IEEE Latin American Robotics Competition for Student

RULES OF SEK Category – 2015/2016

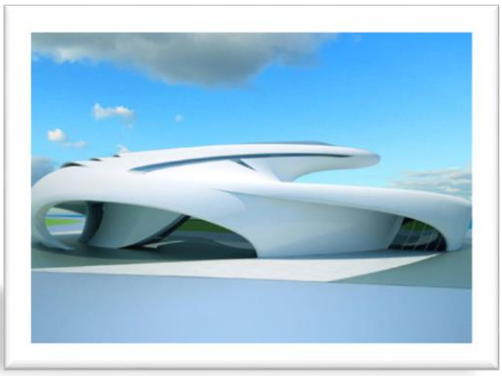
Version 2.2 – February, 2016

INTRODUCTION

In a galaxy very far from the planet Earth, three nations have been living harmoniously in DIRTO planet for years. In this planet is never night, as there are two suns, LE-1 and LE-2, which provide light and heat all the time. Therefore, the inhabitants cannot get much time out of the CLOCLONS, which are protected environment where the inhabitants can preserve themselves from the constant radiation from the SV rays - Single Violet, a variation of the UV - Ultra violet found on Planet Earth.

The 3 nations that live in DIRTO planet are: **S**IMU, **E**SITU and **K**IEFA. The ESITU Nation, from a distant planet XODOS, has an extreme white skin which is very sensitive to radiation from the sun. The SIMU people, originally native of URGEY planet, have a black color skin that protects them from the sunlight, however it absorbs SV very quickly when exposed to the sun, which may cause diseases. Finally, the KIEFA nation is native of the DIRTO planet and they have a bright red skin, fully adapted to the suns of the planet.

Nations came together in DIRTO planet to help the natives KIEFAs. They were created under continuous sunlight, but they cannot get around in cool and dark places. When in these environments, they soon hibernate and stand still for years. The problem is that the planet DIRTO can only survive if there is exploration of FIUTA crystal, that can only be found in cold and dark circular caves. This crystal is essential for food production in the DIRTO planet since it can filter the SV-ray which damages the seeds. Since SIMU nation is specialized in dark places and they could perform the extraction of the crystal from the caves, the KIEFA´s created the CLOCLONS that are large areas of FIUTA exploration protected from sunlight. The ESITU nation helps in the scientific and technological development of the region and, together with the SIMUs, they produce inputs from the crystals collected inside the CLOCLONS.



Clocons
safety . research . future

An effort of friendly nations:

SIMU
ESITU
KIEFA

Everything was going well on the planet. KIEFA was responsible for external work of CLOCLONS whereas ESITU and SIMU nations were responsible for production inputs within the CLOCLONS. However, about 1 year ago, ESITU discovered through an intense scientific research that the sun LE-1 will emit a large amount of radiation that will extinguish ESITU and SIMU nations even if they are within the CLOCLONS. The radiation will pass through walls and reach the underground caves of the planet as well. Even the KIEFA would not survive. The radiation will reach underground parts of the planets with lesser intensity, and although it will be still lethal to the SIMU and ESITU nations, KIEFAs have a good chance of survival to the powerful energy LE-1 if they are within the circular cold dark caves existing in CLOCLONS. However, they will need help to enter to the deeper part of dark and cool caves.

Despair gripped the foreign nations because they need to be rescued and taken back to their home planets and KIEFAS need to hide in caves. They set a very audacious plan, with a great chance of success. The idea is that the SIMU and ESITU would help KIEFAs to hide in the caves of CLOCLONS, and soon after, the SIMU and ESITU would be rescued by robots and they would be taken to large spacecrafts back to their planets. Two outlets were prepared, one green and one blue, so that SIMU gather in one and the ESITUs on another, from where they would be properly rescued. The colors serve to help the nations going properly to their spaceships because the ESITUs would not survive on the planet of SIMUs because of the full nitrogen atmosphere neither the SIMUs would survive on the planet XODOS due to the excessive moisture. Therefore, they could not take the wrong spacecraft. Once the radiation from LE-1 has lowered, they would return and awake the KIEFAs from hibernation. A delicate but a well prepared plan.

Three days before the radiation was emitted, the plan was put into action and all KIEFAs were properly placed in the cave and went into hibernation. However, when SIMU and ESITU were still preparing everything within CLOCLONS to go to the rescue sites, the planet's energy has completely exhausted, presumably due to increased solar intensity of LE-1 that was about to appear on the horizon. This situation was not foreseen, and in the dark, the SIMUs and ESITUs could not reach the rescue sites and would be killed by the LE-1 radiation soon.

An emergency action was implemented. Robots scheduled for rescue were reprogrammed to come inside the CLOCLONS to find and rescue all SIMUs and ESITUs. However, each robot must rescue people of only one nation, so they can be taken to the correct spaceship. And they cannot, in any hypothesis, rescue or get the KIEFAs out of the caves, otherwise they will die. Each robot must get in an unknown location, carrying a flag or an ID of its site color (green for SIMU and Blue for ESITU). Time is short, the place is unknown and desperation takes hold in the entire planet.

CHALLENGE

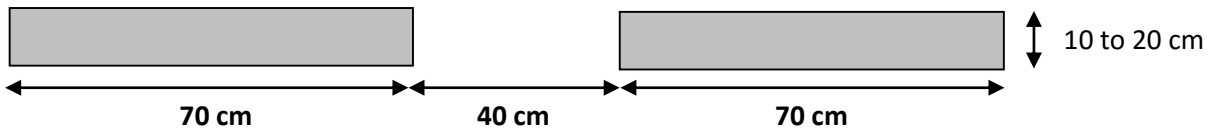
Build a robot to explore the environment of a CLOCLON and rescue the inhabitants of a nation as the rescue color designated to the robot. Luckily, the CLOCLONs are well designed and all have 5 well-defined modules, although they have slight configuration differences. Your robot will compete against another robot, created by another team, in the arena.

Over the last 3 days, the robots should enter in different CLOCLONS and rescue SIMUs and ESITUs, leaving the KIEFAs within the circular caves. As time is short, two robots, each from different teams, must enter the CLOCLON simultaneously, each seeking to rescue a specific nation (ESITU or SIMU). The best robots will be scaled to other CLOCLONS to remain the top two for the final CLOCLON in order to maximize the rescue.

Arena - CLOCLON

The arena of the challenge represents a CLOCLON. It is composed by 5 independent modules, connected by wooden dowel pins that allow different CLOCLONS designs.

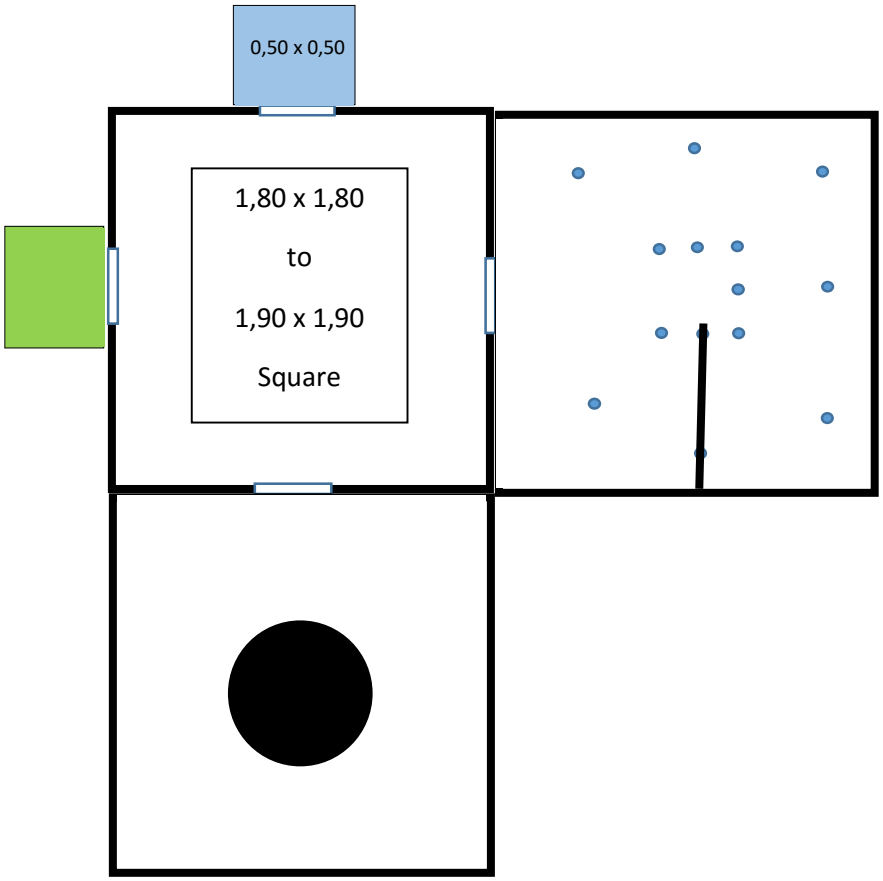
The main module, called Central, is a wooden white MDF platform necessarily SQUARE, that can measure from 1,80m x 1,80m to 1,90m x 1,90m, with walls of 10 cm to 20 cm in white MDF. Each wall has a "gate" which is an opening of 40 cm (+/- 1cm) centered.



There are two peripheral and rectangular or square modules containing at least one side with the same lateral size of the main module. They also range from 1,80m x 1,80m to 1,90m x 1,90m. One side does not contain a wall and the other 3 sides contain walls of 10cm to 20cm high, with no opening or door.

One of these peripheral modules will have a centered black circle with a diameter that can vary from 50cm to 70cm, representing the dark and cold circular cave. The other peripheral module will have little holes in the ground for coupling walls of 10 cm height, as further specification.

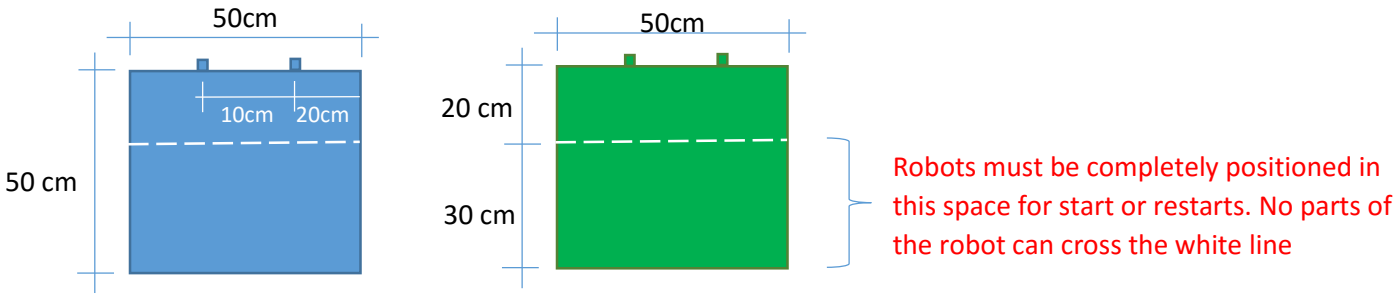
The last two modules are entrance modules for the robots. They are square of about 50cm x 50cm in MDF, one in green color and the other is blue.



Each door will have a black tape on the floor (Suggestion: Isolation Tape of 3M® width of 18mm)

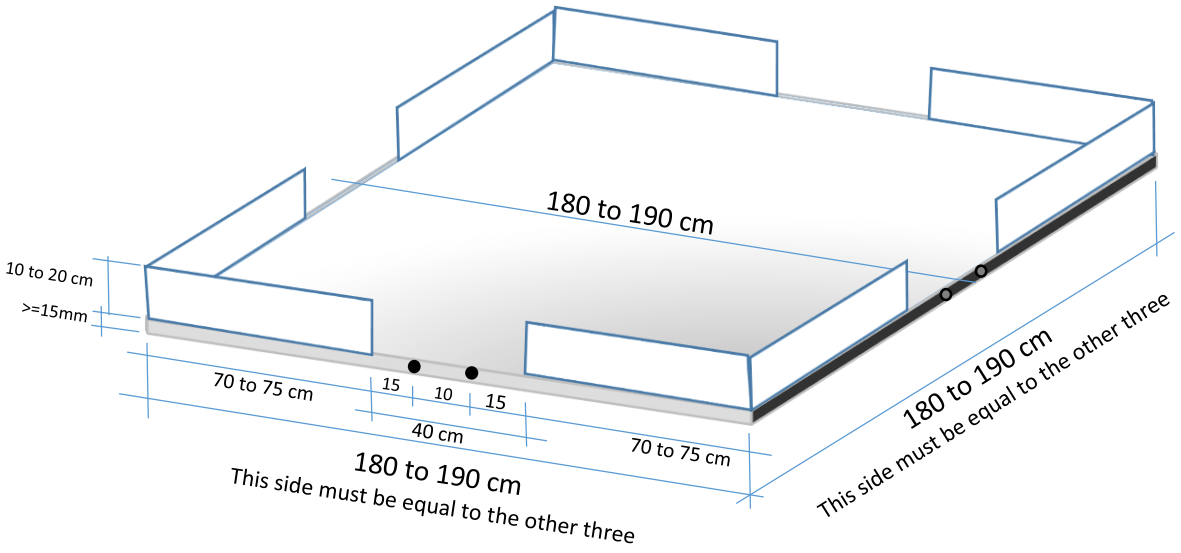
ENTRANCE MODULES (2 units)

There will be two square modules of 50cmx50cm, one in blue, and the other in green, both made of MDF greater than 15mm (1.5 cm) of thickness. Two wooden dowel pins must be placed on one side of each module for engagement of these modules in the central module. The pins must respect the distance of 10cm from each other. Each entrance module will have a dotted (or thin straight) white line distant 20cm from the entrance. This white line will delimit the space from where the robot must start or restart its rescue journey.



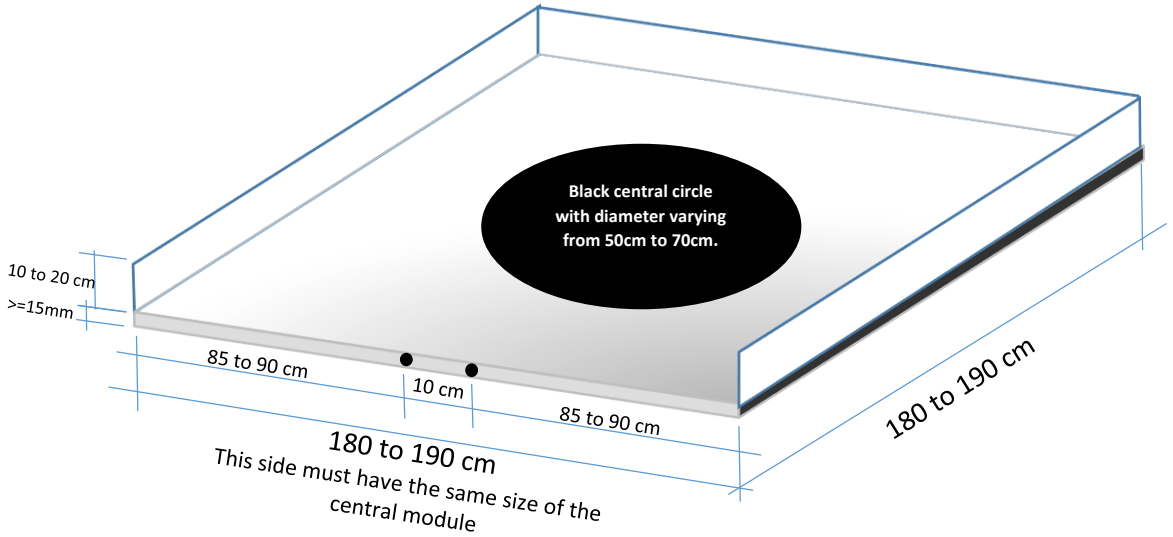
CENTRAL MODULE (1 unit)

It is a white wooden platform of MDF with a thickness greater than 15mm necessarily square. It can measure from 1.80m x 1.80m to 1.90m x 1.90m with walls of 10cm to 20cm height also in white MDF. Each wall has a "gate" that is an opening of 40 cm (+/- 1cm) centered. Each port has two inlet holes for wooden dowel pins of the peripheral modules with a 10 cm of distance between them.



CAVE MODULE (1 unit)

This module can be square or rectangular. One side must necessarily have the exact size of the side of the central module. This module can range from 1,80m x 1,80m to 1,90m x 1,90m. The side with the same central module size does not contain a wall and the other three do contain a wall of 10cm to 20cm high, without any opening. The side without wall has two centralized wooden dowel pins with a distance of 10 cm between them. This module must have a central black circle, made of black paper, painted with black ink or black tape. The diameter of the black circle must be between 50cm and 70cm.



WALLS MODULE (1 unit)

This module can be square or rectangular. One side must necessarily have the exact size of the side of the central module. This module can range from 1,80m x 1,80m to 1,90m x 1,90m. The side with the same central module size does not contain wall and the other three contains a wall of 10cm to 20cm high, without any opening. The side without wall has two centralized wooden dowel pins with a distance of 10 cm between them.

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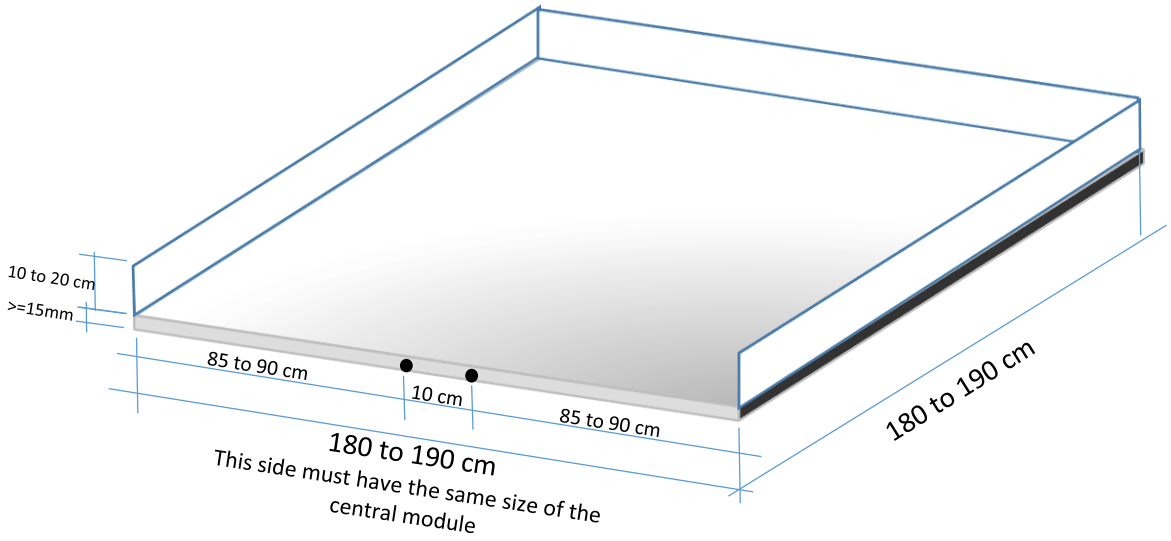
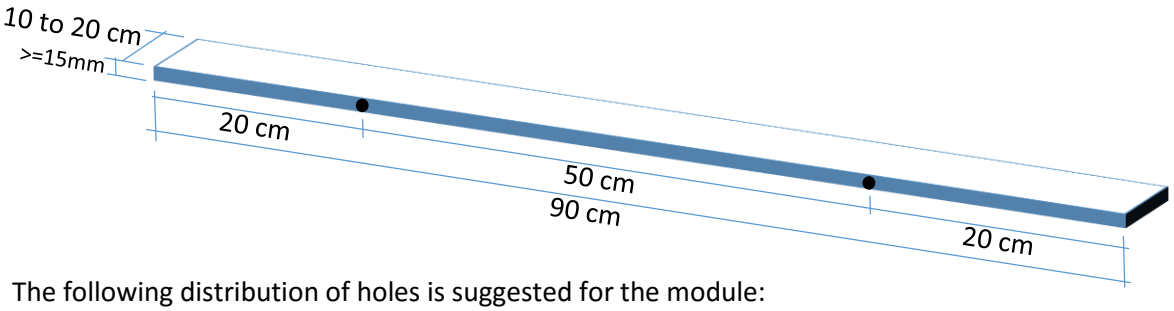
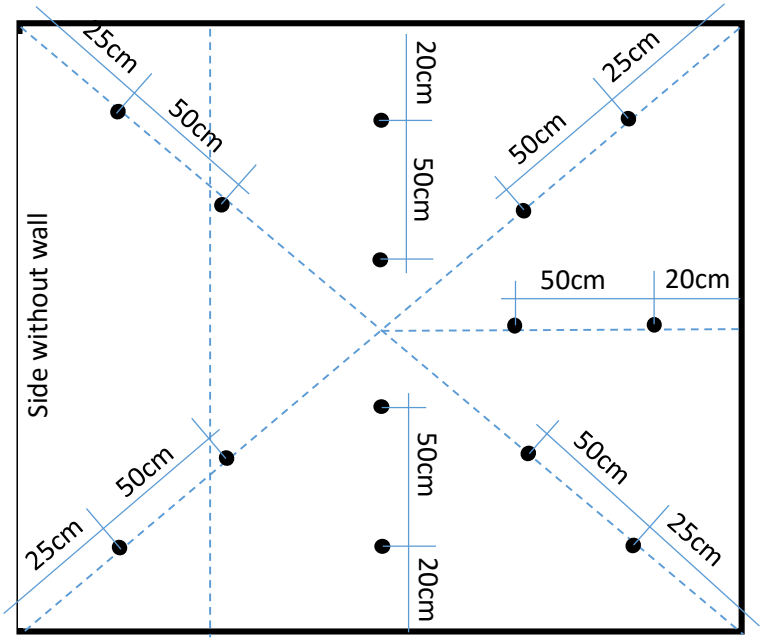


This module should contain holes that allow fitting walls of 10cm to 20cm to the platform. These inner walls have a size of approximately 90cm, with the same thickness of the wall of the module. They are white MDF with two holes for pins, as below:



The following distribution of holes is suggested for the module:

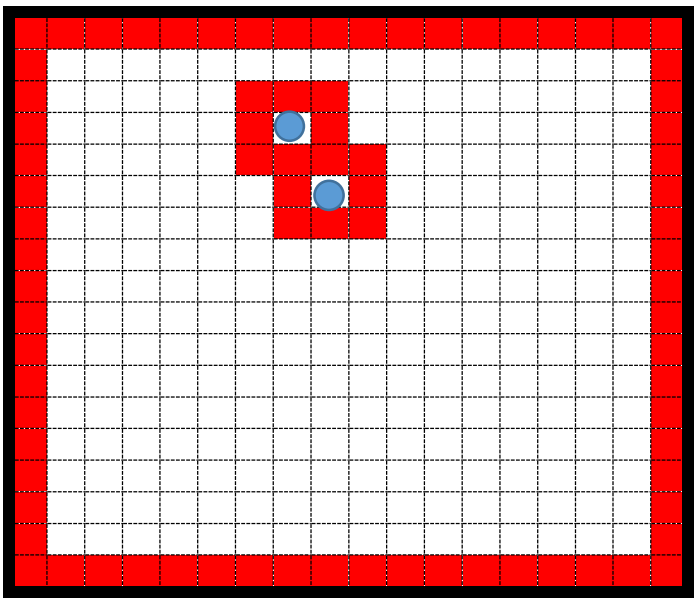


STARTING THE RESCUE

All information the rescue team has is that there are 6 KIEFAs inside the CLOCLON. All of them are within the black circle at a distance of at least 10 cm from the edge.

The other inhabitants of CLOCLONS, the SIMU and ESITU, can be anywhere **(central module, walls module or cave module)** distant at least 10 cm from the others and 10cm from the wall. What is known is that in each CLOCLON the robot can find at least 10 and most of 20 members of each nation, in equal numbers. This means that there are 15 ESITU in a CLOCLON, it must be sure that 15 SIMU will also be there.

The teams have 5 minutes for calibration before the rescue starts and only after the calibration, the judge will decide where each member (humanoid) will be placed in the arena and which team will be responsible to rescue SIMU members and which robot will be responsible to rescue ESITU members. The arena configuration must be unkown by the teams before the robots be ready to start.



Red color marks the area where the humanoids (represented by blue circles) cannot be placed.

The modules can have thin and gray marks (made by a pencil for instance) that create a little square of 10cm x 10cm. These marks will help to determine the right place of the humanoids inside each module, by clearly show where is prohibited to place humanoid for the rescue by avoiding the first squares near by the wall and the squares adjacent to an existing humanoid.

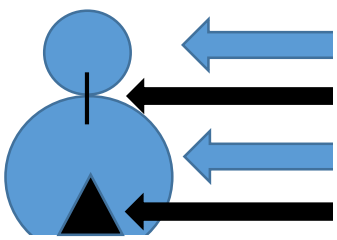
NATIONS

All three nations have humanoid shape about 10cm high, ranging from 8cm to 12cm, made of polystyrene balls, a smaller on top and a greater one underneath. Different sizes of polystyrene balls may be used. The rule is that the beneath ball is greater than the upper ball, and that the doll is greater than 8cm and smaller than 12cm in total height.

The base of the humanoid will have a metal of approximately 50g - 100g in order to prevent the doll from falling when touched by robots.

The SIMU nation, which has black skin, it will be a polystyrene humanoid completely painted in black color. The ESITU will be white. The SIMU must be redeemed in GREEN module and ESITU in blue module.

The KIEFAs will be represented by the same polystyrene humanoids, however, the will be all red.



polystyrene balls (ex: 4cm of diameter)

Stick to hold the balls

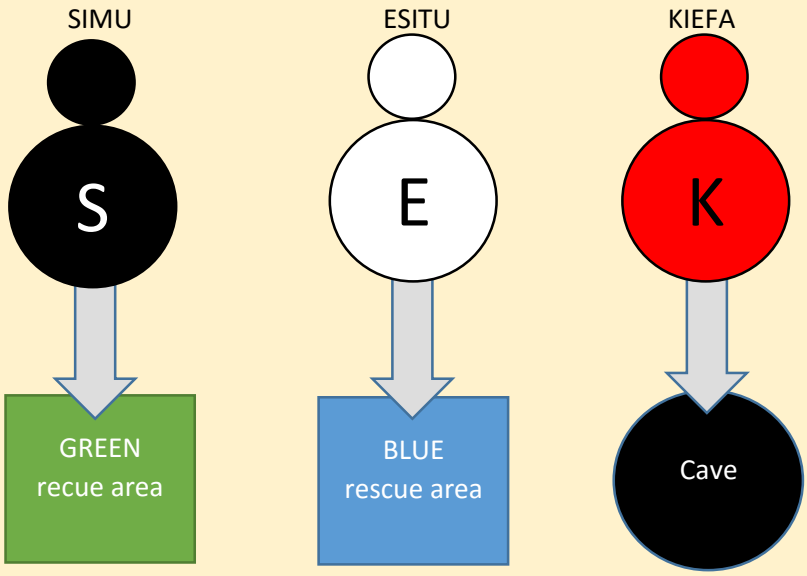
polystyrene balls (ex: 6cm of diameter)

Sinkers (metal) aprox.. 50g - 100g inside the polystyrene balls

Example of humanoid made of painted polystyrene balls:

Sinker of aprox.. 100g

HUMANOID COLORS



Robots

There is no limit to the amount of motors and sensors that each robot can use during its mission within a CLOCLON. However, **its size shall not exceed 30cm wide and 30cm long**, when all parts are fully extended. There is no limit to the height.

Another limitation is that **ALL** robot parts and accessories must belong to a **unique ROBOTIC KIT**.

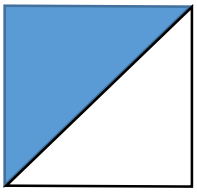
For example, a robot made with LEGO parts should have in their constitution just official PIECES and ACCESSORIES of LEGO®, such as motors, sensors, rubber bands, plastic parts, etc., even if they are sold in different kits. Other kits are Vex®, pETe® and FischerTechnik®.

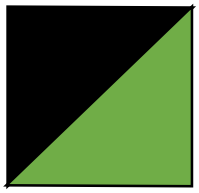
Pieces from a third-party company that is regulated or certified by the original company are also allowed. An example is the Hitechnic company that fabricates certified pieces of LEGO® robotic kit. Not all pieces of Hitechnic company are allowed, but only the LEGO® certified ones.

The robots must contain a space or a mast for fixing a sticker or flag that allows a robot to declare the module and the nation it is demanded to rescue.

Score and Penalties

Two robots, each from different two teams, must enter the area (CLOCLON) to rescue the humanoids in each round of rescue. Each robot is called to rescue one nation must carry a sticker or flag in the rescue color as below:





One robot will use green with black color and the other will use blue with White.

Each team should be responsible for preparing a flag or sticker that can be placed on the robot with the colors above. Adhesives and flag must be clearly visible and should not hinder the development of the robot.

If the team has no flag or identification, it will start the round with **PENALTY** -10 points.

During the progress of rescue, it is considered as scoring and penalty rules as follows:

AT THE BEGINNING

Each robot will start with **150 points** for a **10 minutes** round.

SCORING

Rescue points: Each humanoid correctly rescued **(+ 10 pts)**

Progress points:
Each humanoid correctly removed from the Peripheral Modules and brought to the Central module – The points will be scored as soon as the robot passes through the door towards the central module carrying the correct humanoid. **(+5pts)**

P.S. An humanoid caught in Peripheral Module and correctly rescued will yield 15 pts for the rescue team (5 pts of Progress plus 10 for rescue)

PENALTIES

No-Flag Penalty: Each robot to enter the round without proper identification (flag or sticker) **(-10 pts)**

Forgotten Penalty: Each humanoid left behind **(-5 pts)**
Not redeemed at the end of 10 minutes

Mistake Penalty: Each humanoid wrongly rescued **(-5 pts)**
(rescue the other nation's member for your base or put a member of your nation on the other base).

Poor-K Penalty: Each KIEFA that is removed from the cave **(-5 pts)**
It is considered that a KIEFA was removed from the cave if any part of the humanoid is outside the black circle, no matter how small this part is. The robot responsible for taking any KIEFA from the cave will be the robot that first pushed the humanoid out of the cave.

Progress Penalty:
Each humanoid that the robot carries back to any peripheral module of any nation will receive a penalty. The points will be discounted as soon as the robot passes through the door towards the Cave Module or the Wall Module. In other words, if a robot passes through the door towards any peripheral module carrying some humanoid **(-5pts)**

150 points

10 minutes

Progress points

+ 5 pts

Rescue points

+ 10 pts

Forgotten Penalty

- 5 pts

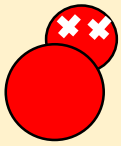
Mistake Penalty

- 5 pts

Progress Penalty

- 5 pts

Poor-K Penalty



- 5 pts

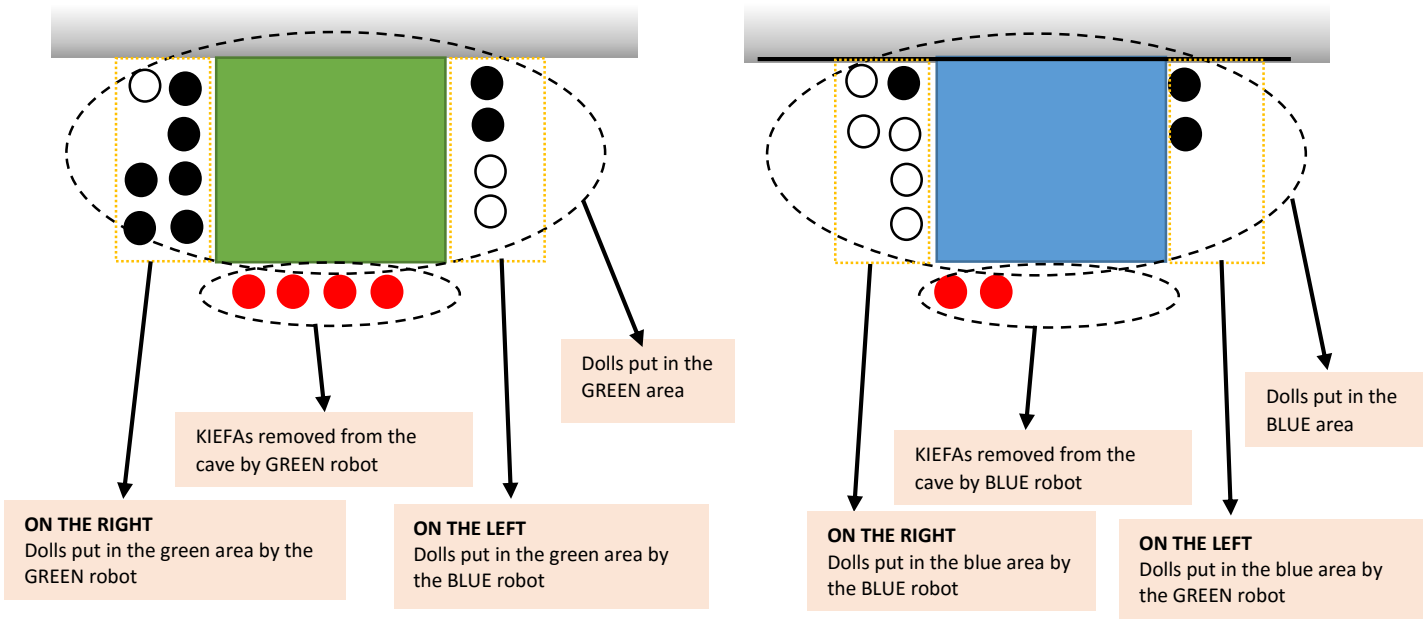
No-Flag Penalty

- 10 pts

Score Assignment

The Progress Points and penalties must be assign during the development of the round. The other points can be distributed after the round ends.

It is suggested for Referees to score the game as follows. The collected dolls and KIEFAs withdrawn from the cave can be placed around the entrance modules. If the doll was rescued by the correct robot, the doll must be put on the right side of the platform. If the wrong robot rescued it, the doll must be put on the left. Each KIEFA that is removed from the cave must be withdraw by the referee and placed in front of the platform with a color regarding the robot that removed the doll from the cave.



Note that if the configuration above happens, the final score of each robot would be:

- The robot with GREEN flag rescued 6 black dolls in the green area correctly and 1 white doll erroneously. It also put 2 black dolls in the blue platform and took 4 KIEFAs from the cave. With this, it got 6 correct redemptions (+60 points), and lost -35pts on behalf of seven dolls wrongly rescued. Getting 150-35 + 60 = 175 points

- The BLUE robot rescued 5 white dolls correctly and 1 black doll wrongly. It, unfortunately, put in 2 black and 2 white dolls in the green output, and retrieved 2 KIEFAs from the caves. With this, it got 50 points by correct redemptions and lost - 30 points (6 x 5pts) on behalf of other dolls. With this, it achieves 170 points.

The score is given at the end of **10 minutes**, which is the total rescue time in a CLOCLONS. After this time, the CLOCLON will be sealed.

ROUNDS AND CHALLENGE'S DYNAMIC ** NEW**

Teams can compete in playoff challenges where only the winner (which got more points) advances in the competition or the teams can be distributed in groups where the best ones can advance.

When the teams are disposed in groups, the classification in a group cannot be made by the sum of rescue points obtained in challenges within group members, because arena's configuration for each challenge is supposed to be different and unknown.

Therefore, when in groups, teams will compete against other teams and the winner (team with more rescue points) will receive 3 points, the loser will receive 0 (ZERO) points and a tie will provide 1 point for each team for classification purposes.

The sum of rescue points will only be used to resolve ties if two or more teams has the same points at the end of groups challenges. In order to resolve ties of points, after apply the sum of rescue points in all matches, the direct

confrontation points and rescue points of only tied teams can be considered for tie-breaking decisions. After failure of all these alternatives of tie-break, extra matches (round) among tied teams must be performed.

It is also mandatory that any team in a group must compete against all other teams in the same group. The best teams with more points will advance in the competition.

Playoffs can be defined in any format and it always use the rescue points to define the winners. When the teams tie in rescue points, an extra time of 3 minutes can be stated. If the tie remains, the team with less penalties points will advance. If the tie insists to stay, one team will advance by lottery or another round (challenge) will be state from the beginning after 10 minutes of interval. The way to finish a tie playoff will be decided by the judge taking into account the schedule of the entire event.

The competition can be arranged to have groups and playoffs like soccer games. The organization will decide the best way for the competition by considering the number of registered teams. It is expected that each team competes at least 3 times.

RESTARTS POLICY ** NEW**

The team may ask to restart the robot at any time and as often as it desires. For each restart, the robot must be repositioned in the corresponding entrance module. In any restart, the team can withdraw the robot from the arena and take it to maintenance. During the maintenance, the robot can be completely changed, reprogrammed or even may have parts replaced in order to maximize the rescue of humanoids. However, time does not stop running and it is allowed only three (3) maintenance in each round. There is no limit for restarting.

For any maintenance or restart, the judge must be NOTIFIED, in order to control the restarting process and to count the number of maintenance times.

Although the number of restarts is unlimited, each restart must follow the rules below:

ROBOT HOLDS HUMANOIDS

If the robot is withdraw from the arena and the robot contains (hold) humanoids, the follow proceed will be follow:

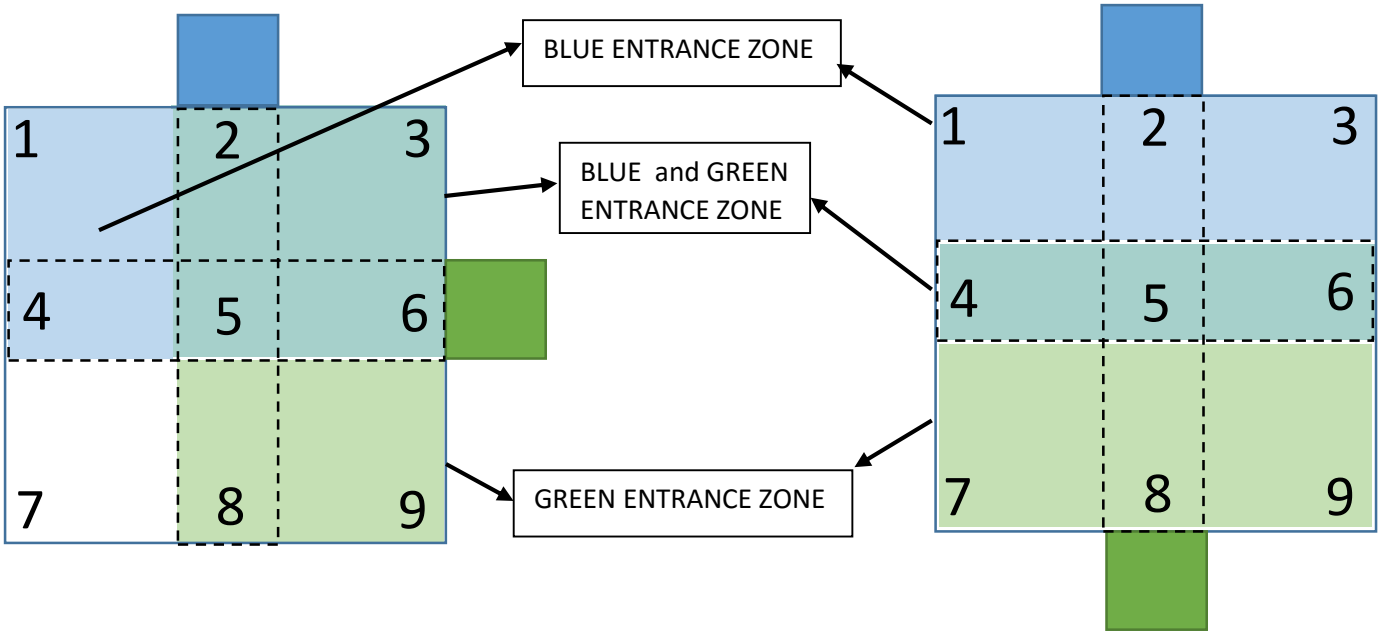
a. For each humanoid rescued (hold) of **any** color (except a red KIEFA) that was put back to the arena, a progress penalty will be applied. If a KIEFA is in the robot, it must be put back to the cave without any additional penalty to the robot, since it already received a penalty to take the KIEFA out of the cave.
b. Independently from which module the robot was withdraw, each humanoid rescued (hold) of the right color of the robot will be ALWAYS placed back into arena in the WALLS MODULE.
c. For each humanoid rescued (hold) of the wrong color, i.e. of the other team, it will be ALWAYS placed back in the CENTRAL MODULE independently from where it was originally rescued.

ENTERING ARENA IN A RESTART

Robots are not allowed to enter arena at any time during a restart. There are some moments that the robot cannot enter. Your robot cannot move towards arena if the opponent robot is in the entrance zone of your robot. The blue entrance zone is defined as the 6 zones closed to the blue entrance module and the green entrance zone is defined by the 6 zones closed to the green entrance module, from the 9 zones as defined in the figure below.

It is suggested that the CENTRAL MODULE has thin gray lines to delimit the nine zones above.

Although it is unlimited, restarts must be carefully used because it can be harmful instead of helpful for your team once the entrance of the robot can be extremely restrictive while the opponent robot is in the central module. In other words, your robot will be allowed to enter in the arena only if the opponent robot is in the opposite side of your entrance or in any peripheral modules.



IMPORTANT: A robot is considered in the entrance zone of the opponent robot if approximately 20% of its part is in the zone. Since it is a judge's decision, do not take a risk to run your robot toward the entrance if any part of the opponent robot is in your entrance zone. In doubt, ask the judge if you can put your robot back in the arena.

PENALTIES APPLIED - if the robot enter in the central module and the opponent robot is in its entrance zone, the following penalties will be applied:

a. The robot that infringed the restart policy and entered in the central module must return to the ENTRANCE MODULE and the team will receive a PROGRESS PENALTY.
b. The opponent robot has two choices that must be announced to the judge by the team member:
   b1 – The team can decide to withdraw its robot from the arena and placed in the entrance module and all humanoids that its robot carries (hold) will be considered for punctuation as rescued, i.e. the team is exposed to receive **Rescue points** and **Mistake Penalties**.
   b2 – The team can decide to continue the rescue if they think that it is better than be withdraw.
c. The robots will be able to return to the arena after authorization of the judge.

Regular Q&A

What if the robot stands still?
A robot is considered stopped if it stays around 10 seconds without moving by another 10 seconds. If the robot stands still, the team can decide to restart it or quite the round. If the robot stopped somewhere that hinders the other robot development, the judge must ask the team to restart the robot. At any moment that the robot stops move, after 10 seconds, the judge can force the team to restart the robot. Penalties and restrictions described in RESTARTS POLICY must be promptly applied.

What if my robot left humanoid in the rescue zone (entrance module) and returns to the arena while the opponent robot is in my entrance zone ?
Nothing happens. The policy to return the robot to the arena only if the opponent robot is outside your entrance zone is applied for restarts where the decision to come back to the arena is up to the human intervention. It is important to mention that if the robot is touched during its rescuing procedure in the entrance module, it will be considered as a withdraw and the robot must be restarted, and all restarts policies for all carried humanoids will be applied.

What if my robot enter in the entrance module with many humanoids and it leaves the right humanoids for rescue in the entrance module and returns to the arena with all opponent humanoids ?
Nothing happens and no penalty is applied. Although it is not good to carry opponent humanoids, your robot made the right thing and took the opponents back to the arena to be further rescued by the other robot.

What if the robots collide and get stuck to each other ?

After 10 seconds, the judge can ask both teams to restart and he will apply ALL penalties and restrictions described in RESTARTS POLICY. It is expected that robots can detect other robot and avoid collisions.

What If the team decides to quit?

The team that decides to quit, or that goes to the maintenance and does not return before the end of the 10 minutesof the round will receive a total of **0 (zero) points**.

FAIR PLAY

At any moment, if the judge decides that a team has been used of intentional actions against a healthy fair play of the competition and clearly prefers to obstruct the opponent's evolution instead of focusing in pursuit your goal in the challenge, the team can be penalized by loss of points, disqualified from the round or disqualified from the competition depending on the severity and repetition of such actions.

All IEEE Latin America Competitions are intended to develop robotic technology through autonomous robot challenges where the teams can share ideas, successful developments, scientific achievements and efficient solutions, in order to spread the knowledge in robotic fields and creates an atmosphere of joying and learning. The IEEE Latin American Robotics Council encourages all teams to participate of the competition with the spirit of learning and sharing and not with a spirit of only wining the competition.

Requirements to Participate

Those interested in participating in the Latin American Robotics Competition LARC IEEE SEK category must form teams of undergraduate students in any educational institution in any country. Nevertheless, high school students will also be allowed to participate. To register, teams must submit a document describing the development and operation of the robot (TDP) in IEEE format. This TDP will be used for the winners to make a brief report to the other competitors. Please, verify the deadlines on the event website.

The Jury

The JURY is composed by a member of organizing chairs, an auxiliary of the organization and a member of other team that is not competing in the match, chosen before the match starts.

Extraordinary Situations During the Competition

If there is any situation not covered under the above mentioned rules, or any doubt about the score, it will be up to the judges and the organizers of the competition to consider the case in the greatest possible impartiality and make a decision. It is important to mention that any fact that it is not explicit in the rules cannot be automatically considered as allowable in the competition. Missing facts will always be treated as **extraordinary situation** and it must be judged as allowable or not by the judges and organization.

We believe ....

Version Control

Version 1.0 – February 2015 – First Released Document

Version 1.1 – March 2015 – Some English Corrections and adaptation of some points

Version 2.0 – January 2016 – Some new restrictions and clarification of rules.

Version 2.1 – January 2016 – Refinements of new restrictions made by suggestions

Version 2.2 – February 2016 - Some English Corrections and the inclusion of FisherTechnik robot kit.