THE CRC ROBOTICS COMPETITION

RULEBOOK

OUTLINING THE FULL RULES FOR:

VERTI GOAL 2019

BY ROBOTIQUE CRC ROBOTICS

AN ORGANIZATION AFFILIATED WITH

AEST EAST

ALLIANCE POUR L'ENSEIGNEMENT DE LA SCIENCE ET DE LA TECHNOLOGIE
EDUCATIONAL ALLIANCE FOR SCIENCE AND TECHNOLOGY

Foreword

i. Welcome to the CRC Robotics Competition

On behalf of the Educational Alliance for Science and Technology (EAST) and CRC Robotics, welcome and congratulations to all the participants on joining your school's robotics team and embarking on the CRC Robotics Competition journey! Take it from the current leaders of CRC Robotics, who were all former student participants in the CRC Robotics Competition: you will remember this unparalleled experience for many years to come.

We wish to welcome and thank the many teachers, parents, and mentors for embarking on this journey and for all the hard work you will put in to enrich your students' lives throughout this activity. A big thank-you to all the volunteers involved in CRC Robotics, whose dedication has allowed us to hold Vertigoal 2019, our 18th annual competition.

In addition, we wish to acknowledge all our partners, without whom CRC Robotics could not exist.

The 2018-2019 CRC Robotics season will have a lot to offer: a new brand identity for our organization, a revamped website, and a completely re-organized rulebook for the Competition! We recommend that you read the rulebook thoroughly; although the unique CRC Robotics Competition experience will remain the same, some modifications were made to the rules.

It is also the first time since 2009 that the Competition is held on the South Shore of Montreal. We wish to thank the Principal of Centennial Regional High School, Sherry Tite, and her team for their warm welcome as the host school and for the time and energy they've put towards the success of this event.

Good luck to all and we will see you at Vertigoal 2019 from February 21st to 23rd, 2019 at Centennial Regional High School in Greenfield Park.

Jean-Philippe Gélinas
Coordinator
jp@sciencetech.ca

Simon Marcoux
Coordinator
simon@sciencetech.ca

David Martin
Coordinator
david.martin@sciencetech.ca

Natasha Vitale
Coordinator
natasha.vitale@sciencetech.ca

Jeremy Webb
Coordinator
jeremy.webb@sciencetech.ca

ii. About CRC Robotics

CRC Robotics was founded in 2001 by a group of young professionals and teachers, fueled by their passion for robotics and education. Unsatisfied with the robotics competitions available for high schools and CEGEPs in Canada, they created an annual competition linking science, technology, engineering, and mathematics (STEM) with computers, arts, and languages.

We've since grown into a non-profit organization run by former participants willing to give other students the chance to participate in the CRC Robotics adventure that has been so much fun for them. The Competition now welcomes teams from coast to coast in a 3-day, action-packed event held annually, in February.

We believe in providing exciting learning opportunities to students with various interests and goals. Under the umbrella of the Educational Alliance for Science and Technology (EAST), we hold events allowing tomorrow's leaders to find their passion and develop key skills that will serve as assets in an ever-changing, global world.

In essence, the CRC Robotics Competition is:

- A coherent body of several competitions, integrating different disciplines and unique challenges, including languages, computers, mathematics, science, art, and much more;
- An experience that develops the qualities of a leader and teaches students about organization and teamwork, since everything is directed and performed by the students;
- An event that involves students from high schools, CEGEPs, and professional vocational centres from all over Canada;
- A challenge that allows students to apply the theoretical knowledge gained in the classroom to a practical application in order to familiarize the students with technology outside of the classroom;
- A chance to take part in an extra-curricular activity and work with students and mentors from different backgrounds and domains (engineers, technicians, university professors, etc.).

The CRC Robotics Competition has seen an increasing number of female student participants over the years, who have also continued their studies in STEM fields! To further expand the participation of girls in STEM, CRC Robotics also organizes an annual networking event for high school and CEGEP girls and non-binary students, entitled *Aim Together*, with the goal of inspiring girls to consider a career in STEM. Our mission is to brand STEM fields, which are thought of primarily as masculine environments, as welcoming to women, in the hopes that girls will consider STEM as a viable career path. For more information on this event, happening in November, or for questions on how to register, please contact the organizers at conference@sciencetech.ca.

iii. Roles within the CRC Robotics Competition

In the CRC Robotics Competition, there are three different roles: students, teachers, and mentors. We have laid out the following responsibilities for each:

1. **Students are to do all the planning and building**. They should be creating the strategies, designing the critical paths, and controlling all aspects of the team. Any work done on any aspect of the Competition must be done entirely by the students.

2. **Teachers are available to provide the support that students may need, only if they need it.** They should not be directing the students, but instead, acting as an advisor. If a student has a question, the teacher may point the student toward the answer or show the student how to find the solution. If a student is unsure of how to accomplish a specific task, the teacher may demonstrate, but any pieces attached to the robot are to be touched only by the students. However, we do realize that there may be times when an educator must step in for academic reasons. We believe that every teacher is a competent professional that can differentiate between teaching and doing.

3. **Mentors are external professionals who may be consulted throughout the course of this activity.** Their job is to help with questions which exceed both the students' and teachers' knowledge. An engineer would have more practical experience; however, the engineer may not direct the students as he/she is acting only as an advisor.

We value the participation of your school, but always keep in mind that this is the students' project. Let them show you what they are made of and let them develop their own skills! Their own work is what truly matters and that is what makes the CRC Robotics Competition so unique and relevant.

iv. Participating Schools

Once again, teams from coast to coast have decided to take on this year's CRC Robotics challenge:

2019 Team Number	School Name	Division	Rookie
1	Dawson College	2	
2	West Island College	2	
3	John Abbott College	1	
4	Centennial Regional High School	1	
5	Collège Sainte-Marcelline	1	
6	Collège André-Grasset	1	✓
7	Marianopolis College	1	
8	École secondaire Jules-Verne	2	
9	Collège de Bois-de-Boulogne, Team #1	1	
10	Collège de Bois-de-Boulogne, Team #2	1	
11	Bishop's College School	1	
12	Cégep du Vieux-Montréal	2	
13	Lower Canada College	2	✓
14	Royal West Academy	2	
15	Selwyn House School	2	✓
16	Lake of Two Mountains High School	1	
17	Macdonald High School	1	
18	St. George’s School of Montreal	1	
19	École secondaire Curé-Antoine-Labelle	2	
20	Cégep Vanier College	1	
21	Collège Montmorency	2	
22	Collège Citoyen	1	
23	École secondaire Chomedey-de-Maisonneuve	2	
24	Rosemount Technology Centre	2	
25	Saint-Lambert International High School	2	✓
26	École secondaire Henri-Bourassa	2	✓

v. Our Partners

One of the most important aspects of the CRC Robotics Competition is that it keeps registration fees for schools at a bare minimum to ensure an easy and equal access for schools from all socio-economic situations. This would not be possible without the help of our generous sponsors that, year after year, help us prepare this wonderful event for the students.

We are always seeking to establish new partnerships to achieve our goal of positively improving as many student lives as possible. If you or someone you know is willing to help us in any way, please contact Jeremy Webb at jeremy.webb@sciencetech.ca. On behalf of the students, a heartfelt thank-you!

vi. Season Calendar

Item	Date & Location	Description
Information Sessions	Year-Round	The CRC Robotics Organizing Committee is always available to meet you and present a detailed explanation of what the Competition is all about and what it entails for students, teachers, and their school. Interested parties may contact us via info.crc@sciencetech.ca.
Registration Period	August 1, 2018 to October 12, 2018	Registration is opened to all high schools, CEGEPs, and professional vocational centres in Canada. Late registrations may be possible. Please contact info.crc@sciencetech.ca for more information.
Training Day	October 2018	The Training Day is a hands-on tutorial and training day for teachers and mentors who wish to familiarize themselves with the technology involved in the CRC Robotics Competition as well as with the Competition structure and dynamics. The Training Day is organized according to the demand. Interested parties may contact us via info.crc@sciencetech.ca.
Preliminary Rulebook Release	October 29, 2018	A partial version of the rulebook is made available to participants on www.robo-crc.ca one week prior to Kickoff. This way, participants can familiarize themselves with this year's game and prepare questions to be asked at Kickoff.
Kickoff	November 5, 2018 at 7pm *Doors open at 6:30pm* Centennial Regional High School 880 Hudson St. Greenfield Park, QC J4V 1H1	The kickoff officially marks the beginning of the season for the participants. The complete rulebook and the playing field are revealed and the participant kit (which includes the legal power motors and batteries) are distributed to the teams. For logistical reasons, a maximum of 10 individuals may attend.

CRC Workshops	November 2018 December 2018 January 2019	The CRC Workshops are events intended to provide specific training to participants in their field of interest. Multiple topics are covered simultaneously in multiple rooms on the same evening. All subjects covered, and details related to the workshop will be made available at www.robo-crc.ca/participant-portal.
Aim Together Event	November 25, 2018 Concordia University 1515 Saint-Catherine St. W., EV2.260 Montreal, QC H3G 2W1	A free event where many successful women from diverse cultural backgrounds and different STEM fields are present to speak to the girls and young women about their unique career path. No need to be a participant in the CRC Robotics Competition to attend. Invite all your friends! Interested parties may obtain information and register on www.robo-crc.ca/aim-together.
Website, Video, and Tutorial Submission, and Programming Component Opt-In Deadline	February 4, 2019 at 11:59:59pm Using the Participant Portal: www.robo-crc.ca/participant-portal	Having the website up and running and uploading the video to YouTube might take several hours. We therefore recommend you not to wait until the very last minute before starting the upload and going through the submission procedure. If you encounter any problems, send a detailed explanation to natasha.vitale@sciencetech.ca **before** the submission date and time.
Deadline to make Website, Video, and Tutorial Public	February 21, 2019 at 7:59:59am	Teams must make their website, video, and tutorial available to the general public and the other teams. For more information, refer to the specific sections outlining the details of these components.
18th Annual CRC Robotics Competition **VERTIGOAL 2019**	February 21 to 23, 2019 Centennial Regional High School 880 Hudson St. Greenfield Park, QC J4V 1H1	Join us in the pinnacle of the 2018-2019 CRC Robotics season. After over three months of hard work and countless hours of design and construction, close to 30 teams will show off what their robot can do. Also, the students will be showcasing their school and accomplishments in their kiosk, on their website, and in their video. An exciting, action-packed, 3-day event not to be missed!

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1. The Competition

The Competition is a three-day event that takes place annually, in the month of February, at one of the participating schools. The final Competition rules are made public at Kickoff, approximately 3 and a half months before the Competition.

1.1 Components

The Competition is divided into seven (7) distinct components, which allows students to demonstrate their strengths in different ways and across various disciplines. While not mandatory, teams may choose a theme that would be applicable to all components of the Competition.

1.1.01 Game

This year's game is named Vertigoal 2019. The teams must participate in a tournament with their own radio-commanded robot and must ensure that they follow this game's specific rules and regulations. More information on the game can be found in Section 2 of this rulebook.

1.1.02 Robot

The design and construction of the robot primarily involve the application of engineering, science, technology, and mathematics to ensure that the robot can participate in the year's game. Since the game changes from year to year, the students cannot reuse the exact same robot from previous years; however, certain parts and mechanisms may be reused. More information on the robot can be found in Section 3 of this rulebook.

1.1.03 Kiosk

The kiosk acts as an information booth, which presents the team's hard work to judges, fellow participants, and visitors to the Competition and also acts as a workshop for the team's robot between the heats. The kiosk often represents the team's theme for the year's Competition and essentially involves the application of art and communication. More information on the kiosk can be found in Section 4 of this rulebook.

1.1.04 Programming

The programming component is designed to recognize the skills required to program a fully autonomous robot. The robot itself is provided by CRC Robotics; however, the students are responsible for developing a code that will allow the given robot to accomplish a set of tasks consecutively. More information on the programming competition can be found in Section 5 of this rulebook.

1.1.05 Video

A fully bilingual video must be submitted and be publicly available prior to the Competition and must present the participating school's history as well as a description of the year's game. It must also, among others, demonstrate and elaborate on the construction of the robot, the challenges encountered during the build process, and the solutions implemented by the students. This aspect involves the application of technology, computers, and languages. More information on the video can be found in Section 6 of this rulebook.

1.1.06 Website

A fully bilingual website must be created and publicly published prior to the Competition, with the goal of demonstrating the hard work of the team to the public. The website must include, but is not limited to: the school's history, a list of participating students, a description of the year's game, and the design and construction of the robot. This aspect involves the application of technology, computers, and languages. More information on the website can be found in Section 7 of this rulebook.

1.1.07 Tutorial

The tutorial component allows teams to demonstrate their mechanical, electrical, programming, video, and coding talents, among others, by providing a step-by-step explanation to achieve any particular task. The tutorial must be accessible on the team's website and can hold various media formats. More information on the tutorial can be found in Section 8 of this rulebook.

1.2 Divisions

With a goal of making the Competition as fair as possible to teams with less experience, the CRC Robotics Organizing Committee has introduced a two-division system for certain elements of the Competition.

1.2.01 Teams are divided among Division 1 and Division 2 for the following components:
   a. Robot design,
   b. Robot construction,
   c. Kiosk,
   d. Video,
   e. Website content, and
   f. Website design.

1.2.02 This year’s division is based on the overall result obtained by the team in last year's Competition. The team’s Division is the same for all previously mentioned components.

1.2.03 The top half of the overall ranking will be assigned to Division 1. If there is an odd number of teams, the median team will be in Division 2.

1.2.04 The divisions are re-assigned every year.

1.2.05 New high school teams are automatically placed in Division 2, while new CEGEP teams and vocational centres are automatically placed in Division 1.

1.2.06 A team in Division 2 can win the overall ranking award.

1.2.07 The best Division 1 and Division 2 teams will receive separate awards for the components based on the ranking for each component.

1.2.08 Teams will know their division on the night of the Competition Kickoff. However, if a team registers afterwards, these assignments can be modified. If it is the case, teams will be advised.

1.3 Awards and Recognitions

Awards and recognitions are presented to the most performing team(s) in each component. If the divisions system is used for the ranking of a particular component, then awards are presented to the most performing team(s) in each division for the component. Refer to Section 1.2 for details on components for which teams will be ranked within their division only. In the event of a tie, both teams receive an award and/or recognition. In this section, an "award" is a prize that is presented for a component whose score counts towards the overall ranking and a "recognition" is a prize that is presented for a component whose score does not count towards the overall ranking.

1.3.01 Game

The Game award is presented to each team that was a finalist in this year's game. Finalists are the teams that participated in the final round of the game.

1.3.02 Robot Design

The Robot Design award is presented to the three teams that received the greatest scores from our engineering judges and that were deemed to have best designed their robot for the purpose of this year's game.

1.3.03 Robot Construction

The Robot Construction award is presented to the three teams that received the greatest scores from our engineering judges and that were deemed to have best constructed their robot for the purpose of this year's game.

1.3.04 Kiosk

The Kiosk award is presented to the three teams that received the greatest scores from our pedagogical judges and that were deemed to have the best designed, best constructed, and best maintained kiosk.

1.3.05 Programming

The Programming award is presented to the three teams that achieved the highest scores in the programming component of the Competition and that were deemed to have the best executed code to accomplish the tasks at hand.

1.3.06 Video

The Video award is presented to the three teams that received the greatest scores from our professional/expert judges and that were deemed to have the best executed video.

1.3.07 Website Design

The Website Design award is presented to the three teams that received the greatest scores from our professional/expert judges and that were deemed to have the best website from a technical standpoint.

1.3.08 Website Content

The Website Content award is presented to the three teams that received the greatest scores from our professional/expert judges and that were deemed to have the best written content on their website.

1.3.09 Tutorial

The Tutorial recognition is presented to the team that was deemed to have the best explanation of the task selected. This winner is selected by the CRC Robotics Organizing Committee.

1.3.10 Never Say Die

The Never Say Die recognition is presented to the team that encountered many obstacles throughout the course of the Competition and that persevered to finally overcome those hurdles in spite of everything. This winner is selected by the CRC Robotics Organizing Committee and also receives a trophy that symbolizes all their hard work and perseverance.

1.3.11 Sportsmanship

The Sportsmanship recognition is presented to the three teams that are respectful towards their peers and exhibit behavior based on values of respect and integrity that go beyond the Competition's rules and etiquette. The winning teams are selected by their peers and the team in first place also receives a trophy that symbolizes their sportsmanlike conduct: The Founders' Trophy.

1.4 Overall Ranking

1.4.01 Scoring Logic

1. For each component of the Competition, the number of points equal to the total number of teams is given to a first-place ranking. The score given to other ranks can be calculated using the following formula:

$$Score = Total\ Number\ of\ Teams - Rank + 1$$

2. Kiosk, programming, robot design, robot construction, website design, website content, and video components follow the formula mentioned above.
3. The game component counts for double the value of the formula mentioned above.
4. In the case of a tie, the teams receive the same score for that category.
5. The total number of points for all components determines the overall ranking.

1.4.02 Overall Ranking Award

The Overall Ranking award is presented to the three teams that received the greatest score after combining the points in each component. They are deemed to be the best performing teams in the Competition as a whole. The team in first place also receives a trophy that symbolizes their success.

2. The Game

The game component requires robots to score the most amount of points while working in teams. It is the main component of the CRC Robotics Competition, giving each school an equal opportunity to demonstrate their robot design, robot construction, and strategic playing skills. Refer to the Survival Guide for tips and suggestions.

2.1 Teams

2.1.01 Two teams, blue and yellow, composed of two robots each, are playing against each other during each heat.

2.1.02 Robots will change partners from heat to heat.

2.2 Playing Field

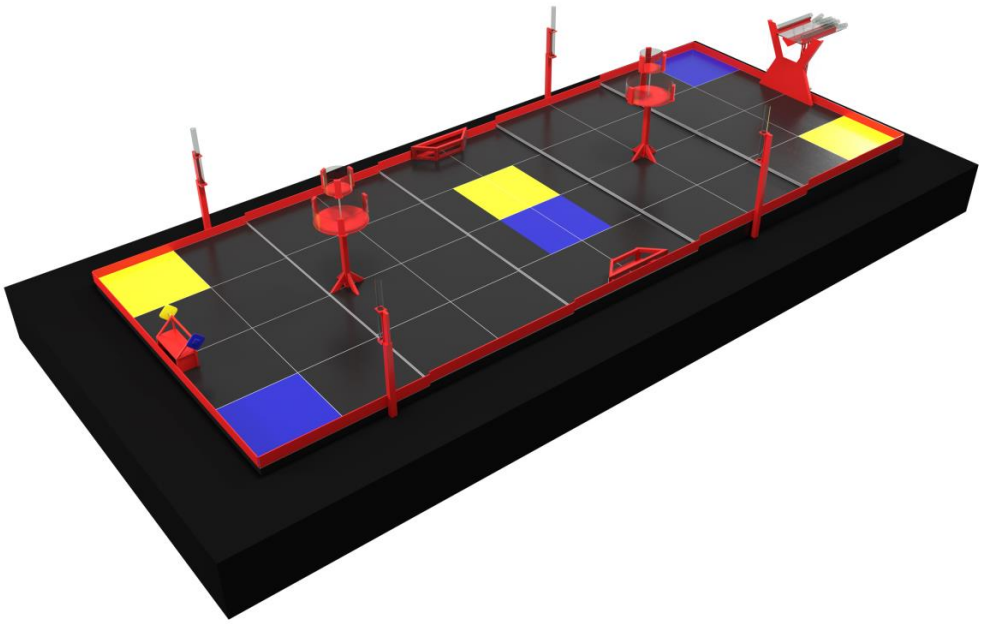
2.2.01 This year, the playing field resembles a staircase. It is made up of five sections of the same size, but they are not positioned on the same horizontal level. Level 1 is the lowest level and Level 5 is the highest.

2.2.02 Available starting zones are located on Level 1, Level 3, and Level 5.

2.2.03 Game piece dispensers are located on Level 1, Level 4, and Level 5.

2.2.04 Targets are located on Level 2, Level 3, and Level 4.

2.2.05 The image below shows a view (not to scale) of the playing field. Unless otherwise communicated by the CRC Robotics Organizing Committee in the event of a modification, measurements of the playing field recorded at Kickoff will be considered accurate.



2.3 Game Pieces

2.3.01 This year's game pieces (GPs) are coloured tennis balls.

2.3.02 There is a total of 142 GPs that can be put into play: 70 blue, 70 yellow, and 2 red.

2.3.03 There is no limit to the number of GPs a robot can hold at any time during the game.

2.3.04 At the beginning of the heat, GPs are held in 5 dispensers across the playing field: 2 team-specific dispensers and one dispenser common to both teams. Each team-specific dispenser contains 15 GPs of the team's colour and the common dispenser contains 20 GPs of each colour and 2 red GPs.

2.4 Putting Game Pieces into Play

2.4.01 Each robot can be preloaded with a maximum of 10 GPs. If a robot is preloaded with less than 10 GPs, the remaining GPs are placed on the floor in the robot's starting zone.

2.4.02 When the game starts, robots may move across the field to remove the GPs from their dispensers and use them to score points.

2.4.03 To release GPs from the tube-shaped dispensers, robots must activate the corresponding mechanism located on Level 1.

2.4.04 To release GPs from the tilting dispenser, the rope must be pulled by either team.

2.4.05 A GP is considered removed from the dispenser when it is no longer in contact with the dispenser.

2.4.06 A GP on the field floor can be picked up by any team, regardless of which dispenser or robot it previously came from. For example, if a robot of the blue team removes a GP from a blue dispenser and that GP falls on the field floor, then that GP can be picked up by any robot from the yellow or blue team.

2.4.07 If a team picks up a GP of another team and the GP is processed by any mechanism to sort GPs, the opponent's coloured GP may not be stored in the robot to prevent the other team from using it.

2.4.08 GPs that leave the field will no longer be in play. It is not permitted to intentionally remove GPs from the playing field.

2.5 Scoring Points

2.5.01 A team scores points by placing GPs in the targets located on the playing field.

2.5.02 There are 3 target types in which teams can place GPs. The table below shows the location of the targets as well as the number of points awarded per GP found in that type of target.

Target Name	Points/GP	Location
Top Bucket	40	Level 2 and Level 4
Bottom Bucket	20	Level 2 and Level 4
Trapezoidal Prism	10	2 on Level 3

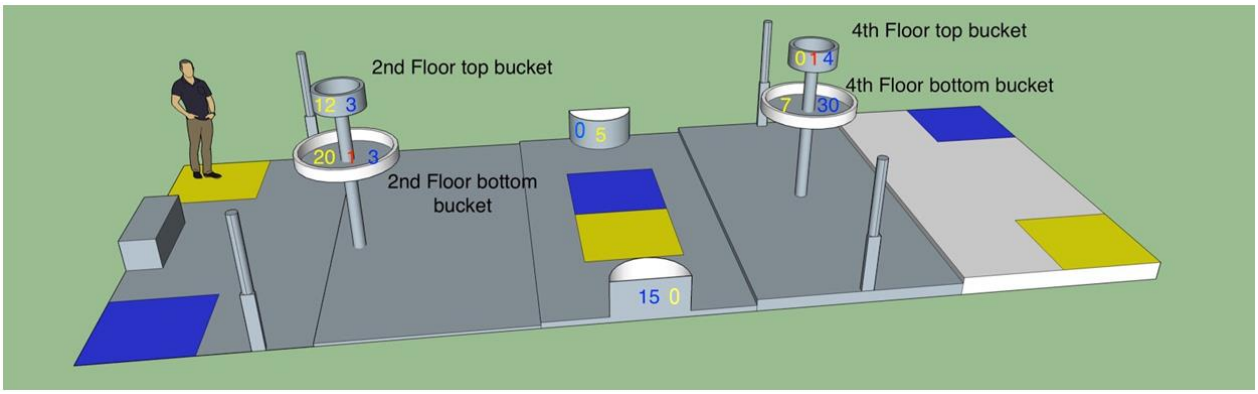
2.5.03 Yellow GPs found in targets award points to the Yellow team and blue GPs found in targets award points to the Blue team, regardless of which team placed the GP in the target.

2.5.04 Red GPs are worth 0 points, but act as a multiplier. If at least 1 red GP is located in a target at the end of the heat, then the value of all GPs inside that target is doubled. If both red GPs are located in the same target at the end of the heat, then the value of all GPs inside that target is still doubled.

2.5.05 No points are awarded for removing GPs from the dispensers.

2.5.06 No points are assigned to the GPs located in the dispensers, on the robots, or on the playing field at the end of the heat.

2.5.07 The following is a scoring example. It constitutes an integral part of the rules and acts as a reference for scoring disputes. Please note that this image does not represent the real playing field to scale, the various elements of the field, or the positioning of the starting zones. This image is simply to help understand the scoring system. The numbers represent the number of GPs of each color located in each target at the end of a heat.



	Number of GPs in each target at the end of the heat					
	2nd level		3rd level		4th level	
	Bottom Bucket	Top Bucket	Trapezoidal prism #1	Trapezoidal prism #2	Bottom Bucket	Top Bucket
Blue GPs	3	3	0	15	30	4
Yellow GPs	20	12	5	0	7	0
Red GPs	1	0	0	0	0	1

Blue team's score				
Target	Number of GPs	Value of a GP	Multiplier	Score
2nd level, bottom bucket	3	20	Yes	120
2nd level, top bucket	3	40	No	120
3rd level, trapezoidal prisms	15	10	No	150
4th level, bottom bucket	30	20	No	600
4th level, top bucket	4	40	Yes	320
			Total	**1310**

Yellow team's score				
Target	Number of GPs	Value of a GP	Multiplier	Score
2nd level, bottom bucket	20	20	Yes	800
2nd level, top bucket	12	40	No	480
3rd level, trapezoidal prisms	5	10	No	50
4th level, bottom bucket	7	20	No	140
4th level, top bucket	0	40	Yes	0
			Total	**1470**

2.5.08 In order to share points with its teammate, a robot must contribute to the score by putting at least one GP in a target. The robot will then be defined as a sharing robot and will share the team's points.

2.5.09 The final score for each team is assessed at the end of the heat, although an estimated score might appear on the display as the heat is in progress.

2.6 Arbitration and Penalties

2.6.01 Our referees are experts in calling and assessing penalties and always have the final word on the playing field.

2.6.02 The referees on the playing field have full authority to judge all aspects of the game. In particular, the referees will:

- Prevent robots from negatively blocking other robots;
- Prevent robots from damaging the playing field and GPs;
- Prevent robots from violating the air space on the edges of the field;
- Try their best to make sure the numbers displayed on the screens are accurate and updated as soon as possible; however, their ruling overrides whatever is displayed on the screens.

2.6.03 Any robot that is deemed dangerous by any of the referees runs the risk of being disqualified.

2.6.04 Various items may be placed, intentionally or not, on or around the playing field by a robot, on the condition that they are removed from the playing field by the robot before the end of the heat. If items are no longer in contact with the robot by the end of the heat, the robot that released these items will be liable to an individual junk penalty of 4% of its total score for the heat for each item left on or around the playing field.

2.6.05 If liquid seeps from a robot onto the playing field, the robot's total score for the heat will be reduced to 0.

2.6.06 While we trust that all participants will provide clear intentions, certain conducts may occur that require sanctions, especially during the heat of battle. To avoid such penalties, remain courteous. These penalties are considered as Unsportsmanlike Conduct and have a series of escalating consequences, depending on the severity of the issue. The number of points deducted from the robot's total score for that heat will be at the discretion of the head referee and will be proportional to the severity of the action. Some examples of the types of behaviour that signal a lapse of sportsmanlike behavior are:

- A deliberate attempt to disable or damage another robot;
- A deliberate attempt to hit another robot;
- Inappropriate behaviour directed at an official, another participant, or a spectator.

2.6.07 The minimum score that can be awarded for any given heat is 0 points; therefore, if a penalty brings a robot's total score to below 0, the final score awarded to the robot for the heat will be 0.

2.6.08 A robot can only release GPs from the dispensers corresponding to their team colour or from the common dispenser. For example, a robot from the yellow team cannot release GPs from a dispenser corresponding to the blue team. In case this happens, the yellow robot that released the GPs will obtain a 20% penalty applied to its total score for that heat.

2.6.09 If a team judges that its robot needs assistance on the playing field during a heat, its pilot may ask the referee to assist their robot. A penalty of 100 points will affect only the robot that was assisted by the referee. The referees reserve the right not to assist the robot even if asked to do so by the pilot.

2.6.10 GPs that are intentionally thrown out of the playing field by a robot will result in a penalty of 40 points for the robot and its teammate.

2.7 Heat Progress

2.7.01 Blue robots start the heat in two of the three blue starting zones on the playing field, while yellow robots start the heat in two of the three yellow starting zones on the playing field.

2.7.02 All heats are 5 minutes in duration. When the heat time is over, all parts of all robots must stop moving. GPs will be considered only when they stop moving, even if that occurs after the heat time is over. All the points generated by a team due to the motion of their robots after the heat ends will be canceled.

2.7.03 Team members may not interfere with any items on the field during the heat, including contact with the robots or the GPs.

2.7.04 Robots may not damage the GPs or the setup on the playing field.

2.7.05 All robots must be labelled with the school's name (either full or shortened) and number as well as its corresponding team colour for the heat. These three elements must be clearly visible to the crowd and referees. If these elements are

not all visible, the robot will not be allowed to participate in the heat. Adding the robot's name (if any) is optional.

2.7.06 If a robot is not able to fully exit its starting zone during the heat for whatever reason and is not actively trying to score points from its starting zone, or if it is simply absent, it will be considered as an inactive robot. A robot teaming up with an inactive robot will see its score multiplied by 1.5 to compensate for the disadvantage of playing alone. Inactive robots will be removed from the playing field after 30 seconds of inactivity to prevent them from blocking play.

2.7.07 In the event that a robot puts at least one GP in a target without ever leaving the starting zone during the heat, this robot will not be considered an inactive robot and will share the team's points.

2.7.08 If a robot makes it out of its starting zone and stops moving for whatever reason, it will be considered a broken robot. If the robot breaks before it meets the sharing requirements, then it will not share the team's score, but the other robot's score (from the same team) will not be multiplied by 1.5, because, initially, the broken robot was an active robot. Broken robots will be removed from the playing field after 30 seconds of inactivity to prevent them from blocking play.

2.7.09 Following the buzzer signaling the end of play, team members are not allowed to enter the field, to touch any robot, or to touch the GPs before they are cleared to do so by the head referee. It is essential that the configuration of the GPs, at the end of the heat, remain intact for scoring purposes. The head referee will indicate when the team members are allowed to enter the playing field.

2.8 Pilot and Co-Pilot

2.8.01 Each team's pilot, co-pilot (spotter), and robot participating in the next heat must be in the "On Deck Area" when the buzzer sounds to end the previous heat. If not, a penalty is assessed to the offending robot. It is the team's responsibility to make sure the team is on time, even if the schedule is delayed.

2.8.02 If a robot, pilot, or co-pilot of a team is not ready to start, the heat will start without the team in question.

2.8.03 The pilot and co-pilot must remain seated during the entire game in their designated seats provided by CRC Robotics, which are placed within the designated areas surrounding the playing field.

2.8.04 Each person is responsible for taking all necessary precautions to ensure its own safety.

2.9 Tournament Progress

2.9.01 The tournament consists of 5 stages:

a. **Preliminary round:** These heats are played on Thursday night and throughout the day on Friday by all teams. After all the preliminary heats have been completed, each robot will cast out their two lowest-scoring heats. Heats affected by an unsportsmanlike penalty cannot be cast out. The total of all other heats will be summed to determine each robot's final rank for the preliminary round. Depending on a team's rank, teams can advance directly to semi-finals or quarter-finals, or they will play in the knock-out rounds.

b. **Knock-out rounds:** These heats are played on Saturday morning by teams that did not directly advance to quarter-finals or semi-finals. These rounds provide teams with an opportunity to advance further in the tournament.

c. **Quarter-finals:** Top teams from the preliminary and knock-out rounds advance to this stage of the tournament.

d. **Semi-finals:** Top teams from the preliminary rounds and quarter-finals advance to this stage of the tournament.

e. **Finals:** Top teams from the semi-finals advance to this stage of the tournament.

2.9.02 The schedule for the various rounds will be published at the beginning of the Competition.

3. Robot

This section outlines the robot design and construction constraints on which robots will be evaluated at the Competition. Non-compliance with the following rules will cause to fail certification. Uncertified robots are not allowed to compete. Refer to the Survival Guide for tips and suggestions. The evaluation rubrics used by the judges to evaluate the robot design and robot construction may be found in Appendix A and Appendix B of this rulebook, respectively. The Robot Certification form may be found in Appendix C of this rulebook.

3.1 Transmission and Controls

3.1.01 Authorized Microcontroller

The microcontroller acts as the robot brain. All robot control signals must originate from a VEX ARM Cortex-based Microcontroller (VEX EDR Part Number: 276-2194), referred to as "the microcontroller" in the rest of this document.

3.1.02 Remote Control

The robot may only be controlled by a single VEXnet Joystick Remote Control (VEX EDR Part Number: 276-2192) using a VEXnet Key 2.0 (VEX EDR Part Number: 276-3245). VEXnet Key 1.0 is also permitted. The remote control must send all commands to the microcontroller. However, the robot may perform autonomous actions.

3.1.03 Other Transmitters

It is forbidden to use any transmission methods disrupting other robots in any way.

3.1.04 Other Control Systems

Other onboard control systems are allowed if they are controlled by the microcontroller. Therefore, using sensors and/or other microprocessors is permitted as all control instructions go through the microcontroller.

3.1.05 Onboard Cameras

Cameras may be attached to robots, but live transmission of the images is prohibited during the heats.

3.2 Low-Voltage Control Circuit and Motorization

The low-voltage circuitry refers to the microcontroller power source and all sensors, motors, and servo-motors powered through a 5V microcontroller port and the microcontroller power source.

3.2.01 Low-Voltage Sensors

Usage of any onboard sensors to give feedback to the microcontroller is allowed.

3.2.02 Low-Voltage Motors

Only VEX EDR motors (3-wires, 2-wires 393, or 2-wires 269) are allowed. There is no low-voltage motor count limit.

3.2.03 Low-Voltage Servo-Motors

All 5V hobby-type servo-motors are allowed as long as they can only perform a partial rotation. There is no low-voltage servo-motor count limit.

3.2.04 Power Expander

Usage of a single VEX Power Expander (VEX EDR Part Number: 276-2271) is permitted.

3.2.05 Microcontroller Power Source

Any sub 12V battery may be used to power the microcontroller. This battery can only power the microcontroller and a power expander (if used). Refer to the Microcontroller and Power Expander Specifications Sheets for nominal voltage and current needed.

3.3 Power Circuit and Motorization

The power circuitry refers to all motors powered by the 12V batteries. The use of power motors is not mandatory.

3.3.01 Power Circuit Source

The power circuit must be fed by one 12V, maximum 4Ah lead-acid sealed battery or two 12V, maximum 2Ah parallel-wired lead-acid sealed batteries.

3.3.02 Kill Switch

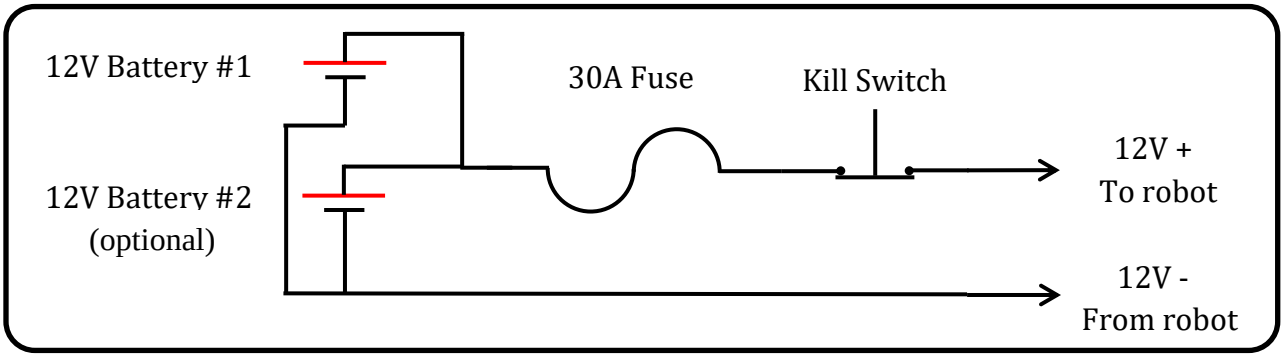
For safety reasons, the robot must have an easily identifiable and accessible ON/OFF kill switch. The kill switch must be connected to the circuit such that it kills the robot's 12V-circuit when the switch is pushed down, not pulled. The kill switch that must be used on all robots is the NPB22-J, or a switch deemed equivalent by CRC Robotics.

3.3.03 Fuse

All robots must have a fuse (single usage or reusable) between the 12V batteries and the power motors. The total 12V battery output must be limited to 30A.

3.3.04 Safety Specification Scheme

The power circuit must, at a minimum, adhere to the following safety schematic:



3.3.05 Power Motors

Only the following power motors can be used as part of the power circuit.

Motor Type	Part Number
Banebot	RS555 motor, with any or no gearbox attached
Black Motor	Either 200680 N or 200681 N

3.3.06 Power Motor Count

The maximum number of power motors allowed on the robot is 8, with a maximum of 4 power motors of the same type and gearbox combination. In all cases, the maximum number of motors of the same type, regardless of the coupled gearbox, is 6.

3.3.07 Power Motor Modifications

Any modification to the electrical components of the power motors is prohibited. Modifications may only be made to the mechanical components of the power motors, if desired. Therefore, the gearbox can be changed or removed completely.

3.3.08 Power Servo-Motors

Servo-Motors powered by the 12V power circuit are prohibited.

3.3.09 Power Motor Controller

Power motors may be controlled with relays, interrupts, switches and/or any motor controllers, such as the Victor SPX.

3.3.10 Capacitors

The addition of capacitors to the 12V power circuit of the robot is permitted. The role of these capacitors is to reduce the magnetic field emitted by the motors. However, no electrolytic capacitors are permitted for this task. The capacitor may not be used to accumulate charge. If the capacitor is polarized (if it contains only one direction for connection), it is considered illegal.

3.4 Pneumatics

There are many dangers to working with high pressure systems. Thus, the following regulations are put in place to emulate the same safety standards present with the power circuit.

3.4.01 Kill Switch

If the robot uses any pneumatics, it must have an easily identifiable and accessible ON/OFF manual pneumatic kill switch. All actuators/valves must be at the ambient pressure when turned to OFF.

3.4.02 Maximum Pressure

The pneumatic system of the robot must be divided in two parts. Their maximal pressures are the following:

- Tank section: 90 psi
- Low pressure section (actuators/valves): 55 psi

3.4.03 Pneumatic System Protection

In a similar fashion to the fuse in an electrical circuit, the pneumatic system must be equipped with an overflow valve that can be controlled to release any pressure greater than 90 psi.

3.4.04 Altered Pneumatic Parts

All pneumatic pieces (actuators, valves, cylinders, tanks, switches, etc.) must be unchanged from their original state, as purchased new. No altered parts will be accepted. All serial numbers must be visible for certification.

3.4.05 Actuator/Cylinder Control

Each actuator/cylinder must be controlled by no more than one valve.

3.4.06 Valve Control

All the valves must be controlled by the microcontroller. It is permitted to add relays or power modules to the low-voltage or power-electrical circuit to control the valves if they are still controlled by the microcontroller.

3.4.07 Maximum Input and Tube Diameters

The valves must have a maximal input hole of 1/8" (3mm). The tubes between valves and their actuators/cylinders must have a maximal diameter of 3/16" (5 mm).

3.4.08 Manometers

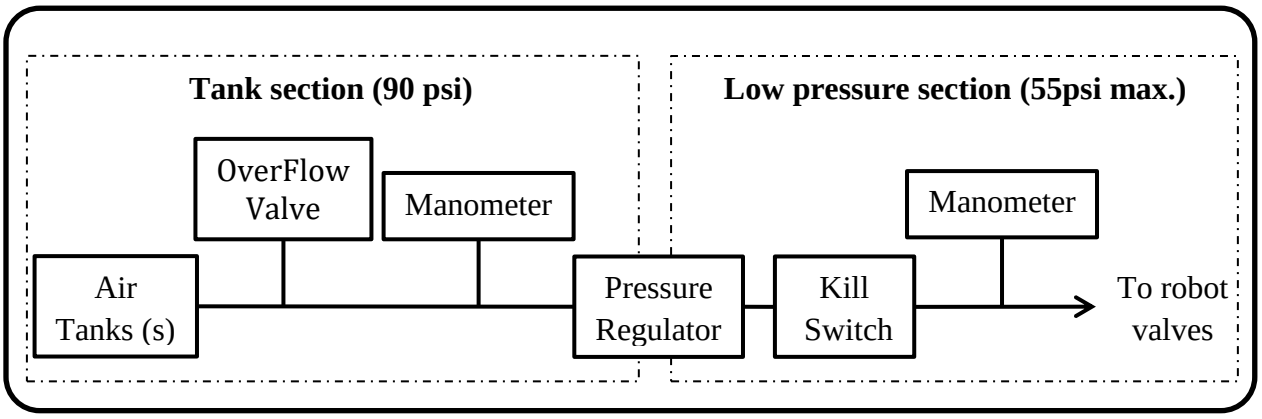
A manometer must be installed in both low- and high-pressure sections.

3.4.09 Series/Parallel Plugging

Plugging several tanks in series or in parallel is allowed if their pressure does not exceed 90 psi.

3.4.10 Safety Specification Scheme

The pneumatic systems must, at a minimum, adhere to the following safety schematic:



3.5 Alternative Power and Energy Systems

3.5.01 Gravitational Energy

There is no restriction with regards to using gravity.

3.5.02 Single Decompression Springs

A spring that, after having started the heat in a compressed or stretched state, releases its energy during the heat, but cannot return to its original state without human intervention, will be deemed illegal.

3.5.03 Proper Spring Usage

If spring systems are used, they must be in relaxed states, or compressed or stretched by the same batteries and motors used during the heat, before the heat begins. Spring systems that function through oscillation are also allowed, given they conform to the above rules.

3.5.04 Fans

Fans can only be used to cool down motors or electrical components that can potentially overheat.

3.5.05 Lights

Lights can be used on robots, but they must draw their energy from the 12V power circuit. Blinding lights or other components deemed distracting or disruptive by the certification judge or the referees on the playing field must be disconnected.

3.5.06 Lasers

The use of lasers of any type is prohibited.

3.5.07 Other Electrical Sources

The only electrical power sources allowed are the ones stated in Sections 3.2 and 3.3.

3.6 Dimensions

3.6.01 Initial Size Limits

Robot dimensions are limited to 91.44cm x 91.44cm (length x width) with a height limit of 91.44cm at the beginning of each heat.

3.6.02 Extension Constraints

After a heat begins, robots cannot extend their dimensions or height.

3.6.03 Moving Parts

Moving robot parts are allowed if they do not extend beyond the specified maximum dimensions and height before and/or during a heat.

3.7 Certification

3.7.01 Safety Inspection

Robots will be required to pass a safety inspection (on site, at the Competition) in order to be judged and have access to the playing field. During the certification, the electrical power circuit will be inspected for its integrity. If parts are protected inside boxes, the boxes will need to be opened during certification. Should any part of the circuit be inaccessible, the robot will not be certified. Refer to Appendix C of this rulebook for the certification criteria and safety checklist.

3.7.02 Post-Certification Modifications

Teams may modify their robot between heats at their discretion. However, each electrical modification and each modification made to enlarge the robot's dimensions must be subsequently certified. Failure to recertify the robot will result in all points gained in subsequent heats to be void.

3.7.03 Safety

Any robot deemed to be dangerous for any reason can be disqualified until the necessary safety measures are put into place.

4. Kiosk

The kiosk component requires the organization of an information kiosk and presentation of accomplishments to visitors and judges. This component gives each school an equal opportunity to showcase their school, their team, and their robot while also developing presentation and artistic skills. Refer to the Survival Guide for tips and suggestions. The evaluation rubric used by the judges to evaluate the kiosk may be found in Appendix D of this rulebook. The Kiosk Certification form may be found in Appendix E of this rulebook.

4.1 Constraints

4.1.01 Space Provided

A 12' by 12' space is available to each team.

4.1.02 Material Provided

Objects provided by CRC Robotics: 1 folding table (if desired), 2 school chairs (if desired) and 1 electrical outlet with 2 plugs (120V, 15A total).

4.1.03 Layout

Each team's kiosk must have the following:

a) A distinct and delineated pit area for robot maintenance, modifications, and repairs;
b) A school and robot demonstration and presentation area;
c) A clear and obvious identification of the team number and full school name.

4.1.04 Levels

It is not permitted to have any livable space on a second level due to safety concerns, including during set-up and dismantling time.

4.1.05 Respect for Neighbors

The surrounding kiosk areas must be respected; otherwise, the team at fault will be penalized for any behavior that has a negative impact on other kiosks (e.g. loud music, extending beyond the kiosk footprint, etc.).

4.1.06 Visual Appeal

Since kiosk spots are randomly assigned to teams, the outside walls of a kiosk will not be judged for reasons of equality. However, teams are encouraged to put an effort to make both the interior and exterior side of the walls of their kiosk visually appealing for the benefit of visitors and other participants.

4.1.07 Electrical Work Conformity

All electrical work within the kiosk must adhere to Québec's building safety standards.

4.1.08 Safety

If any CRC Robotics officials feel that there is a risk of accident either with the kiosk or with the construction methodology (unsafe ladder, tools, etc.), CRC Robotics will consult the team and stop the building process until a safe approach or correction can be agreed upon.

4.1.09 Competition Readiness

In an effort to have the best experience possible for all teams, kiosk elements must be painted and cut before teams arrive at the Competition. Minor tweaks will be permitted, but if major parts of the kiosk are being built on site, a penalty will be sanctioned.

4.1.10 Safety Gears

Each kiosk must be equipped with at least one first aid kit and at least three pairs of safety glasses.

4.1.11 Access

There must be clear access for the robot and team members within the kiosk.

4.1.12 Assembly Time Limit

The kiosk must be fully mounted and ready for judging within 7 hours of a team's scheduled arrival time. The arrival schedule will be sent by email to all teams in the day prior to the Competition.

4.1.13 Dismantling

A team's kiosk area must be cleared and cleaned 6:00 p.m. on the Saturday night of the Competition. No damage can be done to the area. Any team leaving any debris will be subject to a $200 fine as well as any cleaning costs incurred by the host school. Repeat offenders may be subject to further penalties.

4.1.14 Dismantling Time

Kiosks may not be dismantled until instructed to do so by the CRC Robotics Organizing Committee.

4.2 Certification

4.2.01 Safety Inspection

Each kiosk will be required to pass a safety inspection on Thursday afternoon in order to be judged. Refer to Appendix E of this rulebook for the certification criteria and safety checklist.

4.3 Judging

4.3.01 Multiple Teams per School

Kiosk spaces of teams from the same school will be placed beside each other. If the school decides to build one combined kiosk, judges will be informed to evaluate them separately, without considering the other space.

4.3.02 Language

Teams must ensure to always have at least 1 bilingual student speaker in the kiosk, giving presentations and answering questions from the public.

4.3.03 Judges

Preliminary and final presentations will take place in the kiosk of the evaluated team, and the jury will be composed of teachers from the host school.

4.3.04 Schedule

There will not be a detailed schedule provided for the judging of the kiosks. Instead, time intervals will be provided during which the judges may visit the kiosks. This measure is necessary given the nature of this component of the Competition. However, a visual signal in the kiosk area will inform participants that the kiosk judging is in session.

4.3.05 Visual Support

Visual support is permitted.

4.3.06 Structure

The presentations must abide by the following structure:

Length	Action
5min	The team presents the kiosk (without the judges interrupting).
5min	The judges ask their questions to the evaluated team.
5min	The judges give feedback, rank teams, discuss, and move toward the next team.

5. Programming

The programming component allows teams to develop and showcase their ability to program a robot so that it can perform a series of tasks autonomously. Teams run their programs on a robot provided by CRC Robotics and are evaluated on the performance of the code as it achieves the required tasks. Refer to the Survival Guide for tips and suggestions.

5.1 Scope

5.1.01 Goal

This year's edition of the programming component is "out-of-the-box". Instead of solely relying on pure coding and programming platform knowledge, it mixes mathematics, algorithms, game theory, and psychology in a true multidisciplinary CRC Robotics way.

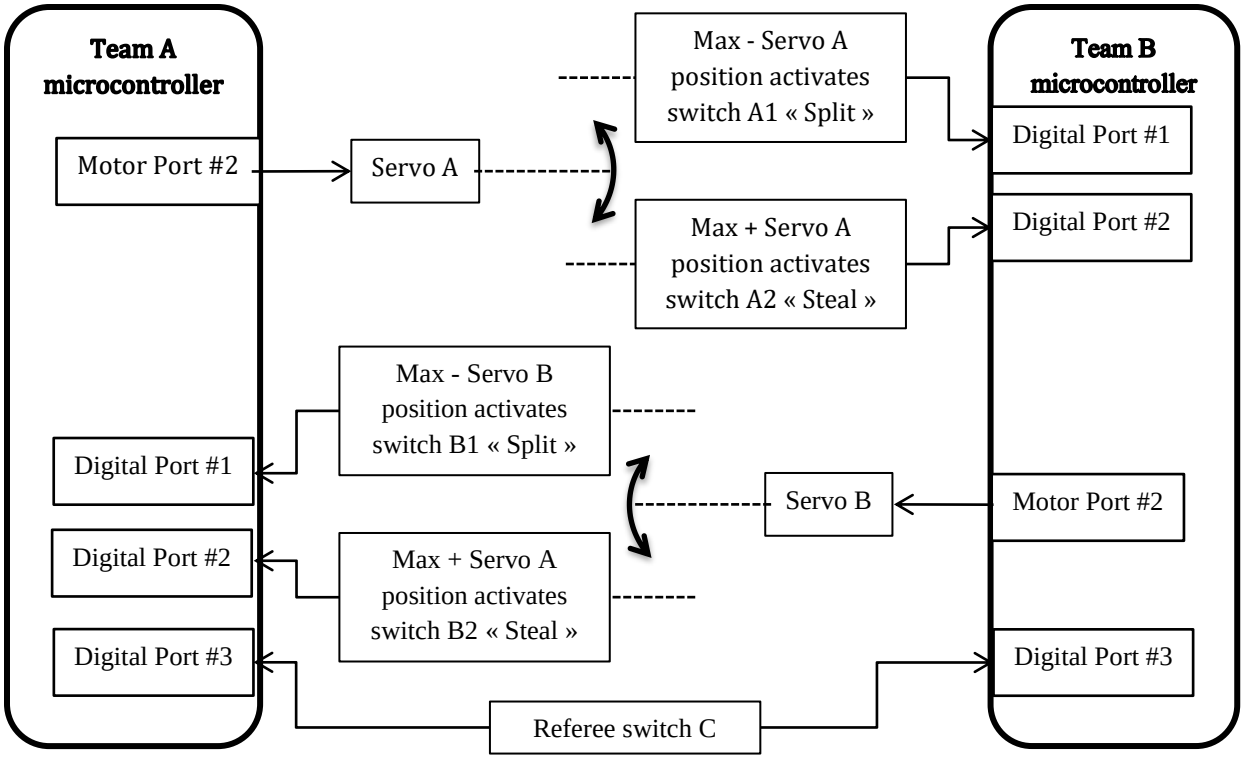
5.1.02 Summary

Teams will face each other in a Swiss-style bracket tournament, with the robots playing "Split or Steal", a head-to-head game version of the prisoner's dilemma, where two competitors play against each other to accumulate the highest possible final score in a heat.

5.2 Platform

5.2.01 Components

Opposing teams, A and B, face each other using 2 independent microcontrollers. Team A controls a servo-motor that, when rotated to its maximum positive value, activates switch A1 ("Split") and that, when rotated to its maximum negative value, activates switch A2 ("Steal"). Team B controls a servo-motor that, when rotated to its maximum positive value, activates switch B1 ("Split") and that, when rotated to its maximum negative value, activates switch B2 ("Steal"). The microcontrollers are wired according to the following scheme:



5.2.02 Microcontroller

The microcontrollers used are VEX ARM Cortex-based Microcontrollers (VEX EDR Part Number: 276-2194).

5.2.03 Servo-Motor

The servo-motors used are 3-wire *hobby* servos (VEX EDR Part Number: 276-2162).

5.2.04 Switch

The switches used are NO (Normally Open) limit switches (VEX EDR Part Number: 276-2174).

5.3 Challenge

5.3.01 Heat Duration

Each heat is composed of 12 to 20 face-offs. The number of face-offs of any given heat is unknown to the teams.

5.3.02 Face-off

A face-off starts with the referee holding down Switch C for 3 seconds. Once Switch C is released, both robots must immediately activate their respective servo so that it presses either their "Split" or their "Steal" switch. Each robot's servo must hold down the chosen switch until the referee presses and immediately releases Switch C, indicating the end of a face-off. Once the referee presses and immediately releases Switch C at the end of the face-off, each robot's servo must return to a neutral position, ready for the next face-off. Instead of a press and immediate release, the last face-off of a heat ends Switch C being held down for 5 seconds. Robots must send their servos to a neutral position at the end of the heat and hold this position even if the referee presses Switch C again.

5.3.03 Scoring

The objective is to accumulate the most points during the face-offs to win the heat. During a face-off, if

a) both robots select "Split", each team will acquire 1 point;

b) one robot selects "Split", and the other selects "Steal", the team that stole will acquire 2 points and the team that split will receive 0 points;

c) both robots select "Steal", no points are awarded to either team.

The following table summarizes the points awarded depending on the outcome of a face-off. CRC Robotics reserves the right to modify this point table up to two weeks before the Competition.

Team B / Team A	**Team B Splits**	**Team B Steals**
Team A Splits	Team A receives 1 point Team B receives 1 point	Team A receives 0 points Team B receives 2 points
Team A Steals	Team A receives 2 points Team B receives 0 points	Team A receives 0 points Team B receives 0 points

5.3.04 Penalties and Limit Cases

a) A two-point penalty is given to a robot if it presses the same switch for more than 3 consecutive face-offs. If the robot keeps pressing the same switch on the 5^{th}, 6^{th}, …, n^{th} consecutive face-off, the penalty will be given for each of these consecutive face-offs.

b) If a robot does not press any switch during a face-off or delays the pressing of a switch, it will receive a 2-point penalty while its opponent will gain 2 points. If both robots do not press a switch, they both receive a 2-point penalty.

c) A 5-point penalty is given to a robot that does not stay in the neutral position after a face-off (before the next face-off begins) or at the end of the heat.

5.3.05 Minimum Score

The minimum score that can be earned by a team for a single heat is -5 points.

5.3.06 Scoring Example

The following is a scoring example. It constitutes an integral part of the rules and acts as a reference for scoring disputes. This heat contains 17 face-offs.

	Switch pressed by		Points awarded to		Penalty given to		Faceoff score	
Face-off	Team A	Team B	Team A	Team B	Team A	Team B	Team A	Team B
#1	None	Split	0	2	-2	0	-2	2
#2	None	None	0	0	-2	-2	-2	-2
#3	Steal	Split	2	0	0	0	2	0
#4	Split	Steal	0	2	0	0	0	2
#5	Steal	Steal	0	0	0	0	0	0
#6	Steal	Split	2	0	0	0	2	0
#7	Steal	Steal	0	0	0	0	0	0
#8	Split	Split	1	1	0	0	1	1
#9	Steal	Split	2	0	0	0	2	0
#10	Split	Split	1	1	0	0	1	1
#11	Steal	Split	2	0	0	-2	2	-2
#12	Split	Split	1	1	0	-2	1	-1
#13	Split	Steal	0	2	0	0	0	2
#14	Steal	Split	2	0	0	0	2	0
#15	Steal	Steal	0	0	0	0	0	0
#16	Steal	Split	2	0	0	0	2	0
#17	Steal	Steal	0	0	-2	0	-2	0
					Heat score		9	3

5.4 Logistics

5.4.01 Download Platform

Team A and Team B must use the CRC Robotics computers provided to download their programs into their respective robots. Teams must use their own USB key to transfer their program onto the designated computer for download.

5.4.02 Download Time

Team A and Team B have 2 minutes to download their program into their assigned microcontroller. If both teams indicate they are ready before the 2-minute period ends, the referee can start the heat before the end of the 2-minute period.

5.4.03 Tournament Structure

The preliminary phase is played in the Swiss bracket format, while finals are played in a round-robin tournament format with the top 4 teams from the preliminary phase participating. The complete schedule will be announced in the days prior the Competition on the website: www.robo-crc.ca/participant-portal.

5.4.04 Punctuality

Due to the nature of the bracket-style system, teams must check-in and present themselves at the designated programming competition area within two minutes of the scheduled start time. A team which fails to present itself within the designated start time will forfeit the heat. The team that did not show up will earn -5 points for the heat it did not attend, while the opposing team (the team that was scheduled to play against the "no-show") will earn 5 points for the heat. Both teams will receive -5 points if they both do not show up to a heat.

5.4.05 Tournament Registration

Due to the planning required to hold a Swiss-style bracket tournament, teams must register to participate in the programming component on the date and platform outlined in the Season Calendar, available in the Foreword of this document.

5.4.06 Ranking

Rankings for teams that do not advance to the finals are based on their performance in the Swiss bracket. The rankings of the 4 teams that advance to the finals will be determined by their performance in the finals.

5.4.07 Total Face-offs Played

The total number of face-offs played during the Preliminary rounds will be the same for each team. The total number of face-offs played during the Finals rounds will be the same for each of the four teams.

6. Video

The following section outlines the rules and regulations of the video component. Refer to the Survival Guide for tips and suggestions. The evaluation rubric used by the judges to evaluate the video may be found in Appendix F of this rulebook.

6.1 Format

6.1.01 Run-time

The submitted video must be no less than 4 minutes long and no more than 5 minutes long, not including end credits.

6.1.02 Stylization/Style

The video submitted must have a fictional narrative or journalistic/documentary style.

6.2 Required Content

6.2.01 School Description

The video must outline the following details of the school:

a. Name
b. Location
c. Institution Type (High School, CEGEP, Professional Vocational Centre)

6.2.02 CRC Robotics Competition Description

The video must briefly describe the CRC Robotics Competition in such a way that the components are presented, and the goal of the Competition is mentioned. The video must end by visually showing the time, place, and name of this year's Competition.

6.2.03 Game Description

The video must explain the game rules in an original fashion and in enough detail such that the game can be understood from an outsider's perspective.

6.2.04 Robot Design and Construction

The video must detail the steps involved in designing and building the team's robot in enough detail such that the functionality of the robot can be understood from an outsider's perspective. The hardships encountered during the design and construction of the robot must also be included in the video.

6.2.05 Bilingualism

Both the English and French languages must be equally represented in the video, either through dialogue and/or subtitles. YouTube's closed-captioning tool is not permitted.

6.2.06 Copyright Law Adhesion

There must not contain copyrighted material present in the video, unless the team has an expressed permission from the content creator to use it in such a fashion. If the video is themed around an existing work, it must be clearly mentioned and credited. It is the responsibility of each team to ensure that the video does not violate YouTube's Copyrighted Content policy.

6.2.07 Forbidden Content

No vulgar, offensive, violent, or inappropriate content is tolerated. In doubt, contact the CRC Robotics Organizing Committee.

6.3 Submission

6.3.01 Deadline and Submission Platform

Refer to the Season Calendar in the Foreword of this document for the date and platform on which to submit the video. The specific URL pointing to the video's YouTube page must be provided at the time of submission. Video upload must be done by the deadline. A team that does not submit a video will receive a score of zero in the video component. A team that submits a video within a day after the deadline will be evaluated; however, this team will not be able to rank within the "Top 3" for the video component. Submissions received more than 24 hours after the deadline will not be judged.

6.3.02 Privacy Settings

The video's privacy setting must be switched to "Public" no later than the first day of the three-day Competition. Refer to the Season Calendar in the Foreword of this document for the exact time and date.

7. Website

The following section outlines the rules and regulations of the website content and design components. Refer to the Survival Guide for tips and suggestions. The evaluation rubrics used by the judges to evaluate the website design and the website content may be found in Appendix G and Appendix H of this rulebook, respectively.

7.1 Technical Requirements

7.1.01 Compatibility

The website must be functional in Google Chrome, Firefox, Microsoft Edge, and Safari.

7.1.02 Quality Assurance

The website should be tested prior to submission. Any bugs found during evaluation will negatively affect the team's score in the website design component. Bugs include, but are not limited to, malformed links, missing images, or actions that cause a "500 error".

7.1.03 HTML Standards Adhesion

The website should validate against HTML5 Standards (http://www.w3.org/TR/html5/), with little to no errors.

7.1.04 CSS Standards Adhesion

The website should validate against CSS 3.0 (https://www.w3.org/standards/techs/css#stds & https://jigsaw.w3.org/css-validator/) or better with little to no errors.

7.2 Website Content

7.2.01 Bilingualism

The website content must be fully bilingual. When the locale is changed to French, no English content should be displayed. When the locale is changed to English, no French content should be displayed.

7.2.02 Team Roster

The website must contain a browsable roster of every student, teacher, and mentor on the team, which includes each member's:

a. Name
b. Photograph (optional)
c. Sub-team / contribution

7.2.03 School Description

The website must include a page that outlines the following details of the team's school:

a. Name
b. Location
c. Institution Type (High School, CEGEP, Professional Vocational Centre)

7.2.04 CRC Robotics Competition Description

The website must contain a page that briefly describes the CRC Robotics Competition in such a way that the components are presented, and the goal of the Competition is mentioned. This page must also show the time, place, and name of this year's Competition.

7.2.05 Game Description

The website must explain the game rules in an original fashion and in enough detail such that the game can be understood from an outsider's perspective.

7.2.06 Robot Design and Construction

The website must detail:

a. the steps in the design and construction of the robot;
b. the hardships that were encountered along the way;
c. the solutions to the aforementioned problems;
d. conception and prototype plans and drawings;
e. most recent design plans and drawings available at time of submission;
f. photos of the robot, at various stages of construction.

7.2.07 Student Experience Documentation

The experiences and lessons learned, as well as hardships encountered, must be documented on the website. The aforementioned documentation must contain:

a. what the team learned;
b. what the team enjoyed regarding the preparation for the Competition;
c. the concepts or aspects with which the team struggled;
d. the sacrifices made for the team.

7.2.08 Copyright Law Adhesion

There must contain zero copyrighted material present on the website, unless the team has an expressed permission from the content creator to use it in such a fashion. If the website is themed around an existing work, it must be clearly mentioned and credited.

7.2.09 Forbidden Content

No vulgar, offensive, violent, or inappropriate content is tolerated. In doubt, contact the CRC Robotics Organizing Committee.

7.3 Submission

7.3.01 Online Accessibility

The website must be publicly accessible and hosted on the Internet under a domain name or IP address. Should the URL provided during submission be broken or mistargeted, the website will be considered as not submitted.

7.3.02 Post-Submission Changes

Once submitted, changes must not be made to the website. Should changes be discovered past the submission date, the website will be considered as not submitted.

7.3.03 Deadline and Submission Platform

Refer to the Season Calendar in the Foreword of this document for the exact date and platform on which to submit the website. The specific URL pointing to the website must be provided at the time of submission. A team that does not submit a website will receive a score of zero in the website design and website content components. A team that submits a website within a day after the deadline will be evaluated; however, this team will not be able to rank within the "Top 3" for the website design and website content components. Submissions received more than 24 hours after the deadline will not be judged.

7.3.04 Website Visibility

The entirety of the website must be made visible to the general public and, preferably, discoverable by search engines no later than the first day of the three-day Competition. Refer to the Season Calendar in the Foreword of this document for the exact time and date. No points will be deducted if the website is not discoverable by search engines.

8. Tutorial

To promote the sharing of knowledge and to encourage a spirit of cooperation between the CRC Robotics Competition teams, the CRC Robotics Organizing Committee awards the team with the best tutorial each year. All tutorials of adequate quality will be added to the CRC Robotics website permanently, with credit to the team. The following section outlines the tutorial constraints on which all submitted tutorials will be evaluated. Refer to the Survival Guide for tips and suggestions. Tutorials are judged on the relevance of the subject and the quality of the submission.

8.1 Requirements

8.1.01 Topic

The tutorial should demonstrate knowledge directly related to any component of the Competition. Although it is strongly encouraged to cover new matter, it is tolerated to cover a subject already present in the tutorial section of CRC Robotics website.

8.1.02 Format

Tutorials can take many forms, and originality is greatly encouraged. For sharing purposes, only video and PDF formats are allowed. The tutorial must be available on the team's website.

8.1.03 Structure

The tutorial can be structured in one or more of the following ways:

- A theoretical and simplified explanation of a common system (e.g. internal functioning of DC motors);
- A step-by-step explanation to achieve a specific task;
- A practical demonstration of a complex system to perform a specific task.

8.1.04 Content

It is not permitted to resubmit a tutorial from a previous year.

8.2 Submission

8.2.01 Deadline and Submission Platform

Refer to the Season Calendar for the date and platform on which to submit the tutorial. The specific URL pointing to the tutorial page on the team's website must be provided at the time of submission.

8.2.02 Multiple Submissions

A team can submit multiple tutorials. If a team submits multiple tutorials, one will be chosen at random to be evaluated, but all of them may be added to the CRC Robotics website.

9. Appendices

Appendix A – Robot Design Evaluation Rubric

The evaluation of a team's robot design is divided into three levels of requirements: primary, secondary, and tertiary. Primary requirements serve as a foundation for your robot design. Secondary requirements serve as a creative stepping stone. Tertiary requirements will set you apart from the rest. The evaluation of each requirement is not point-based. Rather, the preliminary evaluation of a team's robot design is subjective, and the robot design is ranked against the design of the other robots, based on the opinion of existing CRC Robotics teachers and mentors. Teams are divided into three pools, and each judge evaluates and ranks each robot design in their respective pool. The top four teams in each pool will advance to the final round of evaluations. Similarly, the final evaluation of a team's robot design is subjective, and the robot design is ranked against the other finalists, based on the opinion of industry professionals, that act as CRC Robotics judges, and a team's final rank for the robot design component will be the rank assigned by the set of CRC Robotics judges.

Topic	Requirement Level	Criterion
Design & Creativity	Primary	The robot is designed to play this year's game.
	Primary	The robot is designed to be able to move freely around the field in relation to the game.
	Secondary	The robot can adapt to different game strategies.
	Secondary	The robot suggests ingenious details that brings intelligent solutions to design problems.
	Tertiary	The robot is designed with creative concepts and "out-of-the-box" thinking.
	Tertiary	The robot is efficient in terms of concept; it uses minimal resources for a maximal output.
	Tertiary	The robot's intended mechanisms are compatible with speed, stability, and precision with regards to the given overall approach.
Presentation	Primary	The team can explain how it approached this year's game, highlighting their technical expertise, team size, and challenges.
	Secondary	The team can present their design in a professional and concise presentation.
	Secondary	The team can justify the thought process regarding the design of the robot and justify why they chose the final design.
	Tertiary	When faced with questions, the team can confidently answer them and defend their decisions.

Appendix B – Robot Construction Evaluation Rubric

The evaluation of a team's robot construction is divided into three levels of requirements: primary, secondary, and tertiary. Primary requirements serve as a foundation for your robot construction. Secondary requirements serve as a creative stepping stone. Tertiary requirements will set you apart from the rest. The evaluation of each requirement is not point-based. Rather, the preliminary evaluation of a team's robot construction is subjective, and the robot construction is ranked against the construction of the other robots, based on the opinion of existing CRC Robotics teachers and mentors. Teams are divided into three pools, and each judge evaluates and ranks each robot construction in their respective pool. The top four teams in each pool will advance to the final round of evaluations. Similarly, the final evaluation of a team's robot construction is subjective, and the robot construction is ranked against the other finalists, based on the opinion of industry professionals, that act as CRC Robotics judges, and a team's final rank for the robot construction component will be the rank assigned by the set of CRC Robotics judges.

Topic	Requirement Level	Criterion
Robot Structure	Primary	Appropriate materials are used in their proper context.
	Primary	The robot is robustly assembled.
	Secondary	The robot has low mechanical tolerance and is well-calibrated.
	Tertiary	The robot is reliable/resilient and can withstand multiple heats without repair.
Robot Movement	Primary	The robot's driving mechanism operates smoothly.
	Primary	The robot's ancillary systems are stable and make precise movements.
	Secondary	Utilization of motors and mechanisms are logical and appropriate for the task at hand.
	Tertiary	The robot moves with intricacy and efficiency.
Robot Maintenance	Primary	All components are easy to access.
	Primary	The electrical system is protected and easy to access.
	Primary	The appropriate wire gage is used for the amperage run through the wire.
	Secondary	The wire management prevents accidental disconnect and impact.
	Secondary	The robot parts can be swapped easily.
	Tertiary	Maintenance required on the robot is minimal.
Presentation	Primary	The team can describe the build process and describe the tools that were available to them.
	Secondary	The team can justify the allocation of motors and choice of material and point out any outstanding qualities of their robot.
	Secondary	The team can present their robot in a professional and concise presentation.
	Tertiary	When faced with questions, the team can confidently answer them and defend their decisions.

Appendix C – Robot Certification Sheet and Safety Checklist

Certification: _____

School Name: _____

Component	Item	Certification		
		Acceptable	Unacceptable	Not Applicable
Electricity	Accessible circuit			
	Batteries in parallel (if 2 used)			
	Visible Master Kill Switch			
	30A fuse or equivalent			
	Capacitors			
Motors	Banebot			
	Black Motor			
	VEX Motors			
	Integrity of the motors			
Electronics	Speed controller			
	Other electronic devices			
Pneumatics	Presence of Pneumatics			
	Visible Master Kill Switch			
	Pressure valve			
	Number of cylinders			
Robot	Dimension of the robot			
	School Name, Team Number, and Color (when playing) visibility			
	Robot safety (Electric circuit, exposed screw, sharp edge, dangerous mechanism, etc.)			

Notes:

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CRC Robotics Signature Team Signature

Appendix D – Kiosk Evaluation Rubric

The evaluation of a team's kiosk is divided into three levels of requirements: primary, secondary, and tertiary. Primary requirements serve as a foundation for your kiosk. Secondary requirements serve as a creative stepping stone. Tertiary requirements will set you apart from the rest. The evaluation of each requirement is not point-based. Rather, the preliminary evaluation of a team's kiosk is subjective, and the kiosk is ranked against the other kiosks, based on the opinion of CRC Robotics judges. Teams are divided into three pools, and each judge evaluates and ranks each kiosk in their respective pool. The top four teams in each pool will advance to the final round of evaluations. Again, the final evaluation of a team's kiosk is subjective, and the kiosk is ranked against the other finalists, based on the opinion of the CRC Robotics judges, and a team's final rank for the kiosk component will be the rank assigned by the set of CRC Robotics judges.

Topic	Requirement Level	Criterion
Content	Primary	The information displayed and available on the interior or exterior of the kiosk must be fully bilingual.
	Primary	The kiosk is respectful of the neighboring kiosks.
	Primary	The school name and team number are properly showcased.
	Secondary	The kiosk is intriguing to the public.
	Secondary	Students interact with the public in a respectful and friendly way.
	Tertiary	A description of the school and the team is properly displayed or presented.
Technical	Primary	The kiosk must always be kept clean and safe.
	Primary	The kiosk is built sturdily and is structurally sound.
	Secondary	The kiosk demonstrates a good understanding in creating a functional workplace (i.e. tool placement and organization, functionality, etc.).
	Tertiary	The kiosk demonstrates excellence in detail and craftsmanship.
Presentation	Primary	The information presented is organized in a logical manner.
	Secondary	The kiosk is visually attractive to the public.
	Secondary	The kiosk uses lights, screens, sounds, and props in such a way that it augments the visitor's experience.
	Tertiary	The presentation of the kiosk is creative and interactive.

Appendix E – Kiosk Certification Sheet and Safety Checklist

Certification: _____

School Name: _____

Component	Item	Certification		
		Acceptable	Unacceptable	Not Applicable
Electrical: Wiring & Outlets	Wire Gauge			
	Layout			
	Protected			
	Grounded			
	Anchored			
Structural Integrity	Walls			
	Roof			
	Floor			
Safety	Tools properly stored			
	Proper fastening / anchoring (Accessories, equipment, shelves, objects, etc.)			
	Public access			
	Manoeuvrability inside kiosk (Ability to move around without hitting things)			
	Safety equipment (**First Aid Kit**, safety glasses, gloves, etc.)			
	No space on a second level			
Aesthetics	Respects neighbouring kiosks (sound, paint, etc.))			
	Space does not exceed 12' x 12'			

Notes:

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CRC Robotics Signature Team Signature

Appendix F – Video Evaluation Rubric

The evaluation of a team's video is divided into three levels of requirements: primary, secondary, and tertiary. Primary requirements serve as a foundation for your video. Secondary requirements serve as a creative stepping stone. Tertiary requirements will set you apart from the rest. The evaluation of each requirement is not point-based. Rather, the evaluation of a team's video is subjective, and the video is ranked against the other submissions, based on the opinion of industry professionals, that act as CRC Robotics judges. Each judge evaluates and ranks each video, and a team's final rank for the video component will be the average of the ranks obtained from all judges in this component. In the event of a tie, the head CRC Robotics judge will assign the final ranking to the tied teams.

Topic	Requirement Level	Criterion
Video	Primary	The video is between 4 and 5 minutes long (excluding credits).
	Primary	The video is posted on YouTube.
	Primary	The video is fully bilingual (through dialogue or subtitles, excluding YouTube's closed-captioning feature).
Content	Primary	The video includes a description of the team's school.
	Primary	The video includes a description of the CRC Robotics Competition.
	Primary	The video includes a description of this year's game.
	Primary	The video includes a description of the team's robot design and building process.
	Primary	The video ends by visually showing the time, place, and name of this year's competition.
	Secondary	Quality of the acting and narration.
	Secondary	Presence of a well-integrated central theme or storyline that presents the mandatory content.
	Tertiary	Entertainment value of the video based on the execution, creativity and originality of the concept as a whole.
Technical	Primary	Quality of the base picture.
	Primary	Quality of the audible voice.
	Primary	Presence of a basic editing process.
	Secondary	Creativity and mastery of the camera usage (i.e. creative angle, multi-angle filming, etc.).
	Secondary	Creative usage of sound effects, music, and other auditive cues that enrich the viewer experience.
	Secondary	The editing process is seamless to the viewer and the flow of the video is remarkable.
	Tertiary	Creativity and mastery in the film-making process (i.e. quality of the image, original artwork, visual effects, unique music, mastery of the editing process, etc.).

Appendix G – Website Design Evaluation Rubric

The evaluation of a team's website design is divided into three levels of requirements: primary, secondary, and tertiary. Primary requirements serve as a foundation for your website design. Secondary requirements serve as a creative stepping stone. Tertiary requirements will set you apart from the rest. The evaluation of each requirement is not point-based. Rather, the evaluation of a team's website design is subjective, and the website design is ranked against the other submissions, based on the opinion of industry professionals, that act as CRC Robotics judges. Each judge evaluates and ranks each website, and a team's final rank for the website design component will be the average of the ranks obtained from all judges in this component. In the event of a tie, the head CRC Robotics judge will assign the final ranking to the tied teams.

Topic	Requirement Level	Criterion
Aesthetics	Primary	The overall design, including choice and combination of colours, fonts, and layout are appealing and conducive of a pleasant user experience.
	Secondary	The site structure, page structure, and menu design allow the user to find information quickly and easily.
	Secondary	The website is constructed using valid CSS 3.0 or better.
	Secondary	The website is validated against HTML5 Standards.
	Tertiary	Presence of user/social interaction.
Technical	Primary	The website is publicly accessible and is hosted on the Internet under a domain name or IP address.
	Primary	There are no bugs, including, but not limited to, malformed links, missing images, or actions that cause a "500" error.
	Primary	The website is functional in Google Chrome, Firefox, Microsoft Edge, and Safari.
	Secondary	The site's code is well-formed and validated.
	Tertiary	The site demonstrates a grasp of underlying web technologies and indicates a proficient level of web programming (i.e. not solely relying a website template or content management system).

Appendix H – Website Content Evaluation Rubric

The evaluation of a team's website content is divided into three levels of requirements: primary, secondary, and tertiary. Primary requirements serve as a foundation for your website content. Secondary requirements serve as a creative stepping stone. Tertiary requirements will set you apart from the rest. The evaluation of each requirement is not point-based. Rather, the evaluation of a team's website content is subjective, and the website content is ranked against the other submissions, based on the opinion of industry professionals, that act as CRC Robotics judges. Each judge evaluates and ranks each website, and a team's final rank for the website content component will be the average of the ranks obtained from all judges in this component. In the event of a tie, the head CRC Robotics judge will assign the final ranking to the tied teams.

Topic	Requirement Level	Criterion
Content	Primary	The website includes a description of the team's school.
	Primary	The website includes a browsable roster of each student, teacher, and mentor on the team.
	Primary	The website includes a description of the CRC Robotics Competition.
	Primary	The website includes a description of this year's game.
	Primary	The website includes a description of the team's robot design and building process.
	Primary	The website is fully bilingual.
	Primary	No grammar, syntax, or spelling errors should be visible, including blatant translations performed using Google Translate.
	Secondary	Experience-driven content should be present (i.e. student experience, challenges, tutorials, interviews, etc.).
	Secondary	Usage of pictures, schematics, or any other graphic communication tools are used in a logical and sound manner.
	Secondary	The content is creatively wrapped around a compelling theme that is carried throughout all sections in a linguistic and artistic fashion.
	Tertiary	The content conveys a story in which the reader gets invested while navigating from page to page.
	Tertiary	The content inspires people to know more about the school and robotics in general.
	Tertiary	The content is creative and entertaining for the reader.