</b> .....	9
<b>5. Game table and equipment</b> .....	11
<b>5.1 Game Field</b> .....	11
<b>5.2 Game Objects, Positioning, Randomisation</b> .....	12
<b>6. KUBO Missions</b> .....	13
<b>6.1 Helping Grandma</b> .....	13
<b>6.2 Getting Groceries</b> .....	14
<b>6.3 Picking Up Rubbish</b> .....	14
<b>6.4 Save the Community Cat</b> .....	15
<b>7. Specific Game Rules</b> .....	16
<b>7.1 Specific Rules about Materials</b> .....	16
<b>7.2 Specific Rules about the Missions</b> .....	16
<b>7.3 Specific Rules about the Competition</b> .....	17
<b>8. Scoring</b> .....	18
<b>8.1 Presentation Score</b> .....	18
<b>8.2 Competition Score</b> .....	19
<b>9. Awards</b> .....	22

# 1. General Information

## 1.1 National Robotics Competition (NRC) 2022

[National Robotics Competition \(NRC\)](#) has been an ongoing competition organised annually by Science Centre Singapore for the past 23 years with support from the Ministry of Education, various partners and sponsors. NRC has attracted more than 60,000 team members and 240,000 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 team members. This is in line with Science Centre Singapore's mission "To promote interest, learning and creativity in science and technology, through imaginative and enjoyable experience and contribute to the nation's development of its human resource".

NRC 2022 tournaments comprise of:

- WRO® RoboMission (previously known as WRO Regular Category)
- WRO® Future Innovators (Previously known as WRO Open Category)
- WRO® Future Engineers
- NRC WeDo
- **NRC Preschool (New)**
- CoderZ Coding Challenge

In 2022, NRC will include a new NRC Preschool category, for ages 5-6.

Registration for these category challenges will be via <https://www.gevme.com/NRC2022>. Competition registration opens from **1<sup>st</sup> May to 31<sup>st</sup> July 2022**.

## 1.2 Introduction to NRC Preschool 2022

National Robotics Challenge 2022 (NRC 2022) is an exciting game-based robotic competition that provides an opportunity for participants to develop their creativity and problem-solving skills in a fun and engaging way. There are numerous applications of robots at home and in the daily household. One example is robots that can perform various tasks in our community.

On the Preschool game field, the KUBO robot takes on tasks around the community. The KUBO robot will be tasked with 4 missions: taking Grandma to a place of worship, picking up and delivering groceries, picking up rubbish as well as saving a stranded community cat.

## 1.3 Focus Areas

Every NRC category has a special focus on learning with robots. In the NRC Preschool category, students will focus on developing in the following areas:

- Recognising patterns and their impact on code

- Writing code using TagTiles
- Comparing and refining algorithms for a route
- Tinkering and exploratory learning
- Computational thinking, creative problem-solving skills, teamwork, communication

In partnership with Duck Learning as part of the NRC Preschool Robotics Challenge, teachers can create a free KUBO Education account to get access to free learning materials, curriculums and guides in one place on the KUBO platform in preparation for the competition.

#### **1.4. Age-appropriate missions**

The fields and missions are designed with a growing difficulty and complexity from Elementary (Primary) to Senior (Tertiary) age group. The rising complexity is seen in the:

- Route on the field (e.g., line following or only markers).
- Technical complexity of the missions (e.g., pushing, lifting, grabbing game objects).
- Randomness of the game elements (e.g., one or multiple random situations).
- Variety of game elements (e.g., number of different coloured and/or shaped objects).
- Required accuracy of the solutions to the missions (e.g., a big target area or a small spot).
- Overall complexity in the combination of the elements mentioned before.

All these aspects lead to different requirements for the mechanical design of the robot and the complexity of the code. When participating in NRC for multiple seasons, the teams can grow and develop with the program, solving increasingly complex missions as they get older.

#### **1.5 Learning is Most Important**

NRC hopes to inspire students around the world in STEM-related subjects and for the students to develop their skills through playful learning in the competitions. As such, the following aspects are essential across all competition formats and categories:

- Teachers, parents or other adults can help, guide and inspire the team, but are not allowed to build or code/program the robot.
- On a competition day, Teams and Coaches respect the final decision judges take and work with other teams and judges on a fair competition.

## **2. Team and Age Group Definition**

### **2.1 Team Definition**

A team consists of up to two (2) coaches and two (2) to five (5) team members. One (1) coach and one (1) team member is not considered a team. A team may only participate in one of the NRC categories in a season. A student may only participate in one team.

The age group in NRC Preschool Category are:

- 5 - 6 years old (as of 31 Dec 2022)

### **2.2 Coach Definition**

The minimum age of a coach in the NRC tournament (and assistant coaches) is age 18 at the time of registration. Coaches may work with more than one team; however, each team needs to be assisted by an adult. This person may be an assistant coach. Coaches may offer students advice and guidance prior to the competition. However, all work related to preparation and submission, and the actual competition must be performed by the student members of the team.

### 3. Responsibilities and team's own work

A team should play fair and be respectful towards teams, coaches, judges and competition organisers.

The design and coding of the robot may be done only by the team. The task of the coach is to accompany the team and to support them, and to provide assistance where needed for the Preschool category.

Teams are not allowed to communicate in any way with people outside of the competition area while the competition is running. If communication is necessary, a judge may allow team members to communicate with others under supervision of a judge.

Team members are not allowed to bring and use mobile phones or any other communication device into the competition area.

Teams are not allowed to use a solution (hardware and / or software) that is (a.) the same or too similar to solutions sold or posted online or (b.) the same or too similar to another solution at the competition and clearly not the own work of the team. This includes solutions from teams of the same institution and/or country.

If there are suspicions in relation to the rules above, the team will be subjected to investigation and consequences may apply. The organising team reserves the right to refuse the team's continued participation in the competition.

If any of the rules mentioned in this document are broken or violated, the judges can decide on one or more of the following consequences. The team coach may be interviewed to find out more about the possible violation of the rules.

- A team may get up to a 50% reduced score in one or more runs.
- A team may be disqualified completely from the tournament immediately.

## 4. Tournament Format and Procedure

The following are the rules of competition at NRC (Preschools) 2022.

In this category, there are 2 rounds:

- An online presentation round (including a Q&A session with each team) on **23<sup>rd</sup> or 24<sup>th</sup> August 2022**.
- An onsite competition round on **31<sup>st</sup> August 2022**.

### 4.1 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<sup>rd</sup> and 24<sup>th</sup> August 2022**.

The Competition Round will be conducted on **31<sup>st</sup> August 2022** for all participants. This will be held at Marquee, Science Centre Singapore.

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

### 4.2 Competition Schedule

Dates	Components	Mode
23 <sup>rd</sup> - 24 <sup>th</sup> August (Tuesday - Wednesday)	NRC Preschool Presentation	Venue: Online (Zoom)
31 <sup>st</sup> August (Wednesday)	NRC Preschool Competition	Venue: Science Centre Singapore (Marquee)

\*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.

In view of the changing safety management measures dependent on the nation's pandemic response, the Organiser reserves the right to amend the competition schedule and mode of the competition. Participants will be notified of any changes via email.



### 4.3 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<sup>rd</sup> and 24<sup>th</sup> August 2022**.

- 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.

Criteria	Score
Coding and Design of KUBO	10
Reflection	10
Presentation	10

More details on the scoring can be found at [Section 8](#).

### 4.4 Robot Attempt

The competition will be held onsite on **31st August**.

- Teams will get 1 practice run (20 minutes) before the actual attempt.
- Teams will only get 1 attempt (40 minutes) to complete all KUBO Missions on the day of the Competition Round.
- There will be 4 missions to complete, 10 minutes will be given for each mission.
- All teams will begin the same mission simultaneously.

Missions	Score
Mission 1: Helping Grandma	14
Mission 2: Getting Groceries	18
Mission 3: Picking up Rubbish	18
Mission 4: Saving the Community Cat	20

**Points to note about the Competition:**

- The game field mat will be provided to each participating team, together with a set of KUBO and Coding+ set prior to the competition.
- Participating teams must bring along the game field mat, KUBO and Coding+ set on the day of the Competition Round on 31<sup>st</sup> August 2022.
- Participating teams that fail to return the game field mat, KUBO and Coding+ set will be liable to make full payment of the items listed above to Science Centre Singapore.
- In the event that overall scores are tied, the team with the shortest overall time (during the competition) wins the Competition Round.
- Scoring for the Competition Round can be found in [Section 8](#).






The dimensions of the game field mat are as follows:

1 m (Length) x 1 m (Breadth)

The game field will be divided into grids of 4cm x 4cm each. There will be a total of 400 playable grids.

### 5.2 Game Objects, Positioning, Randomisation

The KUBO robot must start from the playable area of the playing field mat (Grid A1).

<p><b>1 Grandma</b></p> <p>There will be 1 Grandma character placed upright on the playing field mat.</p> <p>Grandma's character will be in R17.</p> <p>Grandma's character may be placed upright in any orientation within the grid.</p>	
<p><b>2 Grocery bags</b></p> <p>There are 2 different grocery bags placed on the playing field mat.</p> <p>Grocery bag 1 will be in Grid E13.</p> <p>Grocery bag 2 will be in Grid R13.</p> <p>Grocery bags may be placed upright in any orientation within the grid.</p>	
<p><b>2 Metal cans</b></p> <p>There are 2 metal cans placed on the playing field mat.</p> <p>Metal can 1 will be in Grid J4.</p> <p>Metal can 2 will be in Grid C9.</p> <p>Metal cans may be placed upright in any orientation within the grid.</p>	

### 1 Cat stranded on a tree

There is a cat stranded on a tree on the playing field mat.

Cat will be in Grid I19.

The cat is placed upright on an elevated tree.

A hidden mission will be revealed on the day of challenge.  
The hidden mission is compulsory to complete the mission.



## 6. KUBO Missions

The missions will be explained in multiple sections.

**The order of the missions is fixed and every team will start simultaneously.**

**Each mission will be given a maximum duration for completion as follows:**

Mission	Duration (min)
Helping Grandma	10
Getting Groceries	10
Picking Up Rubbish	10
Save the Community Cat (Bonus)	10

For scoring rubrics, please refer to [Section 8](#).

### 6.1 Helping Grandma

Grandma needs help to make a visit to the nearest place of worship.

Grandma will appear at Grid R17.

KUBO robot can help to bring Grandma to her destination. Therefore, the KUBO robot should transport Grandma from her original position (Grid R17) to the place of worship at Grid N12 - O14.

Teams can fabricate their own method of transport to be attached to the KUBO robot to aid in transporting Grandma to her destination.

Participants can only use their hands to transfer Grandma into or onto their transportation device when KUBO reaches a 1 grid radius around Grandma and the code has stopped running.

Additional points will be awarded if teams are able to transport Grandma's character to the place of worship (Grid N12 - O14) (hands-free) (i.e. no physical contact with manipulatives throughout run).

## **6.2 Getting Groceries**

The neighbourhood supermarket has received a few delivery orders to fulfil.

KUBO robot can help to deliver the orders. Therefore, the KUBO robot is tasked to deliver two Grocery Bags from the supermarket at Grid E13 and the shopping centre at Grid R13 to the bus stop (Grid I13 - J13).

Teams can fabricate their carriers to be attached to the KUBO robot to deliver the Grocery Bags.

Participants can only use their hands to transfer Grocery Bags into or onto their transportation device when KUBO reaches a 1 grid radius around the Grocery Bags and the code has stopped running.

Additional points will be awarded if teams are able to transport Grocery Bags to the bus stop (Grid I13 - J13) (hands-free).

## **6.3 Picking Up Rubbish**

Everyone plays a part in keeping the community clean.

The KUBO robot wants to pick up Metal Cans around the neighbourhood and bring the two Metal Cans to the recycling bin. Therefore, the KUBO robot should bring both Metal Cans (J4 and C9) into the recycling bin (Grid J8 - K8).

The Metal Cans are magnetic. Teams can fabricate their equipment to be attached to the KUBO robot to bring the Metal Cans to the recycling bin.

Participants can only use their hands to transfer the Metal Cans into or onto their transportation device when KUBO reaches a 1 grid radius around the Metal Cans and the code has stopped running.

Additional points will be awarded if teams are able to transport Metal Cans to the bus stop (Grid J8 - K8) (hands-free).

#### **6.4 Save the Community Cat**

There is a stranded cat lurking in the community that needs your help.

KUBO robot can save the Community Cat high up in the tree. Therefore, KUBO robot is tasked to remove the Community Cat from the tree at Grid I19.

Teams can fabricate their equipment to be attached to the KUBO robot to aid in the rescue of the community cat.

This mission has to be completed (hands-free).

However, there is a catch to saving the community cat. Find out more on the day of the Competition.

**\*Additional Challenge will only be made known to participating teams on the day of the Competition, after the first 3 missions have been completed.**

## 7. Specific Game Rules

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

### 7.1 Specific Rules about Materials

- The KUBO robot must be assembled using the complete set of KUBO and Coding+ Set provided to each participating team by Science Centre Singapore.
- Any number and combination of KUBO TagTiles are allowed in programming the KUBO robot.
- Only KUBO branded TagTiles can be used in the programming of the KUBO robot.
- Each set of KUBO robot is tagged to its own set of TagTiles. Please ensure that only the TagTiles that come with the KUBO robot are used in the coding of the robot.
- Coding+ expansion packs may be used with any KUBO robot sets.
- Teams are highly encouraged to use recyclable materials in the fabrication of carriers or equipment to assist their KUBO robot in completing the various missions.

### 7.2 Specific Rules about the Missions

Prior to each mission attempt, the team may touch the KUBO robot to dress or equip it for the selected mission. The design of KUBO, including any carriers, should also be unique to each mission. It should also not be reutilised for other missions.

The team is only allowed to move the KUBO robot, not the game objects. **Game objects not attached to the KUBO robot cannot be moved to another Mission Area.**

During the mission attempt, the KUBO robot may only be operated under KUBO's TagTile programme control.

During a mission attempt, while the KUBO 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 judge 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 KUBO robot is completing its mission.* If a participant touches the game field mat while the KUBO robot is running its programme, the judge 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.



### **7.3 Specific Rules about the Competition**

**Each mission is completed when either:**

The robot completes its coded programme for the mission and the team communicates to the judge that the robot has finished.

OR

The time limit has expired for the mission.

Missions will be considered successful if either KUBO robot or its transported game objects fall within the designated grids.

## 8. 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.

### 8.1 Presentation Score

Criteria	Score
Coding and Design of KUBO Robot <ul style="list-style-type: none"> <li>● What are some special tiles used to solve the missions</li> <li>● How they have designed KUBO robot's attached carriers or equipment to solve the missions</li> </ul>	10
Reflection <ul style="list-style-type: none"> <li>● What they have learnt during the process</li> <li>● What was their favourite part of the process</li> </ul>	10
Presentation <ul style="list-style-type: none"> <li>● Clarity of presentation</li> <li>● Creativity of presentation</li> <li>● Q&amp;A</li> </ul>	10

## 8.2 Competition Score

<b>Missions</b>	<b>Score</b>
Go to Grandma (Grid R17) from Grid A1	1
Transport Grandma from original position (Grid R17) to Hindu temple (Grid N12 - O14) - Any part Grandma is within the grids of the Hindu temple	2
Transport Grandma (hands-free)* throughout mission	1
Finish mission within duration: <2 minutes: 8 pts 2 - 4 minutes: 6 pts >4 - 6 minutes: 4 pts >6 - 8 minutes: 2 pts >8 - 10 minutes: 1 pt	8
No interference from teachers#	2
<b>Total</b>	<b>14</b>
Travel from Hindu temple (N12) to Supermarket (E13)	1
Deliver Grocery Bag 1 (E13) to bus stop (Grid I13 - J13) - Base of Grocery Bag 1 is within the grids of bus stop	2
Go to Shopping Mall (R13) for 2nd grocery bag	1
Deliver Grocery Bag 2 (R13) to bus stop (Grid I13 - J13) - Base of Grocery Bag 2 is within the grids of bus stop	2
Deliver Grocery Bag 1 (hands-free)*	1
Deliver Grocery Bag 2 (hands-free)*	1
Finish mission within duration: <2 minutes: 8 pts 2 - 4 minutes: 6 pts >4 - 6 minutes: 4 pts >6 - 8 minutes: 2 pts >8 - 10 minutes: 1 pt	8
No interference from teachers#	2
<b>Total</b>	<b>18</b>
Go to metal can 1 (J4) from bus stop (J13)	1
Bring Metal Can 1 (Grid J4) into the recycling bin (Grid J8-K8) ● Metal Can is within the grids of the recycling bin	2

Go to metal can 2 (C9)	1
Bring Metal Can 2 (Grid C9) into the recycling bin (Grid J8-K8) <ul style="list-style-type: none"> <li>● Base of Metal Can 2 is within the grids of the recycling bin</li> </ul>	2
Bring Metal Can 1 (hands-free)*	1
Bring Metal Can 2 (hands-free)*	1
Finish mission within duration: <2 minutes: 8 pts 2 - 4 minutes: 6 pts >4 - 6 minutes: 4 pts >6 - 8 minutes: 2 pts >8 - 10 minutes: 1 pt	8
No interference from teachers#	2
<b>Total</b>	<b>18</b>
<b>Bonus mission^</b>	<b>4</b>
Go to the tree (within 1 grid radius from Grid I19) from recycling bin (K8)	2
Bring the community cat down from the tree (Grid I19)	3
Finish mission within duration: <2 minutes: 8 pts 2 - 4 minutes: 6 pts >4 - 6 minutes: 4 pts >6 - 8 minutes: 2 pts >8 - 10 minutes: 1 pt	8
No interference from teachers#	3
<b>Total</b>	<b>20</b>
<b>Maximum Score</b>	<b>70</b>

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

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

^Bonus mission will be announced on the day of the Onsite Competition. Participants are required to complete the Bonus Mission to qualify for task completion.

### 8.3 Best KUBO Robot Design (additional prize)

Criteria	Score
Creativity <ul style="list-style-type: none"> <li>Imagination used to develop and create the robot design</li> </ul>	10
Innovation <ul style="list-style-type: none"> <li>Original solution and application to add significant value to the robot</li> </ul>	10

\* Note that the best KUBO robot design score is an additional prize category, and the scores will not be counted towards the overall championship score.

### 8.4 Best Teamwork Score (additional prize)

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

Criteria	Score
Team Play <ul style="list-style-type: none"> <li>Organise teammates toward a positive common goal with teamwork</li> </ul>	10
Attitude <ul style="list-style-type: none"> <li>Demonstrate participation and show enthusiasm throughout the competition</li> </ul>	10

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

## **9. 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 the scoring section.

The top 3 teams will receive the following

1st place: \$500, trophy, banner and one medal for each participant.

2nd place: \$300, trophy, banner and one medal for each participant.

3rd place: \$200, trophy, banner and one medal for each participant.

### **Best Presentation**

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

The top 3 teams will receive trophies (1 per team), and one medal for each participant.

### **Best KUBO Robot Design**

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

The best team will receive a trophy, and one medal for each participant.

### **Best Teamwork**

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

The best team will receive a trophy, and one medal for each participant.