# 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, mentors and volunteers 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 Invicta 2021, our 20th annual competition.

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

The 2020-2021 CRC Robotics season will have a lot to offer: a never-before-seen completely virtual competition to ensure everyone's health and safety during the COVID-19 pandemic, a significant enhancement of our live streaming capabilities, a revamp of certain legacy rules and evaluation criteria, and the full implementation of the CrcDuino, an Arduino-based robot control platform that was fully developed in-house in collaboration with E.D.A.P.I Inc.

Good luck to all and we will see you (virtually) at Invicta 2021 from February 18 to 20, 2021.


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## 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, 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. 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 partners 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 our Partnerships Team at partnerships.crc@sciencetech.ca. On behalf of the students, a heartfelt thank-you!

# 1. The Competition

The Competition is a three-day event that takes place annually, in the month of February, usually at one of the participating schools. This year, the Competition will be held virtually in order to respect public health guidelines related to the COVID-19 pandemic. The final Competition rules are made public at Kickoff, approximately 3 and a half months before the Competition.

The following presents the typical Competition schedule. The official and detailed schedule is made available a couple of weeks before the Competition at [www.robo-crc.ca/participant-portal](www.robo-crc.ca/participant-portal).

- Thursday Morning: Team Preparation and Setup
- Thursday Afternoon: Opening Ceremony and Preliminary Heats
- Thursday Evening: Preliminary Heats and Evaluations

- Friday Morning: Preliminary Heats and Evaluations
- Friday Afternoon: Preliminary Heats and Evaluations
- Friday Evening: Preliminary Heats and Evaluations

- Saturday Morning: Knock-Out Rounds
- Saturday Afternoon: Quarterfinals, Semi-Finals and Finals
- Saturday Evening: Awards Ceremony

## 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 Invicta 2021. The teams must participate in a tournament with their own autonomous 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 this 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 CRC Pitch

The CRC Pitch replaces the Kiosk component for this year's competition. This component will be executed in an extended elevator pitch format where the students will describe their season and present the challenges and obstacles they encountered and overcame. It involves the application of art and communication and is an opportunity for the students to market their robotics team to others and truly sell the CRC experience. More information on the CRC Pitch can be found in Section 4 of this rulebook.

### 1.1.04 Programming

The programming component is designed to foster and hone the skills and thinking process required to code professionally. In a truly unique way, participants will tackle various online programming challenges at the Competition in a "Capture the Flag" style game. Each challenge will provide participants with the required tools to succeed, and challenges will become more complex as teams move forward. 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 follow a storyline and present a description of this 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, a roster of participating students, a description of this 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. 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. CRC Pitch
   d. Video
   e. Website Content
   f. Website Design

1.2.02 Teams are divided among high school and CEGEP/Vocational centre for the Programming component.

1.2.03 There is no division of teams for the Tutorial component. All teams compete against each other.

1.2.04 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.

1.2.05 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.

1.2.06 The divisions are re-assigned every year.

1.2.07 New high schools are automatically placed in Division 2 while new CEGEPs and vocational centres are automatically placed in Division 1.

1.2.08 A team in Division 2 can win the Overall Ranking award.

1.2.09 The best teams will receive separate awards for the components based on the ranking for each component.

1.2.10 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.

1.2.11 A Division 2 team can request to be upgraded into Division 1.

1.2.12 CRC Robotics has the final say in the division distribution.

## 1.3 Awards and Recognitions

Awards and recognitions are presented to the most performing team(s) in each component. If the division or school type system is used for the ranking of a particular component, then awards are presented to the most performing team(s) in each division or school type for the component. Refer to Section 1.2 for details on components for which teams will be ranked by division or school type. 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 CRC Pitch

The CRC Pitch award is presented to the three teams that received the greatest scores from our CRC judges and that were deemed to have the best executed pitch of the CRC Robotics experience.

### 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 from a marketing standpoint.

### 1.3.09 Tutorial

The Tutorial recognition is presented to the three teams that received the greatest scores from the CRC Robotics Organizing Committee and that were deemed to have the best explanation of the task selected.

### 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 despite all barriers. This winner is selected by the CRC Robotics Organizing Committee and 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 deemed the most 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. CRC Pitch, 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 Competition Award

The Competition award is presented to the three teams that receive the greatest overall 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.