

## REGULATIONS «ENGINO SUMO, LEGO SUMO & MINI SUMO»

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## 1 Introduction

This document describes the regulations for the SUMO competition, a unique and special challenge in robotics competitions. They have been adopted from the “Baltic Robot Sumo” and adjusted accordingly.

## 2 Objective

Two robots are competing in a special battle field with the objective to manage to push each other outside the field and be declared a winner.

## 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.
  - In ROBOTEX INTERNATIONAL in Estonia the team may consist of up to three (3) players. So, in case that the team wins in ROBOTEX CYPRUS, the team may be allowed to register up to three (3) players in ROBOTEX INTERNATIONAL. This remains to the discretion of the ROBOTEX INTERNATIONAL Organizers.
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 «4<sup>th</sup> – 6<sup>th</sup> 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».
  - A player of category «University» is allowed to participate in a team of category «Special».
4. The opposite of the rule 3.4 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 «4<sup>th</sup> – 6<sup>th</sup> Grade Primary » or «1<sup>st</sup> – 3<sup>rd</sup> Grade Primary».
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

communicating with the Organizing Committee, the judges, for the technical control process and for operating the robot during the competition.

- All members of the team must follow the competition rules, the terms and conditions of winning and participate using only self-made autonomous robots at the Dohyo area designated beforehand.

## 4 Categories & Levels

The SUMO challenges are organized for the platforms, categories and levels shown in the table below.

**Table 1: Challenges & Categories**

Category →	Primary 4 <sup>th</sup> – 6 <sup>th</sup>	GYMNASIUM	LYCEUM	UNIVERSITY	SPECIAL
MINI SUMO (ARDUINO, RASPERRY Pi, ARM, ESP)	NOT APPLICABLE	√	√	√	√
ENGINO SUMO (ENGINO GINOBOT, ENGINO PRO, ENGINO Produino)	√	√	√		
LEGO SUMO (LEGO EV3, LEKO SPIKE)	√	√	√		

## 5 The Competition

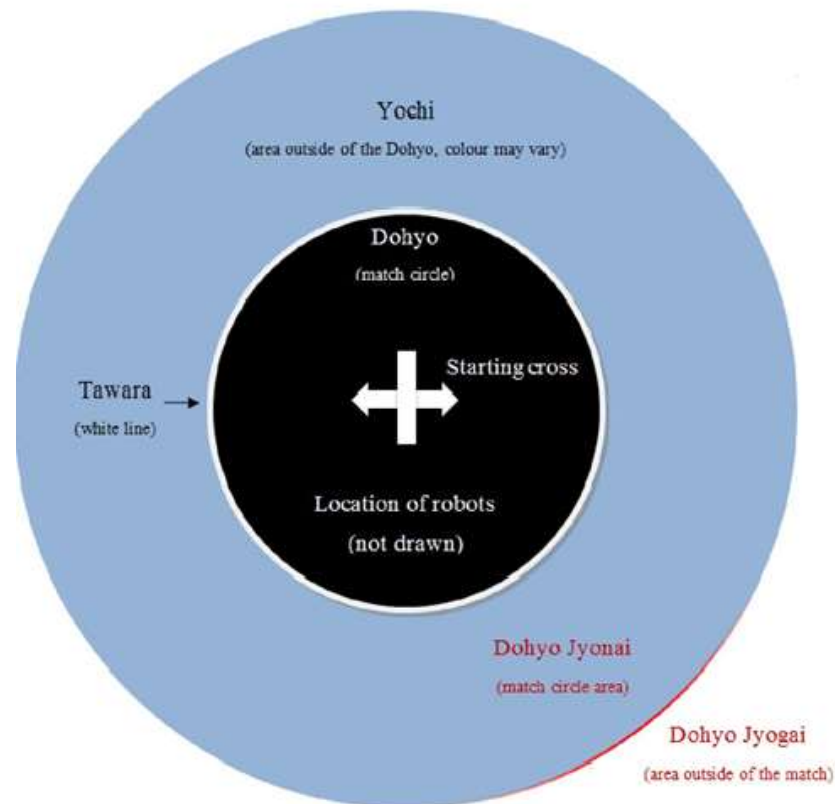
- The competition format is established by the Organizing Committee depending on the number of participants. If the number of participants is high, sub-groups will be used in order to decide who enters the final tournament. The finals are held in the format of double-elimination tournament. If the number of participants is low, all contestants will immediately compete in the format of final tournament.

## 6 Important Definitions

Due to the unique terms used in the Sumo competitions the terms are defined accordingly and used accordingly.

### 6.1 Dohyo Jyonai

Dohyo Jyonai (the match ring area) consists of the Dohyo (the match circle) and the Yochi (the outer layer area of Dohyo). The rest of the space will be deemed as area Dohyo Jyogai (outside the Dohyo area). The area of Dohyo Jyogai is surrounded by guards (see Annex 1. Figure of match area). The Dohyo (the match circle) is a circle that is that is covered with a black colour coating.



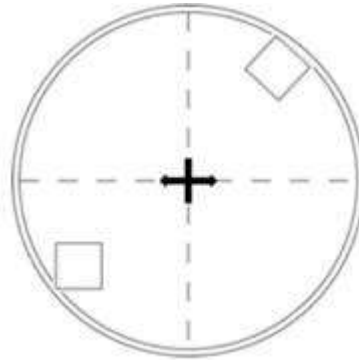
**Figure 1: Dohyo Jyonai – Battle Field**

**Table 2: Field Parameters**

Competition Type	Height	Diameter	Material
MINI SUMO	1 - 5 cm	77 cm	Wood or Plastic
ENGINO SUMO	1 - 5 cm	77 cm	Wood or Plastic
LEGO SUMO	1 - 5 cm	77 cm	Wood or Plastic

## 6.2 Starting Cross

The starting cross is placed in the middle of the Sumo field and it divides the field into four equal sectors. The robots must be always located in two reciprocal sectors (see Figure 2). The robot must cover the area of Tawara (white line) at least partially. The referee removes the starting line from the field once the robots have been fixed. Once the robot has been fixed, it cannot be moved anymore.



**Figure 2: Starting Cross**

## 6.3 Tawara (White Line)

Tawara is the white line around the Dohyo. Tawara line is a part of the Dohyo.

**Table 3: Dimensions of Tawara by competition classes**

Class	Width of Tawara
MINI Sumo	2.5 cm
ENGINO Sumo	2.5 cm
LEGO Sumo	2.5 cm

## 6.4 Yochi

Yochi is an area around the Dohyo with a diameter of at least 100 cm for all sumo competitions (ENGINO SUMO, LEGO SUMO and MINI SUMO). Yochi colour and material can be freely chosen from all colors besides white.

## 7 The Robot

### 7.1 Requirements for the Robot

1. Limitations on Dimension & Weight

**Table 4: Limitations on Dimension & Weight**

Competition	Mass	Length*	Width*	Height
ENGINO SUMO	1.2 Kg	22 cm	22 cm	Unlimited
LEGO SUMO	1 Kg	15 cm	15 cm	Unlimited
MINI SUMO	0.5 Kg	10cm	10 cm	Unlimited

2. The robot may expand after the start of the round, but must stay in one piece.
3. An Infrared sensor has to be placed on top of the MINI SUMO robot, not on the side or under the robot
4. In order to confirm the specifications of the robot, the robot will be weighted and must easily fit within the measurement control box.
  - The size of the LEGO SUMO robot measurement control box is 15 x 15 cm with 2 mm tolerance. The size of the ENGINO SUMO robot measurement control box is 22 x 22 cm with 2mm tolerance. This practically means that for LEGO SUMO only robots with maximum length and width of 15cm accepted to compete while for ENGINO SUMO the acceptable robots must have dimensions 22 x 22 cm. ***It is emphatically noted that the 2 mm tolerance refers to the measuring/control box and not to the robot.***
  - The size of the MINI SUMO robot measurement control box is 10 x 10 cm with 2 mm tolerance. This practically means that only robots with maximum length and width of 10cm will be accepted to compete. ***It is emphatically noted that the 2mm tolerance refers to the measuring/control box and not to the robot.***

### 7.2 Autonomous robots – Starting the Movements

**Table 5: Starting the Movements of Autonomous Robots**

Competition Type	Starting method
MINI Sumo	Official infrared remote control operated by the referee. See the technical specification of the compulsory receiving device in “ <b>Appendix - Start and Stop Remote Control System</b> ”.
ENGINO SUMO & LEGO Sumo	The signal is given by a 5-second timer. The timer can be activated by the operator of the robot by pressing a button or via remote control system.





### 7.3 Autonomous robots – Ending the Movements

**Table 6: Stopping the Movements of Autonomous Robots**

Competition Type	Stopping method
MINI Sumo	<p>The referee stops the robots by using official infrared remote control. See the technical specification of the compulsory receiving device in “<b>Appendix - Start and Stop Remote Control System</b>”.</p> <p>Additionally, the operators of the robot can use their remote controls to stop the robot.</p>
ENGINO SUMO & LEGO Sumo	<p>The operator of the robot stops the robot by pressing a button or via remote control system.</p>

### 7.4 Movements of autonomous robots

The movements of the robot should be designed to detect the movements of the opponent and respond/attack accordingly. If there is any doubt in the autonomy of the robot, the referees have the right to inspect the control logic of the robot.

### 7.5 Use of remote control devices with autonomous robots

During the competition (round), the remote control devices must be placed on a previously designated area. The devices may only be used to stop the robot, when the referee gives a corresponding command. The official infrared remote control device is held by the referee.

### 7.6 Prohibited Components of the Robot

1. Any components that may damage or scratch the surface of Dohyo. An exception is when the robots collide.
2. It is forbidden to use any liquids, powders and gas as a weapon against the opponent.
3. It is not allowed to use any inflammable materials in the robot.
4. The robot must not include any throwing devices (i.e throwing a net on opponent).
5. The robot must not include any parts, which fix it onto the Dohyo (for example, glues, magnets, suction cups, etc.).

### 7.7 Additional Requirements

1. The LEGO SUMO robot must be exclusively constructed of the licensed original parts of LEGO or HITECHNIC.
2. The LEGO SUMO robot must use only batteries or cells that are recommended by

LEGO, preferably rechargeable.

3. The ENGINO SUMO robot must be exclusively constructed of the licensed original parts of ENGINO.
4. The ENGINO SUMO robot must use only batteries or cells that are recommended by ENGINO, preferably rechargeable

## 8 The Match

1. The match generally contains three rounds and lasts up to three minutes. The team who earns two Yuko points (effective points) first during the time of the match will be the winner. Match time is measured during rounds, not between them.
2. If only one Yuko point has been earned by the end of the match time, the winner is the team who earned it.
3. If neither team wins any rounds during the match time, the winner will be announced according to the situation of Yusei (dominance), see paragraph 8.3. If Yusei cannot be decided or the number of rounds that has been won is the same for both teams, the match time will be extended by three minutes. If one team earns one or more Yuko points during the extended time, then this team will be the winner.
4. The contestants have a maximum of 30 seconds between the rounds to maintain their robot.

## 9 Organizing the Competition

### 9.1 Safety requirements

For safety purposes, the referees and contestant must wear gloves and goggles according to the robot class.

**Table 7: Safety requirements**

Competition Type	Gloves
MINI Sumo	Required
ENGINO Sumo	Not Required
LEGO Sumo	Not Required

### 9.2 Starting the match

The match starts according to the referee's signal. The contestants will bow to each other before they enter the area of Dohyo Jyonai.

Before each round and according to the signal of the referee, the contestants place their robots simultaneously on the Dohyo. The robots must be placed in reciprocal sectors and at least some part of the robot must stay on the white line (see Figure 2 Starting Cross). The robots are not allowed to move after they have been placed on the Dohyo.

The round begins as follows:

- After the signal of the referee, the operators start the 5-second timer in the robot and immediately leave the area of Dohyo Jyonai. The robots may start moving 5 seconds after they have received the start command.

In case the Dohyo area is scratched or becomes dirty, the referees decide whether to continue the match on the same Dohyo or replace it.

### **9.3 Ending the Match**

The referee gives a signal to end the match and stop the robots. The match ends officially after a corresponding signal from the referee. The participants must take their robot from the Dohyo, bow to each other and leave the area of Dohyo Jyonai.

### **9.4 Torinaoshi - Repeat of the Round**

The round is repeated in the following situations.

1. Both robots are facing each other and their movement is hindered or it does not happen.
2. Both robots fall out of the Dohyo at the same time.
3. Other situations in which it is not possible to determine who has won and lost.
4. If it is not possible to announce the winner after Torinaoshi, the referee may place the robots himself or herself and continue with the match within the allocated time.

### **9.5 Handling the Robots between the Matches**

For the time between the matches in the same sub-group, the robots must be placed on a table given for it and can be removed from there only for the duration of the match. It is forbidden to leave the competition area with the robot between the matches, except for when a corresponding permission has been given (e.g. the robot needs fixing). The purpose of this requirement is to guarantee the smooth course of the competition.

NB! If the robot can't be found from the designated table at the right time or if the team itself is not present, the match will result in a loss.

## 10 Points in Sumo

### 10.1 Yuko (Effective) Point

The winner is announced in the following situations.

1. If the opponent has been pushed out of the Dohyo (the robot touches the area outside of the Dohyo).
2. If the opponent falls out of the Dohyo and touches the area outside of the Dohyo.
3. In the situation of “Shinitai”.
4. In the situation of “Yusei (Dominance)”.
5. If “Keikoku” (Warning) is given twice to the opponent.
6. If there is a case of “Hansoku” (Violation).
7. If the winner is announced without a match, the winner earns two Yuko points (if the winner already has one Yuko point, he or she earns only one more). The existing Yuko point(s) of the opponent who lost remain effective.

### 10.2 Shinitai

The «Shinitai» situation means that one or several wheels of the robot roll out of the Dohyo and the robot is unable to return to the Dohyo. In this case, the opponent earns one Yuko point.

### 10.3 Yusei (Dominance)

In the «Yusei» case, the referee may grant a Yuko point to the team according to the strategy, movements and skills of the robot.

## 11 Violations and Penalty

### 11.1 Keikoku (Warning)

1. A contestant who acts as indicated below gets a Keikoku» (Warning/Προειδοποίηση). If the contestant gets two Keikokus (warnings), the opponent earns one Yuko point.
2. If the operator or some item of the operator ends up in the area of Dohyo Jyonai before the round ending signal of the referee.
3. If the robot moves before the beginning of the round (movement or changing its shape).
4. If the participant violates the requirements for the use of remote control.
5. If the robot is replaced after it is placed on the Dohyo.
6. If the participant does not comply with the safety requirements.
7. In case of any other action that is considered unfair.

### 11.2 Hansoku (Violation)

In the following situations the opponent or both parties earn one Yuko point.

1. If some part falls off from the robot.
2. If the robot does not move.
3. If both robots move, but do not collide.
4. If the robot is on fire or a situation, which resembles that the robot is on fire.
5. If the participant wants to end the round.

### 11.3 Hansokumake (Defeat due to Violation)

The participant/team that violates the following rules loses the match due to violation.

1. If the contestant fails to show up at the designated Dohyo at the beginning of the match or the participant exceeds the time given for maintenance, see paragraph «8. The Match».
2. If the contestant sabotages the match. For example, deliberately breaking or deforms the Dohyo.
3. If the operator of the robot violates any of the clauses of the paragraph «11.4 Sikkaku».
4. If the robot does not make autonomous movements.
5. If the participant does not comply with safety requirements even after «Keikoku»

(warning).

#### **11.4 Sikkaku (Disqualification)**

In the following cases, the team will be disqualified and its members must leave the competition and is not added to the list of competition results.

1. If the participant's robot does not comply with the requirements provided for in paragraph «**5.1 Requirements for the Robot**».
2. If the participant behaves in an undignified manner. For example, swears or offends the opponent or the referees.
3. If the participant deliberately injures the opponent.

### **12 Suspending the Match**

1. If the participant is injured and the match cannot be continued, the participant may demand the suspension of the match.
2. In the event of the previously described situation, the referees make necessary arrangements for the match to be immediately resumed.
3. If the arrangements do not enable the match to continue, the opponent wins the competition without a match.

### **13 Objections**

The decisions of the referees are not subject to appeals. In case of any conflicts or disputes, the final word will be said by the referees and/or the organisers.

### **14 Marking of the Robots and Participants**

#### **14.1 Markings on the Robot**

The robots must be marked with number stickers. The stickers are provided by the organisers of the competition.

#### **14.2 Participant Marking**

It is recommended that the members of the team wear the same t-shirt so that they distinguish themselves from the members of other teams. The selection of colors is free. It is also recommended that the logo of ROBOTEX CYPRUS is placed on both sleeves.

On competition day, participants will receive a special participation card with their personal details. Participants must wear this card during the whole duration of the competition.

## 15 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.



## 16 Robot Technical Control

1. An initial technical control of the robot 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 paragraph "7. 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.

## 17 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 - Start and Stop Remote Control System

The same start and stop remote control system applies to ROBOTEX CYPRUS Sumo as used in the competitions of RobotSM and RobotChallenge. The aim of the system is to ensure fair and quick start of the round. For safety purposes, the system is equipped with a stop switch. Using one and the same control system in different competitions is convenient for the participants.

The system is based on the infrared transmitter, which is operated by the referee, and on infrared receivers, which are located on top of the robots. The protocol used for the infrared transmitter is RC-5. RC-5 code is a Manchester coded bit stream modulated at 38 kHz. Message payload consists of a 5-bit address and a 6-bit command, which contains the remote commands (programming, start and stop) and Dohyo ID. Dohyo ID is used to differentiate close matches that take place at the same time.

The following table lists the remote commands and their respective payload content:

**Table 8: Remote Commands**

Command	RC-5 message field
Programming	Address[4..0] = 0x0B, Command[5..1] = Dohyo ID
Start	Address[4..0] = 0x07, Command[5..1] = Dohyo ID, Command[0] = 1
Stop	Address[4..0] = 0x07, Command[5..1] = Dohyo ID, Command[0] = 0

The programming commands are used in order to write a new Dohyo ID in the infrared receivers of the robots immediately before the match. The infrared transmitters of the referee are equipped with separate low-power IR LED in order to ensure that only nearby robots could receive specific commands. The programmed Dohyo ID is used with a purpose to filter start and stop commands.

Start and stop commands have the same message address, however, only the first bit of the command field is used to determine the action. The infrared receivers of the robot must verify that the Dohyo ID of the message is the same as the one programmed into the robot and take corresponding action if it is the same.

The components of the infrared receiver must be placed on top of the robot in a way that the robot is able to receive the messages from any direction.

The robot or infrared receiver must be equipped with clearly visible LEDs in order to verify whether it has received the command of the infrared transmitter of the referee or not. In case of a programming command, the LED must quickly flash twice. If the robot receives the start command, then the LED flashes constantly; if it receives the stop command, it starts to flash slowly. More information about the remote control system can be found here: <http://www.startmodule.com>.