

2011 NRC FINAL - RULES AND REGULATIONS

General Guidelines

1. A school team should comprise of 2 or 3 students and one teacher.
2. All rules and regulations are subject to change without any prior notice.

Competition Format

1. Regular Category

Category	Date of Birth	Event
Primary School	After 1 Jan 1999	Guide Robot
Lower Secondary	1 Jan 1996 - 31 Dec 1998	Stair Climber
Upper Secondary	1 Jan 1992 - 31 Dec 1995	Robot Recycler

2. Open Category

Theme: Robots for Life Improvement

Category	Date of Birth
Primary School	After 1 Jan 1999
Lower Secondary	1 Jan 1996 - 31 Dec 1998
Upper Secondary	1 Jan 1992 - 31 Dec 1995

General Rules – Regular Category

1. The competition rules of the 2011 National Robotics Competition are constituted by the organizing committee of the National Robotics Competition (“the tournament” for short in the following paragraphs), and they apply to the tournament. **Surprise additional rules will be announced on the morning of the competition.**

2. Regulations on materials used:
 - (a) Except for special designations in competition rules, materials used by the teams to assemble their robots must be from **9797 LEGO® MINDSTORMS™ Education Base Set, 9695 MINDSTORMS™ Education Resource Set, 9648 Education Resource Set, 9794 LMFS Team Challenge Set, and 9649 Technology Resource Set. The shapes and the colors must be exactly the same.**
 - (b) The control program must be written using the ROBOLAB or LEGO® MINDSTORMS™ Education NXT software. Teams that use materials and control programs that are not certified by the tournament will be disqualified from the competition.
 - (c) Teams should prepare and bring all the equipment (software, portable computers, batteries, extension wires, etc.) that they need during the tournament. Teams should not use any flammable materials as part of their designs.
 - (d) Teams should bring enough spare parts. In the event of accidents or equipment malfunction, the organisers are not responsible for any maintenance and replacement of equipment. Mentors are not allowed to enter the quarantine area to give instructions or guidance to their teams.
 - (e) **Teams are allowed to bring only one NXT/RCX controller into the quarantine area.**
 - (f) Batteries used during the competition can be 6 pieces of AA batteries or lithium batteries of LEGO® MINDSTORMS™ NXT. Other power supply devices which are not authorised by the organisers are not allowed to be used.
 - (g) All the parts for the robot should be in the initial states (not pre-built) when the assembling time starts. For example, a tire cannot be put on a wheel until the assembling time begins.

- (h) Contestants may not refer to any instruction sheets either written, illustrated or pictorial.
 - (i) Teams are allowed to pre-program the robot or store the program in the laptop before the competition.
 - (j) No screws, glues or tapes are to be used to fasten any components of the robot. Non-compliance with this rule will result in disqualification from the competition.
 - (k) Modification of any original parts, for example, RCX Intelligent Brick, NXT Intelligent Brick, motors, sensors, etc. is not allowed. Violation of this rule will result in disqualification.
3. Regulations concerning the robot:
- (a) The maximum dimensions of the robot before it starts the “mission” must be within 250mm X 250mm X 250mm. After the robot starts, the dimensions of the robot are not restricted.
 - (b) Except for special designations in competition rules, the amount of motors and sensors used during the competition are not restricted.
 - (c) Teams are allowed only one controller (RCX or NXT).
 - (d) Except for special designations in competition rules, any action or movement deemed as interference or assistance to the team while the robot is functioning is disallowed. Violation of this rule will result in disqualification from the competition.
 - (e) Use of radio communication, remote control and wire control systems to control the robot is not allowed. Violation of this rule will result in the immediate disqualification of the team from the competition.
 - (f) If the robot uses the NXT Intelligent Brick as its controller, the Bluetooth™ function must be switched off.

4. Regulations on the competition event:

The competition consists of three Qualifying Rounds, Top 16, Quarter Final, Semi Final and Final.

(a) **Quarantine period:**

Qualifying Rounds - 150 minutes for 1st Quarantine Time, 45 minutes for 2nd Quarantine Time and 30 minutes for 3rd Quarantine Time.

Top 16 matches – 30 minutes Quarantine Time

Quarter Final matches – 30 minutes Quarantine Time

Semi Final matches – 15 minutes Quarantine Time

Final matches – 10 minutes Quarantine Time

- (b) Contestants can only start to assemble, program and test their robots after the announcement of the tournament. When the quarantine is over, all the robots must be put in the places designated by the tournament. The matches will begin after the quarantine verification conducted by the judges.
- (c) The score calculation is done by the judges after each match. The contestants must sign the score sheet after each match if they have no fair complaints.
- (d) Contestants should take good care of their robots to avoid malfunction. If programs cannot be downloaded to the robot due to ill-safekeeping, accidental bumping, falling or other causes, quarantine time will not be extended.
- (e) If a violation is found at the inspection, the judge will give the team 3 minutes to correct the violation. If the violation is not corrected during the time given, teams will not be allowed to compete. **Time to correct non-conforming robots will not be provided to participating teams in the Top 16, Quarter Final, Semi Final and Final, after they have been inspected.**
- (f) When assembly time is over, neither modification (for example, downloading programs, changing batteries) of robot, nor request for time-out is allowed. In the case of a robot breaking down accidentally, the contestant may be given maintenance time by the judges but the contestant is not allowed to add any parts, nor download any program.

- (g) **The ranking of team is decided by their best score of a round. If competing teams acquire the same points, the ranking is decided by the time recorded. If teams still remain tied, rankings will be determined by consistency of performance by examining which team achieved the next highest score during previous rounds.**

5. Regulations on the playing field:

- (a) Teams must assemble their robots in the area (each team has its own area) designated by the tournament. Only the contestants, NRC organising committee staff and special personnel are allowed to enter the competition area.
- (b) All models and playing fields are according to the standard provided by the tournament on the competition day.
- (c) As you build and program, keep in mind that our organizers make every effort to ensure that all fields are correct and identical, but you should always expect some variability, such as:
 - i. Variety in lighting conditions
 - ii. Judge's shadow on the field
 - iii. Judges will walk around the field during judging
 - iv. Texture/bumps under the mat
 - v. Waviness in the mat itself – at many tournaments, it is possible for the mats to be rolled out in time to lose their waviness. Location and severity of waviness varies. It is very important to consider this while designing.

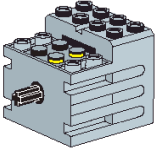
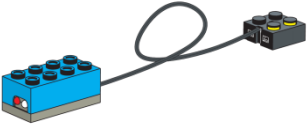





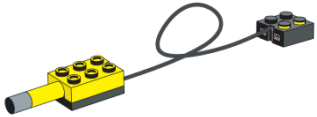
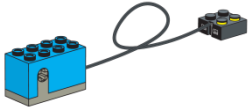
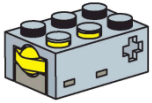

6. Regulations on behaviour:

Behaviours listed below are prohibited and may result in disqualification:

- (a) Causing damage to the competition playing fields, models or robots of other teams.
- (b) Bringing a cellular phone or a medium of wired/wireless communication device in the court.
- (c) Using dangerous items or displaying behaviours that disrupt the competition.
- (d) Using inappropriate words or behaving inappropriately towards other teams, audience, judges or the tournament.
- (e) Creating situations which judges deem unacceptable or interfering.

7. The judges have the utmost authority during the tournament. Their decisions are final and shall not be changed. As such, they may not change their decision even after viewing the competition video.
8. When a team is considered disqualified by any judge, the robot of the team concerned must quit the match immediately, and the team will get no score for the match.
9. The tournament has the right to revoke the qualification of any team if the team violates the rules.
10. Any communication devices and methods are strictly restricted while the competition is in progress. Anyone who is outside the competition area is prohibited from talking or communicating with the contestants in the competition area. Team(s) violating this rule will be disqualified and required to quit the competition immediately. However, under certain circumstances and with permission from the judges, an urgent message can be conveyed through a tournament staff.
11. If the competition is delayed due to electricity breakdown, unavailability of Playing Fields/models or difficulty in determining the scores, the judges may hold a return game, and the contestants shall not raise any objection.
12. The tournament has the right to photograph and videotape the event and the right to reproduce, modify and use the photographs and video tapes for various media.
13. If there is any inadequacy or alteration in the rules, the final decision shall be announced by the judges at the tournament. The judges have the utmost authority to amend the rules and regulations.
14. **Penalty will be imposed if there is any violation to the General Rules.**

NRC 2011 Eligible Motors and Sensors for the Regular Category:

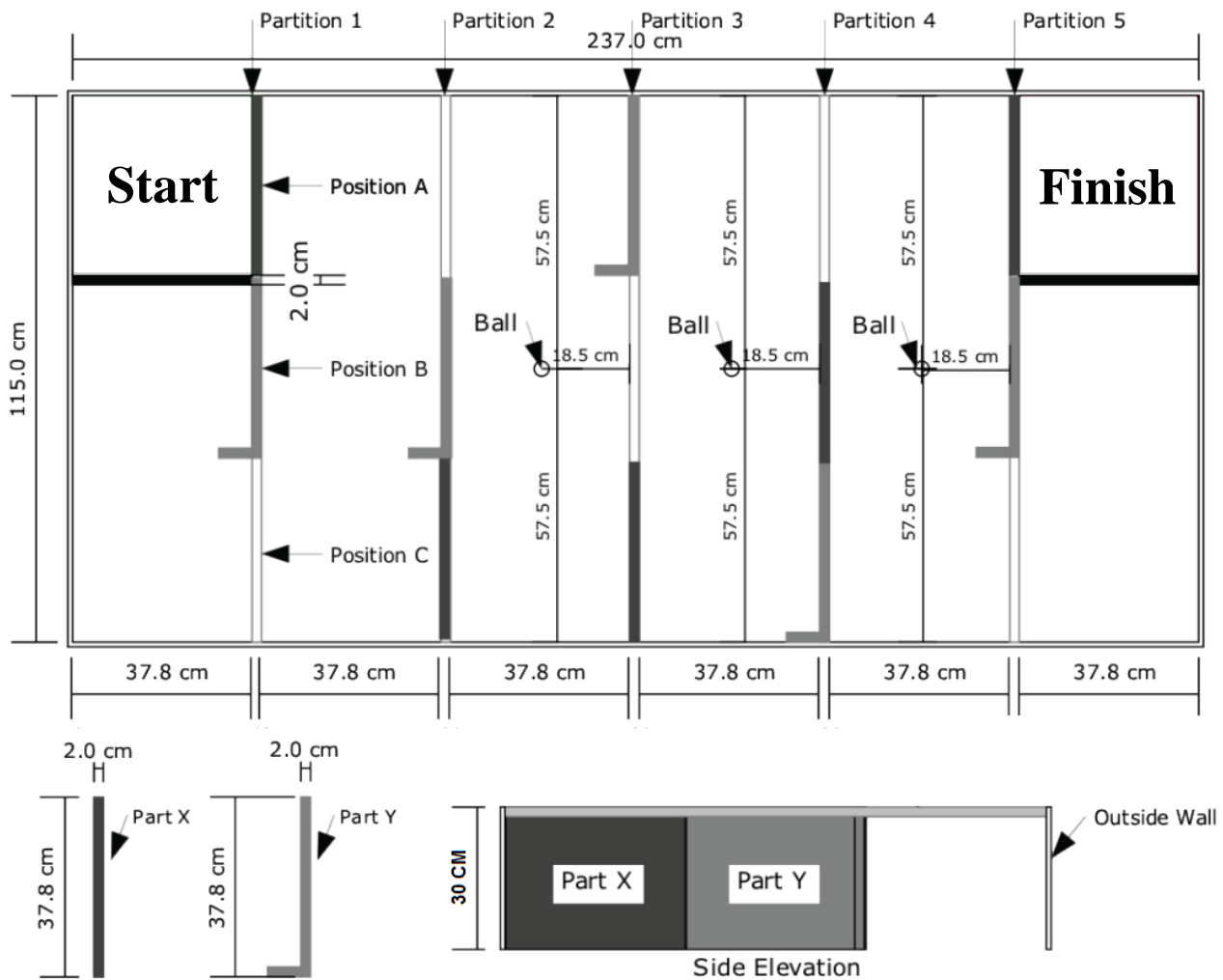
PID	Product Picture	Product Name
5225		9V Motor with Gear Reduction
9758		Light Sensor
9842		Interactive Servo Motor
9843		Touch Sensor
9844		Light Sensor
9845		Sound Sensor
9846		Ultrasonic Sensor
9889		Temperature Sensor (9V)
9891		Angle Sensor (9V)
9911		Touch Sensor and Leads
9694		NXT Colour Sensor

GUIDE ROBOT (PRIMARY SCHOOL)

The robot must move from the Start box and find its way through the labyrinth to the Finish box in the shortest possible time (within a given time limit - 2 minutes). Along the way, the robot must collect three ping-pong balls placed along the course and take them to the Finish Box.

Surprise rules may be announced before commencing the Quarantine Time of the competition.

Court



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Rules and Regulations

1. There will be a ± 20 mm black line around the perimeter of the Start Box and Finish Box.
2. To start and finish, the robot must be entirely within the appropriate Start Box or Finish Box.
3. **The path the robot must take to successfully complete the mission will be announced after each quarantine time.** The positions of Parts 'X' & 'Y' in Partitions 1-5, can be in either Positions A, B or C.
4. The ping-pong balls will be placed on 2 X 2 LEGO® plates (or similar) at the positions marked on the playing field.
5. The time given for the robot to complete its mission is 2 minutes. Time is measured at the point that the robot starts and the judge will give the signal to start.
6. The mission and timing will end if:
 - (a) The robot is touched by any team member.
 - (b) Maximum time (2 minutes) is reached.
 - (c) Robot reaches the Finish Box completely.

Scoring

1. Mission Points
 - Robot moves completely into the next section = 10 points
 - Each ping-pong ball is carried back to the Finish Box completely = 10 points
 - Robot reaches the finish box completely = 20 points

Total Points = 50 points (5 sections) + 30 points (ping-pong ball successfully carried back to Finish Box) + 20 points (mission completed) = 100 points
2. In the event of a tie, ranking is decided by the time recorded

Sample Score Calculation

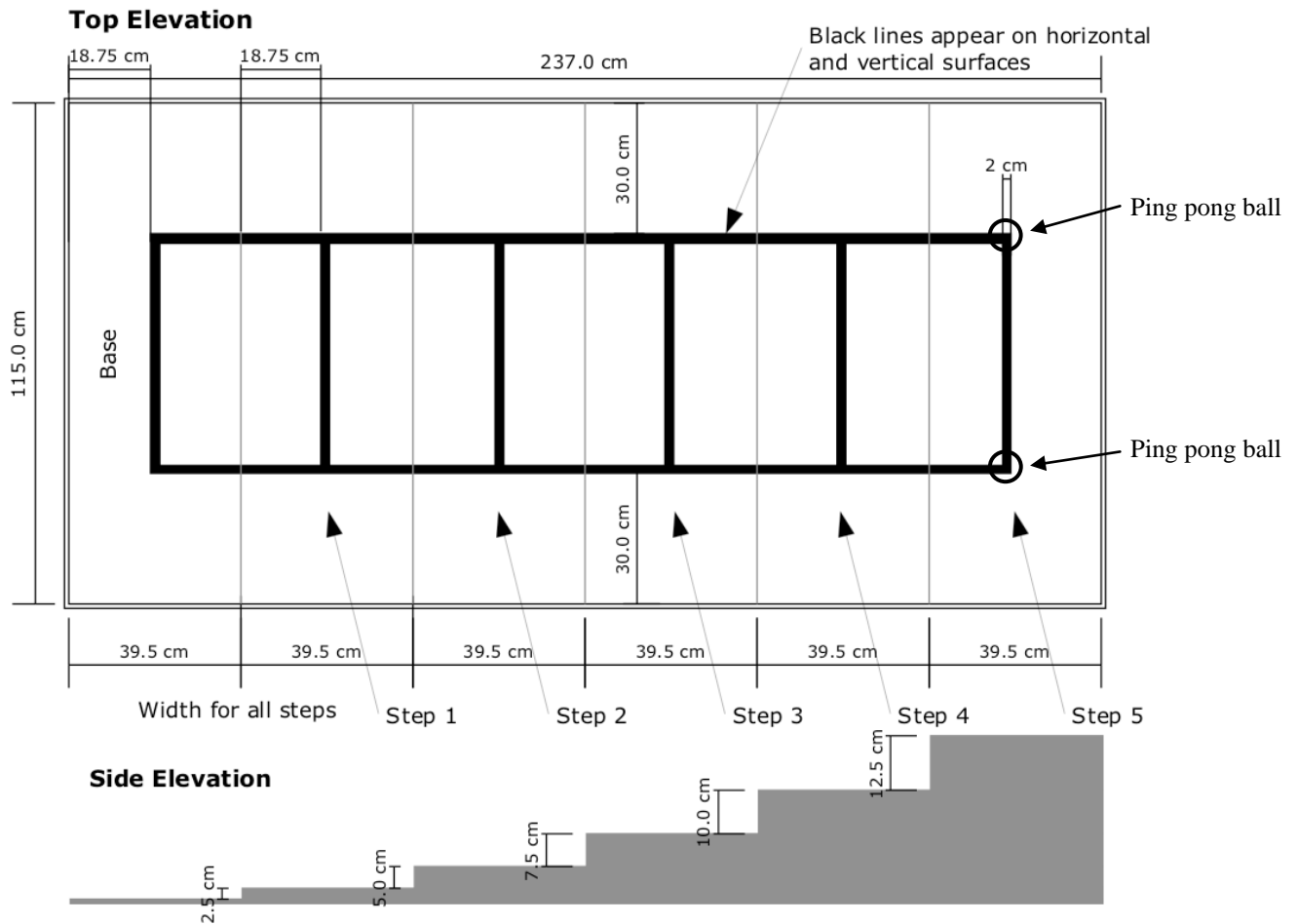
MISSION	COMPLETED					POINT	POINT	
Robot moves completely into the next section	0	1	2	3	4	5	10	50
Ball Carried back to finish box completely	0	1	2	3			10	20
Robot reaches the finish box completely	Yes			No			20	20
TIME TAKEN	M	S	MS	TOTAL POINT				90

STAIR CLIMBER (LOWER SECONDARY SCHOOL)

Design a robot that can ascend and descend uneven steps and transport a passenger safely to their destination, within a given time limit (2 minutes). The robot must move from Base, ascend and descend the steps while **carrying an egg (boiled with shell intact)**. Teams may determine at which step the robot will commence the return journey (as long as the robot has reached the first step). **There are 2 ping pong balls on the fifth step. Robots are required to knock the ping pong balls down in order to get the bonus points.**

Surprise rules may be announced before commencing the Quarantine Time of the competition.

Court



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Rules and Regulations

1. **Prior to undertaking the mission, a team member will randomly choose a hardboiled egg from a selection of eggs. (The variation of shape, mass, etc in eggs is a part of the competition. It is representative of the natural variation that exists in life. All eggs should have shell intact.**
2. The playing field consists of a Base area and five steps. At the start of the mission the robot will be placed in the Base area. The robot must not be touching or exceed any part of the first step.
3. When the mission is started, the robot must independently ascend and descend the stairs, carrying the receptacle containing **an egg**.
4. The robot may commence its descent at any time after successfully reaching a step or continue the ascent to higher steps. A robot will be considered to have reached a step when the robot is resting on the surface of that completely. Upon reaching the top step, the robot should begin the descent.
5. **The robot must knock down the ping pong balls in order to get the bonus points. Bonus points will not be awarded if the ping pong balls fall without physical contact with the robot.**
6. The mission is completed:
 - (a) Once the robot returns to the Base area, clear of any of the steps.
 - (b) When the maximum mission time (2 minutes) is achieved.
 - (c) When the robot is touched by a team member after the mission has begun.
7. Egg carrying receptacle specifications:

Teams may construct the egg carrying receptacle using LEGO parts according to their own design as long as it conforms to the following specifications:

- (a) **The egg must rest in the receptacle in a vertical position throughout the mission.**
- (b) The egg must rest freely inside the receptacle. It must not be fixed to the receptacle in any way.
- (c) The egg cannot be fully encased by the receptacle. The sides of the receptacle should be no higher than approximately half (1/2) the height of the egg.

- (d) Teams can choose how the robot carries the receptacle or how the receptacle is attached to the robot, but the robot must not encase the receptacle or the egg, thus preventing the egg from falling out.
- (e) **Coping with the variation in the size and weight of eggs is a part of the competition. Teams must design and construct an egg carrying receptacle that can cope with slight variations.**
- (f) **If the receptacle is to be attached to the robot, the method used to attach the receptacle should not provide the robot with advantage in terms of its operation and performance. In other words, the egg receptacle itself is only for the purpose of carrying the egg.**

Note: Teams should allow for the natural variation that will occur in the shape and size of the eggs.

Scoring

1. Points will be awarded on the basis of the robot's progression to each step while keeping the egg safe. As the stair height increases, points scored will increase as per the given formula. If the robot loses the egg, it will continue to score points, but at a different rate than with the egg (see scoring sheet). Teams may determine at which point (or step) their robot should turn and head back to base. However the robot must successfully climb at least one step before returning to Base.
2. Robots may ascend and descend on any part of the stairs. **They do not have to follow any particular line or path.**
3. If a robot "tumbles" or "falls", points will only be awarded up to the point when the judge considers the robot to have "lost control", exhibiting actions that are considered not to have been programmed.
4. Scoring will consider the following factors: the number and height of steps ascended and descended; whether the egg is carried or not, and the number of ping pong balls being knocked down.
5. In the event of a tie, the ranking is decided by the time recorded.

Sample Score Calculation

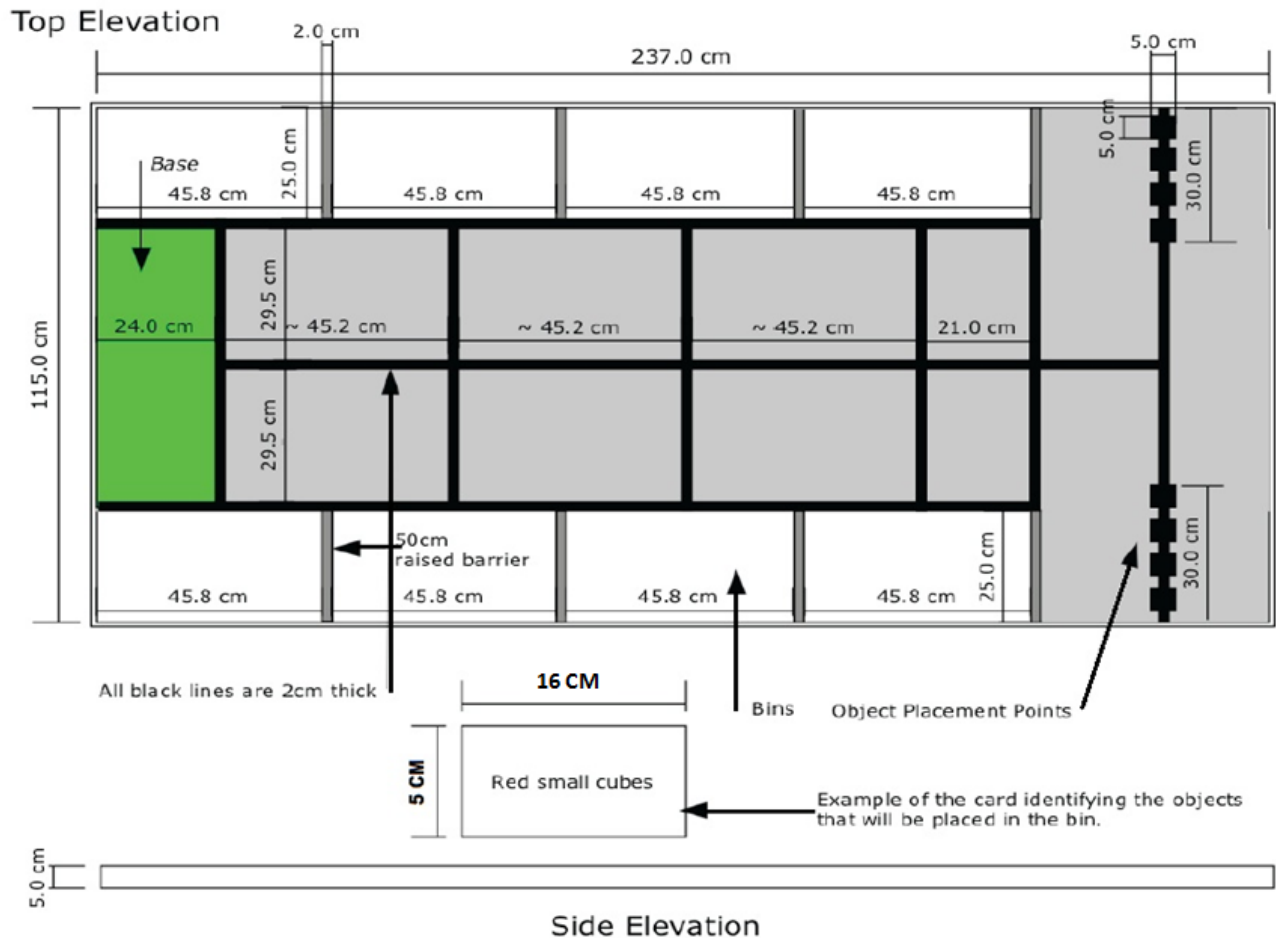
STEP	ASCENT			DESCENT	
1 (Height = 2.5cm)	No Egg (2.5)	Egg (7.5)		No Egg (2.5)	Egg (7.5)
2 (Height = 5cm)	No Egg (5)	Egg (15)		No Egg (5)	Egg (15)
3 (Height = 7.5cm)	No Egg (7.5)	Egg (22.5)		No Egg (7.5)	Egg (22.5)
4 (Height = 10cm)	No Egg (10)	Egg (30)		No Egg (10)	Egg (30)
5 (Height = 12.5cm)	No Egg (12.5)	Egg (37.5)		No Egg (12.5)	Egg (37.5)
BONUS POINTS					
Knocking Down Ping-pong Balls	0	1	2	12.5 each	25
TIME TAKEN	M	S	MS	TOTAL POINT	150

ROBOT RECYCLER (UPPER SECONDARY SCHOOL)

Design a robot that can sort and position objects into groups based on nominated common attributes within a given time period.

Surprise rules may be announced before commencing the Quarantine Time of the competition.

Court



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Rules and Regulations

1. All surfaces will be white, apart from the base (green) and the black lines.
2. Items to be sorted - eight items exhibiting six different attributes will be provided for the standard regular game (There will be two pairs of identical items). These items are to be placed in the squares on the playing field. One item will be placed in each square. Six items with six different attributes (Big Red, Big Blue, Big Green, Small Red, Small Blue and Small Green) will be provided during every quarantine time. 2 additional items will be announced and provided after each quarantine time. **These items can be sorted at a simple level into two categories and possibly six at a complex level.**
3. The distribution of the items on the playing field will be determined by the judges and announced after quarantine time. It will differ for each team and each round.
4. The teams must nominate the characteristics that will be used to determine the “sort” and into which sorting bin the particular items will be placed. Eleven sorting cards noting various characteristics that could be used to sort the items will be available for the teams to place on the base of the sorting bins.
5. The minimum level or refinement/sort is two (2) (e.g. based on the characteristic of size, the items can be sorted into two groups - big and small) **and the maximum level of refinement is six (6).** Teams cannot nominate to sort the items into one (1) group.
6. Teams will have to select appropriate cards that identify the “sort” that will be conducted by their robot. Eleven sorting cards are:
 - (a) Big Cubes
 - (b) Small Cubes
 - (c) Red Cubes
 - (d) Green Cubes
 - (e) Blue Cubes
 - (f) Big Red Cubes
 - (g) Big Green Cubes
 - (h) Big Blue Cubes
 - (i) Small Red Cubes
 - (j) Small Green Cubes
 - (k) Small Blue Cubes

7. If a team identifies that a bin will be used, but the robot places no items in it, it will not be considered in the calculation of the score, i.e. a team nominates 4 bins but the robot uses only 3, the number of nominated criteria will be considered as 3.
8. The teams must nominate the sorting cards first before the judges determine the items to be sorted.
9. The robot must move from the Base and sort items in the Bin into categories nominated by the team.
10. Points are awarded according to the complexity of the “sort” (i.e. the more refined the “sort”, the higher the points), accuracy (points will be deducted for items sorted into a bin that do not meet the nominated criteria) and the time taken. A scoring formula is provided to assist in the scoring.
11. The mission will be completed when:
 - (a) All items have been placed in the correct nominated "sorting bins".
 - (b) The maximum mission time (2 minutes) is reached.
 - (c) The robot is touched (after it has started) by a team member.
12. Item Specification
 - (a) All items will be made from a similar or the same substance (e.g. Plastic, LEGO® Bricks)
 - (b) Items will be either bright blue, bright red or dark green.
 - (c) All items will be cubes.
 - (d) Items will be either of two sizes, large or small (e.g. 50mm & 30mm).

Scoring

1. Four factors will be considered when calculating a team's score:
 - (a) The refinement/complexity of the sort
 - (b) The number of items sorted correctly
 - (c) The number of items sorted incorrectly
 - (d) Time

2. The score calculation is as follows: $\text{Score} = [c \times (n - m) / t] \times 100$
 - Where: 'c' is the sorting refinement level (or the number of bins used to sort the objects); 'n' is the number of objects placed in the correct (nominated) bin completely; 'm' is the number of objects placed in the wrong bin; 't' is the time (in seconds) taken by the robot to sort the objects. (Note: The mission ends when 't' = 120 seconds).
3. Note: Unsorted objects remaining on the playing field (i.e. not in a sorting bin) will be considered as objects incorrectly placed during the score calculation.
4. Using the formula, a team sorting eight (8) objects into six (6) groups correctly in 120 seconds would score 40 points. A team that sorts eight (8) objects into six (6) groups and gets two (2) incorrect in 100 seconds would score 24 points.
5. In the event of a tie, the **rankings will be determined by examining which team achieved the next highest score during previous rounds.**

Sample Score Calculation

MISSION		COMPLETED							
LEVEL OF REFINEMENT (C) min =2, max =6	0	1	2	3	4	5	6		
NUMBER OF OBJECT PLACED CORRECTLY	0	1	2	3	4	5	6	7	8
NUMBER OF OBJECT PLACED INCORRECTLY	0	1	2	3	4	5	6	7	8
TIME TAKEN	M	S	MS	TOTAL POINT				72	
		21	15						

OPEN CATEGORY

Theme: Robot for Life Improvement

The 2011 NRC Open Category theme asks participants to investigate, develop and present their innovative robotic solutions for ways robots can assist in improving our life.

Participants need to identify areas in which robotics may be used to improve our life. They should then develop a robotic solution that fulfils this criterion and present it, according to the Rules of the Open Category competition.

Rules and Regulations

1. A participant may only participate in Regular or Open Category. Not both.
2. The competition will be categorised into 3 different age groups:
 - (a) Primary School (7 - 12 years old)
 - (b) Lower Secondary School (13 - 15 years old)
 - (c) Upper Secondary School (16 - 19 years old)
3. There is no restriction on the use of non-LEGO® materials. However, the final project must be operated or controlled by the RCX Intelligent Brick or NXT Intelligent Brick.
4. Any programming languages are allowed to be used.
5. The robots may be pre-assembled and the software program may be pre-programmed.
6. The size of the whole project, including booth decorations, must not exceed **2 meters (L) x 2 meters (W)**
7. The team must decorate the booth with at least one poster, not less than 150 cm (H) X 100 cm (W), introducing the project together with a video clip.
8. Each team will undergo the following:
 - (a) Test and assemble the final robot at a designated location.
 - (b) Decorate the booth with posters or anything that is related to the theme.
 - (c) Demonstrate the project to the judges.
 - (d) Participate in a 'Question and Answer' (Q & A) session with the judges.
9. A report (hard copy & soft copy in CD/DVD), summarizing the whole project, must be submitted to the registration counter on registration day. The description must be supported by pictures showing different angles of the robotic creation and examples of the program. The CD/DVD must include a video (maximum of 2 minutes) demonstrating the robot.
10. **A video demonstrating the robot must be submitted to the organizing committee of the National Robotics Competition BEFORE 12th of September through Email . (nrc.sasbadi@gmail.com)**
11. In the 10-minute session with the judges, 5 minutes will be given to the team for demonstration and 5 minutes for a Q & A session with the judges.

Judging Criteria

1. Video Presentation (Yes/No)
 - (a) Provide judges with a good overview of the robot's purpose, design and operation.
2. Justification (10 points)
 - (a) Justification is provided, as to why the robot should be considered to be "improving life". This justification should be provided in written form in the report and/or orally in the verbal presentation.
3. Report (40 points)
 - (a) Submission of report electronically prior to competition in English, as directed. (Yes/No)
 - (b) Maximum of 1500 typed words in good English. (10 points)
 - (c) The report should outline the design process the team went through to develop their robotic solution. It should acknowledge the contribution of team members and coach. (10 points)
 - (d) As per the competition rules, the report should include a visual description of the robot. It should be illustrated with photographs, pictures and or diagrams as well as contain clear concepts and understandings. It should summarize what the robot can do, and in which way the robot is unique. (15 points)
 - (e) Quality and presentation of the report. (5 points)
4. Presentation (50 points)
 - (a) Oral presentation and demonstration of robot (20 points)
 - (b) Team spirit and energy (10 points)
 - (c) Overall appearance of the booth and team (10 points)
 - (d) Use of poster/s and their quality (10 points)
5. Robot's Technical Design (50 points)
 - (a) Good Engineering
 - (b) Stable Structure
6. Robot's Creative Design (50 points)
 - (a) Creative appearance
 - (b) Unique, complex, interactive behavior
7. Penalties
 - (a) NO RCX or NXT (Minus 100 points)
 - (b) No Poster (Maximum of 30 presentation points can be awarded)
 - (c) No Report (No report points awarded)
 - (d) No Video (Minus 30 points)
 - (e) Failure to be available or prepared for judging (Minus 50 points)
 - (f) Lack of adherence to rules regarding display area and use of booth space (after warnings have been issued and ignored) (Minus 100 points and possible disqualification)

Content Sample of the Project Documentation

1. Acknowledgement.
2. Project Mission, Vision & Objective
3. Particulars of team members and mentor
4. Introduction about the project in detail
5. Synopsis of the project
 - (a) Background
 - (b) Robot functionality
 - (c) Uniqueness and interactive behaviour
6. Designing and Building Process
 - (a) Concept and Implementation
 - (b) Brainstorming and solution to the problem
 - (c) Engineering and stability of the structures
 - (d) Pictures of the project (at each stage)
 - (e) Final model and pictures depicting different angles
 - (f) Related charts
7. Programming
 - (a) Concept
 - (b) Brainstorming and solution to problem
 - (c) Printed programming with explanations
8. Appendices
 - (a) Interviews (if any)
 - (b) Gantt chart
 - (c) Softcopy of the whole project must be burned in CD (e.g. report, programming, slide show, video clip and etc.)