

## REGULATIONS «LINE FOLLOWING»

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## 1. Introduction

The challenge of Line Following is considered one of the most popular robotics competitions in the world. In the international ROBOTEX competition, Line Following was implemented for the first time in 2010.

## 2. Objective

The task for line following robots is to drive through the track marked with a black line as fast as possible.

## 3. The Team - Eligibility for Participation

1. The competition accepts participation of teams and not individuals.
2. The team consists of two (2) – five (5) persons.
3. **Only one player** of category X is eligible to participate in a team of the immediate higher category. That is:
  - A player of category «4th – 6th Grade Primary» is allowed to participate in a team of category «Gymnasium»
  - A player of category «Gymnasium» is allowed to participate in a team of category «Lyceum»
  - A player of category «Lyceum» is allowed to participate in a team of category «University».
4. The opposite of the rule 3.3 above does not apply. That is, one player of category X is not allowed to participate in a team of any lower category. For example, a player that belongs in category «Lyceum» is not allowed to participate in a team of category «Gymnasium» or «4th – 6th Grade Primary»; a player in the «University» category is not allowed to participate in the category «Lyceum» or «Gymnasium» etc.
5. The coach of the team is not allowed to participate in the same competition with his/her team.
6. The team defines one of its members as a leader who will be responsible for the communication with the Organizing Committee, the judges, for the technical control process and for operating the robot during the competition.

## 4. Robotics Platforms

1. The competition is organized for the robot platforms ENGINO PRO, ENGINO Produino, LEGO EV3, LEGO SPIKE, ARDUINO, RASPBERRY Pi, ARM, ESP and EDISON.
2. Any references to "robot", from this point to the end of the document, include and refer to the robot platforms indicated in point 4.1 above, unless otherwise explicitly specified,

## 5. Categories & Levels

1. The competition is organized for the robot platforms indicated in section «4. **Robotic Platforms**» in the categories and levels shown in the table below:

**Table 1: Categories & Levels for LINE FOLLOWING Competitions**

Category/Level →	PRIMARY	GYMNASIUM	LYCEUM	UNIVERSITY	SPECIAL
Competitions ↓	4 <sup>th</sup> – 6 <sup>th</sup>				
Line Following (ARDUINO, RASPBERRY Pi, ARM, ESP & ENGINO PRO, ENGINO PRODUINO)	NOT APPLICABLE	✓	✓	✓	✓
ENGINO Line Following (ENGINO PRO, ENGINO PRODUINO)	✓	✓	✓		
LEGO Line Following (LEGO EV3, SPIKE)	✓	✓	✓		
EDISON Line Following	✓	✓	✓		

## 6. The Robot

1. The robot must be autonomous.
2. The maximum dimensions of the robot are (25 cm Width x 25 cm Length x 25 cm Height) and its mass 1 kg.
3. For confirmation of the specifications indicated in point 6.2 above, the robot will be weighted and must fit easily in a control box.
4. The control box has dimensions (30 cm length x 30 cm width x 30 cm height) plus two (2) millimetres of tolerance.
5. *The two (2) millimetres tolerance refers to the control box only and not to the size of the robot which is specified in the clause 5.2 above. Tolerance is given so that the robot can easily fit in the control box.*
6. The robot must be placed in the control box without exerting pressure on it.
7. The robot must always cover the line once it follows it; otherwise the race is considered to be failed.
8. The robot must not damage the field or endanger the spectators in any way.
9. It is forbidden to use higher voltage than twenty four (24) V in the robot.
10. The robot must have a start and stop button.
11. The body of the robot must entirely block the light beam of the time measuring system with a diameter of 3 mm at the height of 3 cm.
12. Additional requirements for LEGO robot:
  - The robot must be exclusively constructed with authentic and licensed parts of LEGO and TECHNIC.
  - The robot must use only batteries or cells that are recommended by LEGO, preferably rechargeable.
13. Additional requirements for ENGINO robot:
  - The robot must be exclusively constructed with authentic and licensed original ENGINO parts.
  - The robot must use only batteries or cells that are recommended by ENGINO, preferably rechargeable.
14. Additional requirements for EDISON robot:
  - The robot must be exclusively constructed with authentic and licensed original EDISON parts.
  - The robot must use only batteries or cells that are recommended by EDISON, preferably rechargeable.

## 7. The Field

1. The fields of the competition remain secret until the competition day. Participants are expected to take into consideration the details below and in the Appendix and develop a generic code that can perform successfully on any field.
2. The fields are white synthetic sheets.
3. The starting and finishing points of the field are the same.
4. The characteristics of the field for each robot platform are shown in the table below.

Competition	Robotics Platforms	Minimum Area (square meters)	Maximum Area (square meters)	Width of Black Line (Centimeters)	Type of Field
Line Following	ARDUINO & ENGINO PRODUINO	3	100	1.5	Open or Closed
LEGO Line Following	LEGO EV3 LEGO SPIKE	3	100	1.5	Open or Closed
ENGINO Line Following	ENGINO ERP & ENGINO PRODUINO	3	100	2.5	Open or Closed
EDISON Line Following	EDISON	3	100	2.5	Open or Closed

5. An «open field» is defined as the field whose starting and finishing points are located at different sides of the field, usually at opposite sites.
6. A «closed field» is defined as the field whose starting and finishing points are located at the same side of the field.
7. The line is being printed on the field with black ink or marked with a black tape.
8. The minimum turning radius of the line is zero (0).
9. The line is surrounded by twenty five (25) cm of free space on both sides, except on cross-sections.
10. The lines on the cross-section are perpendicular at least to the extent of twenty (20) cm.
11. To test the robots prior to the start of the competition, sample fields will be available to which the teams will have access for a specific time and according to a schedule to be

announced before the day of the event.

## 8. The Competition

1. Each robot runs alone in the field against the time.
2. An optical time measuring system will measure the time taken by the robot to complete the field during each attempt.
3. There will be three (3) rounds in the competition, the qualifying round, the semi-final round and the final round (best of the best).
4. In the qualifying round all teams will have to make two (2) attempts on the field.
  - The attempts will not be executed back-to-back, the first attempt for all robots will be completed followed by the second attempt.
  - All teams will make their first effort within a specific time frame that will be announced in the schedule of the event.
  - All teams will make their second attempt within a certain amount of time to be announced in the program of the event.
5. In the semi-final round the robots will have to make one (1) attempt on the field.
6. In the final round the robots will have to make one (1) attempt on the field.
7. It is the responsibility of the team leader to ensure that his/her team makes all attempts within the time framework specified.
8. The maximum duration of the field two (2) minutes. If the robot exceeds this time, it is assumed that the robot has failed in the attempt.
9. Between the attempts teams will have the ability to fix their robot and their code/algorithm.
10. Prior to each attempt, the relevant technical inspection will also be carried out, where required.
11. The robot should start moving within three (3) seconds after the referees have given the start command.
12. If the robot does not move within three (3) seconds, it is assumed that the robot has failed in the attempt.
13. The robot is not allowed to drive off the limits of the field. If it does, then the robot is considered to have failed the attempt.
14. The robot must always cover the black line while competing; otherwise the attempt is considered to have failed.
15. If the robot does not complete the field then the distance it covered from the starting point

until the point it stopped is recorded.

16. If the robot fails the attempt, then a DNF – DID NOT FINISH is recorded.

## 9. Declaring the Winning Team

1. Upon completion of the qualifying round for all categories (i.e Primary, Gymnasium, Lyceum, University, Special), ranking will be realized.
  - The ranking will be based on the shortest times of the robots in the two (2) attempts.
  - In case that no robots have finished any attempt, then the ranking will be based on the longest distance covered by the robots on the field.
2. Based on the ranking of the qualifying round, the first X teams of each category will be selected.
  - The number of X teams will be decided by the Scientific Committee taking into account the total number of teams participating in the competition.
  - The X teams will be promoted to the semi-final round.
3. In the semi-final round, robots will have one (1) more attempt on the field.
4. Upon completion of the semi-final round, a new ranking will be realized.
  - The ranking will be based on the point 9.1 above, considering, however, the attempt in the semi-final round.
  - The first robot in the ranking is considered the winner and will be promoted to the final round.
  - In case of a tie in the semi-final round, all robots in the tie will be promoted to the final round.
5. In the final round, robots will have one (1) more attempt on the field.
6. Upon completion of the final round, a new ranking will be realized.
  - The ranking will be based on the point 9.1 above, considering, however, the attempt in the final round.
7. The winner is the robot ranked first in the ranking of the final round.
8. In case of a tie in the final round, then the procedure described in points 9.5 - 9.7 above is repeated for the robots that are in a tie, until a winner can be declared.



## **10. Terms and Conditions of Participation**

1. Participation in ROBOTEX CYPRUS assumes and requires acceptance of all terms and conditions for participation by competitors, the coaches and the organizations they represent.
2. In case of any difference in the competition rules between the English and the Greek versions, the English version is considered as correct.
3. The robot must be registered before the competition. The registration process includes technical inspection of the robot, marking the robot with a number sticker, and the order in which it will compete which is generated by an algorithm in the information system supporting the ROBOTEX CYPRUS organization.
4. In this challenge, there are two (2) judges. An additional head judge may also be present to supervise the whole process.
5. All questions and issues that may arise during the competitions must be reported to the judges.
6. The final decision about objections will be taken by the judges in cooperation with the organizers.
7. Judges' decisions on any objections are considered final and can't be challenged by participants, the coaches or the organizations they represent.
8. In the case of a deliberate alteration or change of marking of the unique number of robots, the coach and his team will be automatically expelled from the event. As a result, they will not be able to take part in any other challenge they may have enrolled. The coach and his team will leave the venue immediately. The coach also loses the right to take part in the next ROBOTEX CYPRUS event and is automatically excluded from participating in ROBOTEX INTERNATIONAL in case one of his/her teams has won a ROBOTEX CYPRUS competition. The Organizing Committee reserves the right to publicly announce the coach, the team and its members.
9. It is expected that both the coaches and the members of the teams will exhibit a spirit of noble rivalry and will behave with mutual respect, decency and esteem both to themselves and to the organizers, judges and volunteers. The behaviour of all coaches and team members should promote "fair play". Therefore, the Organizing Committee reserves the right to expel anyone from the venue of the event who violates the above principles of good practice.

## **11. Robot Technical Control**

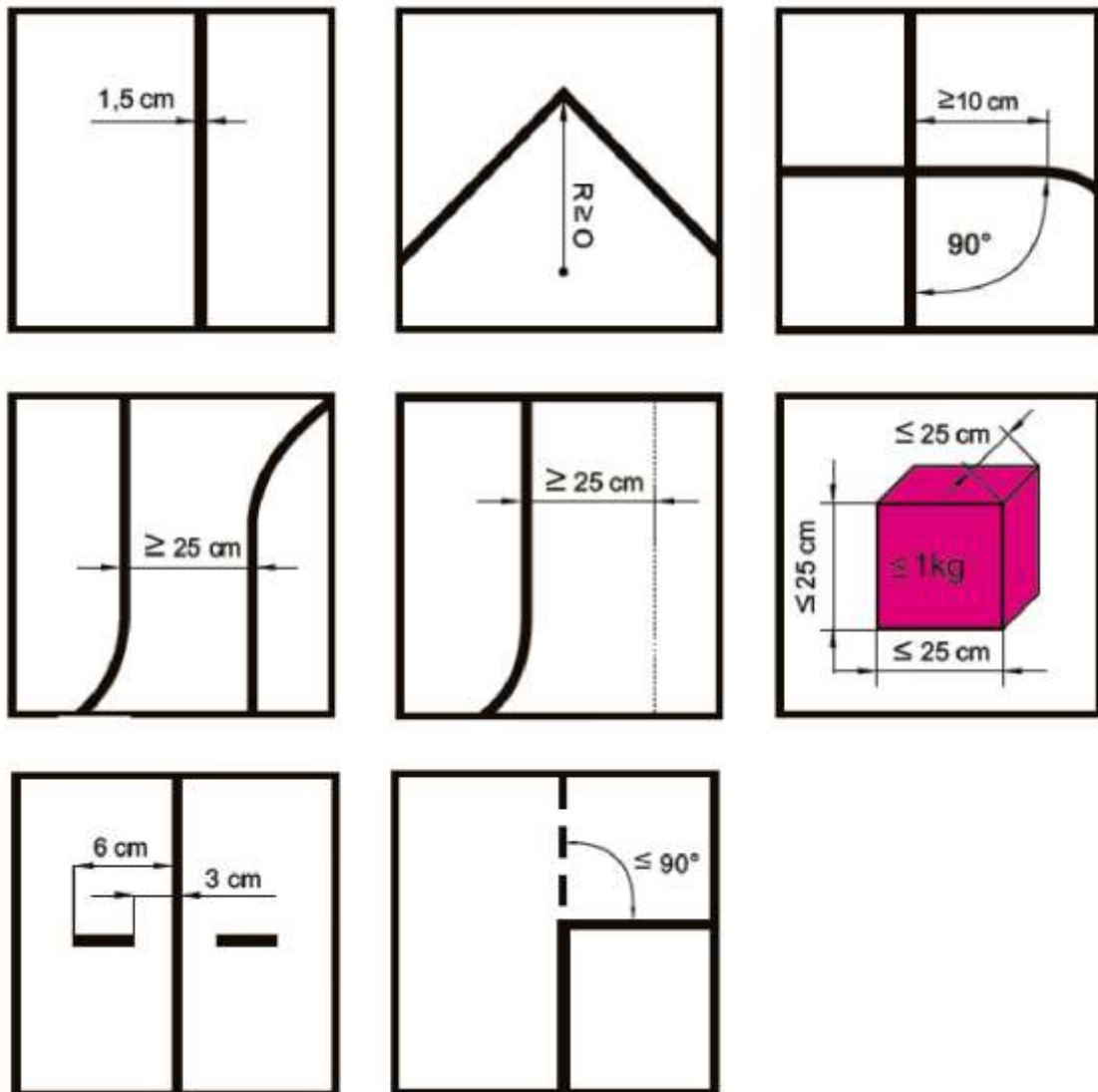
1. An initial technical control of the robot technical control will take place on the day of the competition at an area and on time specified by the organizers.
2. Technical control takes place before each phase of the competition (preliminary, qualifying, final) in which the team may participate.
3. Failure of a team to come in time for a robot's technical check leads to the team being excluded from the event.
4. The leader of the team only is responsible to take the team's robot for technical control.
5. Technical control includes the control of the robot based on the above and the section «**6. The Robot**». If the robot does not meet the requirements it will not be accepted to compete and will automatically be disqualified from the event.

## **12. Changes and Cancellation of Rules**

1. Any changes and/or cancellations in the rules of the competition are decided by the Cyprus Computer Society in consultation with the Organizing Committee of ROBOTEX CYPRUS. You may address comments and suggestions to the Organizers at [robotex@ccs.org.cy](mailto:robotex@ccs.org.cy).

**APPENDIX – DETAILS OF THE LINE FOLLOWING FIELD**

2.5cm for **ENGINO**  
and **EDISON**. 1.5cm  
for all other platforms



**Figure 1: Technical Characteristics of Line Following Field**