



World Robot Olympiad 2019

REGULAR CATEGORY

GENERAL RULES

*Age groups Elementary, Junior, Senior
(for WeDo Rules, please see the WeDo documents)*

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WRO International Premium Partners



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Introduction

Robotics is a wonderful platform for learning 21st century skills. Solving robotic challenges encourages innovation and develops creativity and problem solving skills in students. Because robotics crosses multiple curricular subjects, students must learn and apply their knowledge of science, technology, engineering, math, and computer programming.

The most rewarding part of designing robots is that students have fun. They work together as a team, discovering their own solutions. Coaches guide them along the way, then step back to allow them their own victories and losses. Students thrive in this supportive and immersive environment, and learning occurs as naturally as breathing air.

At the end of the day, at the end of a fair competition, students can say they did their best, they learned, and they had fun.

Important changes for WRO 2019

Rule	Change

2.10	Changed the information on allowed software for all age groups.
2.11	New rule about same laptop / program at the competition day.
2.12	New rule for allowed battery at WRO International Final.
3.2	Specified this rule with the usage of one controller per team.
4	Inserted a new rule about table and game mat specifications. In the past we had this information in the game documents of each age group. In addition, we specified some of these rules.
6.3	Redefined this rule.
6.9	Add an information about what happens if there is no program on the robot.
6.13	New rule about early start by accident.
6.14 b) e)	Added mission objects to this rule.
9.1 / 9.2	Included information about WRO Guiding Principles & Ethics Code.
9.3	New rule for a time penalty if rules are broken.
10.1 / 10.2, add 10.3	Clarifications for both rules for online / similar solutions.

In addition, please note that during the season there might be clarifications or additions to the rules by the official WRO Questions & Answers. The answers are seen as addition to the rules. You can find the WRO 2019 Q&A on this page: <https://wro-association.org/wro-2019/questions-answers/>

Please note that information regarding overall regulations (team-size, coach, age groups etc.) is available on our website on: <https://wro-association.org/competition/regulations/>

Regular Category Rules

The rules of competition are constituted by World Robot Olympiad Association.

1. Surprise Rule

- 1.1. A surprise additional rule will be announced on the morning of the competition.
- 1.2. The announcement of this additional “surprise” must be handed over to each team in writing.

2. Material



- 2.1. The controller, motors and sensors used to assemble robots must be from LEGO® MINDSTORMS sets (NXT or EV3). The HiTechnic Color Sensor is the only third-party element that can be added to this configuration.
- 2.2. Only LEGO branded elements may be used to construct the remaining parts of the robot. WRO recommends use of Education versions of LEGO MINDSTORMS.
- 2.3. Teams should prepare and bring all the equipment, software and portable computers they need during the tournament.
- 2.4. Teams should bring enough spare parts. Even in the case of any accidents or equipment malfunction, WRO is not responsible for their maintenance or replacement.
- 2.5. Coaches are not allowed to enter the court to provide any instructions and guidance during the competition.
- 2.6. All the parts for the robot should be disassembled and in their initial state (**not prebuilt**) when the assembly time starts. For example, a tire cannot be put on a wheel until assembly time begins.
- 2.7. Teams may not use any instruction sheets/guides to assemble their robot, whether written, illustrated or pictorial no matter what format they are in (including paper-based and digital).
- 2.8. Teams may make the program beforehand.
- 2.9. It is not allowed to use screws, glues or tape or any other Non-LEGO material to fasten any components on robots. Non-compliance with these rules will result in disqualification.
- 2.10. Control software for all age groups (Elementary, Junior, Senior) is open to any software and any firmware on NXT / EV3 controllers.
- 2.11. Teams are not allowed to share a laptop and / or the program for a robot on the competition day.
- 2.12. For the WRO International Final the only allowed battery for NXT / EV3 must be an official LEGO rechargeable battery (no. 45501 for EV3, 9798 or 9693 for NXT).
- 2.13. The motors and the sensors for the robot are supplied by LEGO® and HiTechnic. Any other products are not allowed. Teams are not allowed to modify any original parts (for example: EV3, NXT, motors and sensors, etc..) A robot made with modified parts will be disqualified at that match. Allowed sensors and motors:

	9842 - NXT Motor with Tacho
	9843 - NXT Touch Sensor
	9844 - NXT Light Sensor
	9845 - NXT Sound sensor

	9846 - NXT UltraSonic sensor
	9694 - NXT Colour sensor
	45502 – Large Motor
	45503 – Medium Motor
	44504 – Ultrasonic Sensor
	44506 – Color Sensor
	44507 – Touch Sensor
	44509 – Infrared Sensor
	45505 – Gyro Sensor
	HiTechnic NXT Color Sensor V2

3. Regulations about the robot

- 3.1. The maximum dimensions of the robot before it starts the “mission” must be within 250mm x 250mm x250mm. After the robot starts, the dimensions of the robot are not restricted.
- 3.2. Teams are allowed to use only one controller (NXT or EV3). Teams are allowed to bring more than one controller (in case one controller gets damaged), but they can only use one controller during practice time or robot runs. Teams have to leave the spare controllers with their coach and contact the judges if they need it.
- 3.3. The number of motors and sensors to be used is not restricted. However, it is only allowed to use official LEGO® materials to connect motors and sensors.
- 3.4. It is not allowed for the teams to perform any actions or movements to interfere or assist the robot after the actions to start the robot is performed (the program is run or the central

button is pressed to activate the robot). Teams that violate this rule will get a score of 0 in this particular run.

- 3.5. A robot must be autonomous and finish the “missions” by itself. Any radio communication, remote control and wired control systems are not allowed while the robot is running. Teams in violation of this rule will be disqualified and must quit the competition immediately.
- 3.6. The robot can leave on the field any parts of the robot that are not containing main units (controller, motors, sensors) if needed. As soon as the part is touching the field or its game element and does not touch the robot it is considered as a free LEGO element not being part of the robot.
- 3.7. The Bluetooth and Wi-Fi function must be switched off at all times. That means that the full program needs to run on the controller.
- 3.8. Use of SD cards to store programs is allowed. SD cards must be inserted before the robot is inspected and may not be removed for the duration of the competition once inspection is completed.

4. Table and game mat specifications

- 4.1. The internal dimensions of a game table are 2362 mm x 1143 mm.
- 4.2. The external dimensions of the table are 2438 mm x 1219 mm.
- 4.3. The height of the borders is 70 +- 20mm.
- 4.4. All black lines are at least 20mm.
- 4.5. The game mat must be printed with a matt finish /overlay (without reflecting colors!). The preferred printing material is a PVC tarp with around 510 g/m². The material of the game mat should not be too soft (e.g. no mesh banner material).
- 4.6. WRO Association provides the printing files, that will be used for the WRO International Final as well, on the website.
- 4.7. If there is a different setup at a local / national competition (table size, borders, material of game mat etc.), the organizers of the competition need to inform the teams upfront.

5. Prior to competing

- 5.1. Each team must prepare for the match in their specified place until the “check time”, when the team’s materials must be placed in a designated area.
- 5.2. Teams cannot touch designated competition courts before the start of the “assembly time” is announced.
- 5.3. Judges will check the state of parts before announcing the start of the assembly time. Teams must show that their parts are separated. Team members cannot touch any parts or computer during this “check time”. The assembly time doesn’t begin until officially announced at the event.

6. Competition

- 6.1. The competition consists of a number of rounds, assembly time (150 minutes), programming and testing time.

- 6.2. If the Game Rules of the specific age groups do not say something different, the randomization of game objects is done before each competition round (after teams handed in the robot).
- 6.3. Competitors are not allowed to assemble or program their robot outside of specified assemble, maintenance and testing times.
- 6.4. Teams will be given time for assembling, programming and calibrating their robot before each round.
- 6.5. Competitors begin assembly once assembly time is officially announced at the event and can immediately start the programming and test runs.
- 6.6. If teams want to make test runs, they need to queue with their robots in hand. No laptops should be brought to the competition table.
- 6.7. Teams must place robots in their designated inspection area when any assembly or maintenance time ends, after which the judges will assess if the robot conforms to all regulations. Upon successful inspection, the robot will be allowed to compete.
- 6.8. If a violation is found at the inspection, the judge will give the team three (3) minutes to convert the violation. However, it is not possible to participate in the match if the violation is not corrected during the time given.
- 6.9. Before the robot is placed in the quarantine area for inspection the robot must have only one executable program with the name “run2019”. If you can create project folders, name it “WRO2019”. Other files, e.g. sub programs, are allowed to be in the same directory but are not allowed to be executed. If there is no program on the robot, then the robot cannot participate in the current run.
- 6.10. The robot will have 2 minutes to complete the challenge. Time begins when the judge gives the signal to start. The robot must be placed in the starting area so the projection of the robot on the game mat is completely within the start area. The EV3/NXT brick is switched off. The participants are allowed to make physical adjustments to the robot in the starting area. However, it is **not allowed** to enter data to a program by changing positions or orientation of the robot parts **or to make any sensor calibrations of the robot**. If a judge identifies this the team could be disqualified from the competition
- 6.11. Once physical adjustments have been made to the satisfaction of the participants, the judge will give the signal for the EV3/NXT brick to be switched on and a program to be selected (but not run). After that the judge will ask the team about the way to run the robot. There are two possible cases:
 - a. the robot starts moving immediately after the running the program.
 - b. the robot starts moving after pressing central button, **other buttons and sensors cannot be used to start**.

If option a) is used the judge provides a signal to start and the team member runs the program. If option b) is used the team member runs the program and waits for its start. No changes in position of the robot or its parts are allowed in this moment. Then the judge provides the signal to start and the team member presses the central button to start the robot.
- 6.12. If there is any uncertainty during the task, the judge makes the final decision. They will bias their decision to the worst outcome available for the context of the situation.
- 6.13. If a team starts the run early by accident (without any tactical reasons, e.g. because of a nervous situation), the judge can decide that the team can start the run again.
- 6.14. The attempt and time will end if:

- a. Challenge time (2 minutes) has ended.
 - b. Any team member touches the robot or any mission objects on the table during the run.
 - c. The robot has completely left the game table.
 - d. Violation of the rules and regulations.
 - e. The robot ends its run. A team member can inform the judge if the robot has arrived in the final position. Time will stop if the robot does not move anymore.
 - f. If a robot arrives in the finish area and a team member informs the judge that this is the final position.
- 6.15. The score calculation is done by the judges at the conclusion of each round. The team must verify and sign the score sheet after the round, if they have no fair complaints.
- 6.16. The ranking of a team is decided depending on the overall competition format. **For example:** it could be the best score of a round or the best run out of three rounds. If competing teams acquire the same points, the ranking is decided by the record of time (where time has not already been taken into consideration of the scores calculation). If teams still remain tied, rankings will be determined by consistency of performance by examining which team achieved the next highest score during previous rounds.
- 6.17. The score will never result in a negative score. If the score would be negative in case of penalty points, then the score will be 0, example: A team got 5 points for mission and 10 penalty points, then the team will be ranked with 0 points. Same goes for a team with 10 points for a mission and 10 penalty points.
- 6.18. Outside specified assembly, programming, maintenance and testing times it is not allowed to modify or exchange the robot. (For example, during inspection time teams are not permitted to download programs to robots or change batteries). However, batteries are allowed to be charged during any specified inspection time. Teams cannot request time out.

7. Team area

- 7.1. Teams must assemble their robot in an area designated by tournament officials (each team has its own area). People, other than competing students are not allowed to enter the competition area, apart from authorized WRO Organizing Committee staff and special personnel.
- 7.2. The standard of all competition materials and courts are according to what are provided by the committee on the competition days.

8. Prohibited matters

- 8.1. Destruction of competition courts/tables, materials or robots of other teams.
- 8.2. Use of dangerous items or behaviors that may create or cause interference with the competition.
- 8.3. Inappropriate words and/or behavior toward other team members, other teams, audience, judges or staff.

- 8.4. Bringing a cellular/mobile phone or a medium of wire/wireless communication into the designated competition area.
- 8.5. Bringing food or drink into the designated competition area.
- 8.6. Competitors using any communication devices and methods while the competition is in process. Anyone outside the competition area is also banned from talking to or communicating with competing students. Teams violating this rule will be considered as disqualified and should quit the competition immediately. If communication is necessary, the committee may allow team members to communicate with others under supervision by tournament staff or by exchanging a note under permission by judges.
- 8.7. Any other situation which judges might consider as interference or violation of the spirit of the competition.

9. Fairness

- 9.1. By competing in WRO, teams and coaches accept the WRO Guiding Principles that can be found at: <https://wro-association.org/competition/wro-ethics-code/>
- 9.2. Every team needs to bring a signed copy of the WRO Ethics Code to the competition and hand it to the judges before the start of the competition.
- 9.3. If any of the rules mentioned in this document are broken or violated, the judges can decide on one or more of the following consequences:
 - a. A team may be given a time penalty of max. 15 minutes. In this time, teams are not allowed to do any changes on their robot and program.
 - b. A team may not be allowed to participate in one or more runs.
 - c. A team may get up to a 50% reduced score in one or more runs.
 - d. A team may not qualify for the next round (e.g. in case you have a competition mode with TOP 16, TOP 8 etc.).
 - e. A team may not qualify for the national / international final.
 - f. A team may be disqualified completely from the competition.

10. Internet solutions / Duplicate models and programs

- 10.1. If a team is identified as having a solution that is too similar to solutions (including hardware and / or software!) sold or posted online, or clearly not their own, the team will be subject for investigation and possible disqualification.
- 10.2. If a team is identified as having a solution that is too similar to another solution (including hardware and / or software!) at the competition, or clearly not their own, the team will be subject for investigation and possible disqualification. This includes solutions from teams of the same institution.
- 10.3. If a team is identified as having a solution (including hardware and / or software!) that is clearly not their own and might be designed by a non-team member, the team will be subject for investigation and possible disqualification.