



RoboCup Singapore RCJ Rescue Line Rules 2024

Summary

An autonomous robot should follow a black line while overcoming different problems in a modular field formed by tiles with different patterns. The floor is white in colour.

Teams are not allowed to give their robot any information in advance about the field as the robot is supposed to recognize the field by itself. The robot earns points as follows:

- 20 points for overcoming an obstacle (bricks, blocks, weights and other large, heavy items). A robot is expected to navigate various obstacles.
- 10 points for reacquiring the line after a tile with one or more gaps.
- 10 points for taking the correct branch of an intersection.

If the robot gets stuck in the field, it can be restarted at the last visited checkpoint. The robot will earn points when it reaches new checkpoints.

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1. Code of Conduct

1.1. Spirit

1. It is expected that all participants (students and mentors alike) respect the aims and ideals of RoboCupJunior as set out in our mission statement.
2. The volunteers, referees and officials will act within the spirit of the event to ensure the competition is competitive, fair and, most importantly, fun.
3. **It is not whether you win or lose, but how much you learn that counts!**

1.2. Fair Play

1. Robots that cause deliberate or repeated damage to the field will be disqualified.
2. Humans that cause deliberate interference with robots or damage to the field will be disqualified.
3. It is expected that the aim of all teams is to participate fairly.

1.3. Behavior

1. Each team is responsible for verifying the latest version of the rules on the RoboCupJunior Official website prior to the competition.
2. Participants should be mindful of other people and their robots when moving around the tournament venue.
3. Participants are not allowed to enter setup areas of other leagues or other teams unless explicitly invited to do so by team members.
4. Teams will be responsible for checking updated information (schedules, meetings, announcements, etc.) during the event. Updated information will be provided on notice boards in the venue, on the local competition website, and/or on the RoboCup or RoboCupJunior websites if possible.
5. Participants and their companions who misbehave may be asked to leave the venue and risk being disqualified from the tournament.
6. These rules will be enforced equally to all participants at the discretion of the referees, officials, tournament organizers and local law enforcement authorities.
7. Teams are expected to be present at the venue early on the setup day as important activities will occur. These activities include, but are not limited to: registration, participation raffle, interviews, captains and mentor's meetings.

1.4. Mentors

1. Non-team members (mentors, teachers, parents and other family, chaperones, translators and other adult team members) are not allowed in the student work area.
2. Mentors are not permitted to be involved in building, repairing, or programming their team's robots both before and during the competition.
3. Mentor interference with robots or referee decisions will result in a warning in the first instance. If this behavior recurs, the team could face a possible elimination from the tournament.
4. Robots have to be mainly student's own work. Any robot that appears to be identical to another robot may be prompted for re-inspection.

1.5. Ethics and Integrity

1. Fraud and misconduct are not condoned. Fraudulent acts may include the following:
 - a. Mentors working on the software or hardware of student's robot(s) during the competition.
 - b. More experienced/advanced groups of students may provide advice but should not do the work for other groups. Otherwise, the team risks being disqualified.
2. RoboCupJunior reserves the right to revoke an award if fraudulent behavior can be proven after the award ceremony takes place.
3. If it is evident that a mentor intentionally violates the code of conduct, and repeatedly modifies and works on the student's robot(s) during the competition, the mentor will be banned from future participation in RoboCupJunior competitions.
4. Teams that violate the code of conduct can be disqualified from the tournament. It is also possible to disqualify a single team member from further participation in the tournament.
5. In less severe cases of violations of the code of conduct, a team will be given a warning. In severe or repeated cases of violations of the code of conduct, a team can be disqualified immediately without warning.

1.6. Sharing

1. The spirit of world RoboCup competitions is that any technological and curricular developments should be shared with other participants after the tournament. This furthers the mission of RoboCupJunior as an educational initiative.
2. Any developments may be published on the RoboCupJunior website after the event.
3. Participants are strongly encouraged to ask questions to their fellow competitors to foster a culture of curiosity and exploration in the fields of science and technology.

2. Field

2.1. Description

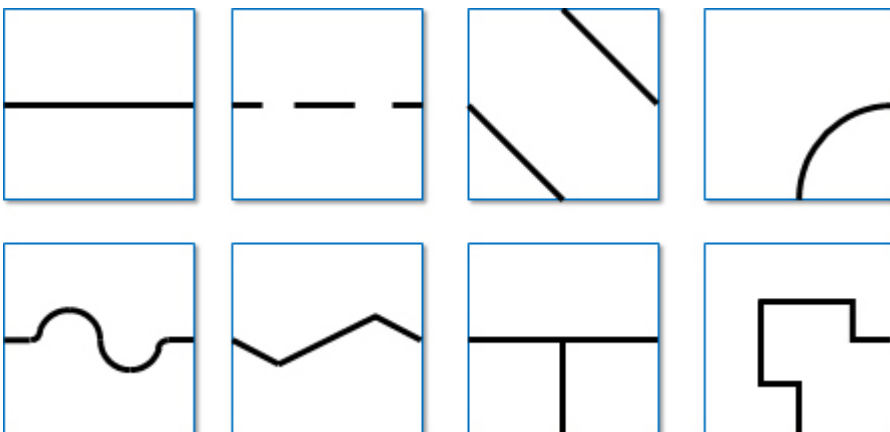
1. The field is made up of modular tiles, which can be used to make an endless number of different courses for the robots to traverse.
2. The field will consist of 30 cm x 30 cm tiles, with different patterns. The final selection of tiles and their arrangement will not be revealed until the day of the competition. Competition tiles may be mounted on a hard-backing material of any thickness.
3. There will be a minimum of 8 tiles in a competition field, excluding the start and goal tile.
4. There are different tile designs (examples can be found under [Section 2.3, "Line"](#)).

2.2. Floor

1. The floor is white in colour. The floor may be either smooth or textured (like linoleum or carpet) and may have steps of up to 3 mm in height in between tiles. Due to the nature of the tiles, there may be a step and/or gaps in the construction of the field.
2. Competitors should be aware that tiles may be mounted on thick backing or raised off the ground, which may make it difficult to get back on a tile where the robot comes off the course. No provision will be made to assist robots that drive off of a tile to get back onto the tile.

2.3. Line

1. The black line, 1-2 cm wide, may be made with standard electrical insulating tape or printed onto paper or other materials. The black line forms a path on the floor. (The grid lines indicated in the drawings below are for reference only and competitors can expect tiles to be added and/ or omitted.)
2. Straight sections of the black line may have gaps with at least 5 cm of the straight line before each gap as measured from the shortest portion of the straight portion of the line. The length of a gap will be no more than 20 cm.
3. The arrangement of the tiles and paths may vary between rounds.
4. The line will be 10 cm away from any edge of the field.



2.4. Checkpoints

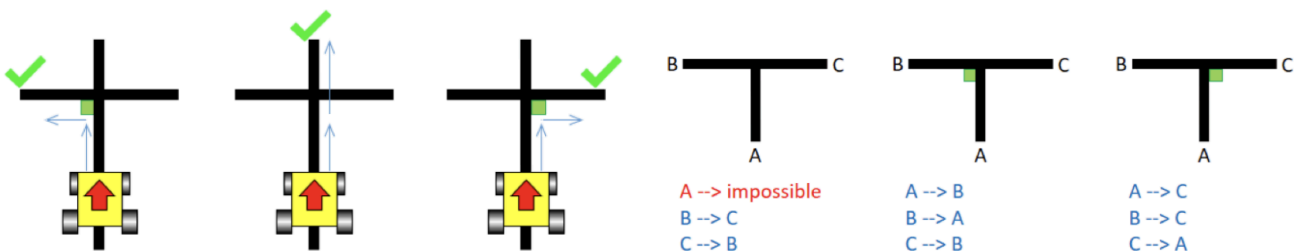
1. A checkpoint is a tile where a robot will be manually placed back when a lack of progress occurs.
2. Checkpoints will not be located on tiles with scoring elements.
3. The start tile is a checkpoint where the robot can restart.
4. A checkpoint marker is the marker that indicates for humans which tiles are checkpoints. A disk with 5 mm to 12 mm thickness and up to 70 mm in diameter has been used frequently, but can be different dependent on the organizer.
5. The number of checkpoint markers and their locations will be predetermined by the field designers.

2.5. Obstacles

1. Obstacles may consist of bricks, blocks, weights and other large, heavy items. Obstacles will be at least 15 cm high and can be fixed to the floor.
2. An obstacle will not occupy more than one line and/or tile.
3. There will be free space in a radius of 25 cm around each obstacle, to allow the robot to pass on both sides of the obstacle.
4. A robot is expected to navigate around obstacles. The robot may move obstacles but it should be noted that obstacles may be very heavy or fixed to the floor. Obstacles that are moved will remain where they were moved to, even if that prevents the robot from proceeding.
5. Obstacles will not be placed closer than 25 cm from the edge of the field.

2.6. Intersections and Dead Ends

1. Intersections can be placed anywhere except in the evacuation zone.
2. There will be no gaps on the tile ahead of an intersection.
3. Intersection markers are green and 25 mm x 25 mm in dimension. They indicate the direction of the path the robot should follow.
4. The robot should continue straight ahead if there is no green marker at an intersection.
5. The intersections are always perpendicular but may have 3 or 4 branches.
6. There will be no dead ends.
7. Intersection markers will be placed just before the intersection. See the images below for possible scenarios.



2.7. Environmental Conditions

1. The environmental conditions at a tournament may be different from the conditions at home. Teams must come prepared to adjust their robots to the conditions at the venue.
2. Lighting and magnetic conditions may vary in the rescue field.
3. The field may be affected by magnetic fields (e.g. generated by underfloor wiring and metallic objects). Teams should prepare their robots to handle such interference.
4. The field may be affected by unexpected lighting interference (e.g. such as camera flash from spectators). Teams should prepare their robots to handle such interference.
5. All measurements in the rules have a tolerance of $\pm 10\%$.

3. Robots

3.1. Control

1. Robots must be controlled autonomously. The use of a remote control, manual control, or passing information (by external sensors, cables, wirelessly, etc.) to the robot is not allowed.
2. Robots must be started manually by the team captain.
3. Any pre-mapped type of dead reckoning (movements predefined based on known locations or placement of features in the field) is prohibited.
4. Robots must not damage any part of the field in any way.

3.2. Construction

1. Any robot kit or building blocks, either available on the market or built from raw hardware, may be used as long as the design and construction of the robot are primarily and substantially the original work of the students.
2. Teams are not permitted to use any commercially produced robot kits or sensors components that are specifically designed or marketed to complete any single major task of RoboCupJunior Rescue. Robots that do not comply will face immediate disqualification from the tournament. If there is any doubt, teams should consult the RoboCupJunior Rescue Line Entry Committee prior to the competition.
3. For the safety of participants and spectators, only lasers of class 1 and 2 are allowed. This will be checked during inspection. Teams using lasers must have the datasheet of the laser, and also must submit them prior to the competition as well as be able to show them during the competition.
4. Wireless communication must be used correctly as described on the [RoboCupJunior General Rules](#). Robots performing other types of wireless communication need to be deleted or disabled. If the robot has other forms of wireless communication equipment, the team needs to prove that they are disabled. Non-conforming robots may be immediately disqualified from the tournament.
5. Robots may incur damage by falling off the field, making contact with another robot, or making contact with field elements. The organizing committee cannot anticipate all potential situations where damage to the robot may occur. Teams should ensure that all active elements on a robot are properly protected with resistant materials. For example, electrical circuits must be protected from all human contact and direct contact with other robots and field elements.
6. When batteries are transported, moved or charged, it is strongly recommended that safety bags be used. Reasonable efforts should be made to ensure that robots avoid short circuits and chemical or air leaks.
7. Robots must be equipped with a handle which is to be used to pick them up during the scoring run.
8. Robots must be equipped with a single binary switch or button(s) or any kind, clearly visible to the referee, specifically for restarting the robot when a lack of progress occurs.

3.3. Team

1. Each team must have only one robot on the field.
2. Each team must comply with the [RoboCupJunior General Rules](#) regarding the number of members and each member's age.
3. The Rescue Line Entry League is open to students in the age from 10 to 14 years (age as of 1st of July).
4. Each team member will need to explain their work and should have a specific technical role.
5. A student can be registered on only one team across all RoboCupJunior leagues/sub-leagues.
6. A team is only allowed to participate in one league/sub-league across all RoboCupJunior

leagues/sub-leagues.

7. A participant may only participate twice on an Entry league level in a regional RCJ qualification final. A participant is allowed to participate in a qualification competition for a regional final without restrictions.
8. Mentors/parents are not allowed to be with the students during the competition. The students will have to self-govern themselves (without a mentor's supervision or assistance) during the long stretch of hours at the competition.

3.4. Inspection

1. The robots will be scrutinized by a panel of referees before the start of the tournament and at other times during the competition to ensure that they meet the constraints described in these rules.
2. It is illegal to use a robot that is very similar to another team's robot from a previous year or the current year.
3. It is the responsibility of the team to have their robot re-inspected if their robot is modified at any time during the tournament.
4. Students will be asked to explain the operation of their robot in order to verify that the construction and programming of the robot is their own work.
5. Students will be asked about their preparation efforts and may be requested to answer surveys and participate in videotaped interviews for research purposes.
6. All teams may be asked to complete a web form prior to the competition to allow referees to better prepare for the interviews. Instructions on how to submit the form will be provided to the teams prior to the competition.

3.5. Violations

1. Any violations of the inspection rules will prevent the offending robot from competing until modifications are made and the robot passes inspection.
2. Modifications must be made within the time schedule of the tournament and teams cannot delay tournament play while making modifications.
3. If a robot fails to meet all specifications (even with modifications), it will be disqualified from that game (but not from the tournament).
4. No mentor assistance is allowed during the competition. (see [Section 1, "Code of Conduct"](#).)
5. Any violations of the rules may be penalized by disqualification from the tournament or the game or may result in a loss of points at the discretion of the referees, officials, organizing committee or general chairs.

4. Play

4.1. Pre-game Practice

1. When possible, teams will have access to practice fields for calibration and testing throughout the competition.
2. Whenever there are dedicated independent fields for competition and practice, it is at the organizers' discretion if testing is allowed on the competition fields.

4.2. Humans

1. Teams should designate one of their members as "captain" and another one as "co-captain". Only these two team members will be allowed access to the competition fields, unless otherwise directed by a referee. Only the captain will be allowed to interact with the robot during a scoring run.
2. The captain can move the robot only when they are told to do so by a referee.
3. Other team members (and any spectators) within the vicinity of the competition field have to stand at least 150 cm away from the field at all times, unless otherwise directed by a referee.
4. No one is allowed to touch the fields intentionally during a scoring run.
5. Any and all pre-mapping activities will result in immediate disqualification of the robot for the round. Pre-mapping is the act of humans providing the robot with information about the field (e.g.: location of obstacles, location of gaps, etc...) prior to the game.

4.3. Start of Game

1. Each team has a maximum of 5 minutes for a game. The game includes the time for calibration and the scoring run.
2. Calibration is defined as taking sensor readings and modifying the robot's programming to accommodate such sensor readings. Calibration does not count as pre-mapping.
3. The scoring run is defined as the time when the robot is moving autonomously to navigate the field, and the referee will record the scores.
4. A game begins at the scheduled starting time whether or not the team is present or ready. Start times will be posted around the venue.
5. Once the game has begun, the robot is not permitted to leave the competition area.
6. Teams may calibrate their robot in as many locations as desired on the field, but the clock will continue to run. Robots are not permitted to move on their own while calibrating.
7. Once a team is ready to start a scoring run, they must notify the referee. To begin a scoring run, the robot is placed on the start tile of the course as indicated by the referee. Once a scoring run has begun, no more calibration is permitted, including changing of code/code selection.
8. Teams may choose not to calibrate the robot and instead immediately start the scoring run.
9. Individual tiles, obstacles, and other scoring elements may be removed, added, or changed when the robot starts moving (as the scoring run begins), to prevent teams from pre-mapping the layout of the fields. This may happen on the basis of a die rolled by the referee or with another method of randomization announced by the organizers. For a particular field during a round, the referee will ensure the difficulty of the field will be kept similar and the maximum points to be constant.

4.4. Scoring Run

1. Robots will start behind the joint of the start tile and the subsequent tile along the course. Correct placement will be checked by the referee.
2. Modifying the robot during a scoring run is prohibited, which includes remounting parts that have fallen off.
3. Any parts that the robot loses intentionally or unintentionally will be left in the field until the run is over. Team members and referees are not allowed to move or remove parts from the field during a scoring run.
4. Teams are not allowed to give their robot any advance information about the field. A robot is supposed to recognize the field elements by itself.
5. The robot has visited a tile when more than half the robot is within that tile when viewed from above.

4.5. Lack of Progress

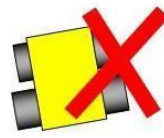
1. A lack of progress occurs when:
 - a. a team captain declares a lack of progress.
 - b. a robot loses the black line without regaining it by the next tile in the sequence (see figures at end of the section).
 - c. a robot reaches a line that is not in the intended sequence.
 - d. "sequence" does not include diagonal sequence
2. If a lack of progress occurs, the robot must be positioned on the previous checkpoint tile facing the path towards the evacuation zone and checked by the referee.
3. After a lack of progress, the team must reset the robot by using a switch/button(s) located in a clearly visible location by the referee (see 3.2.8).



Reset

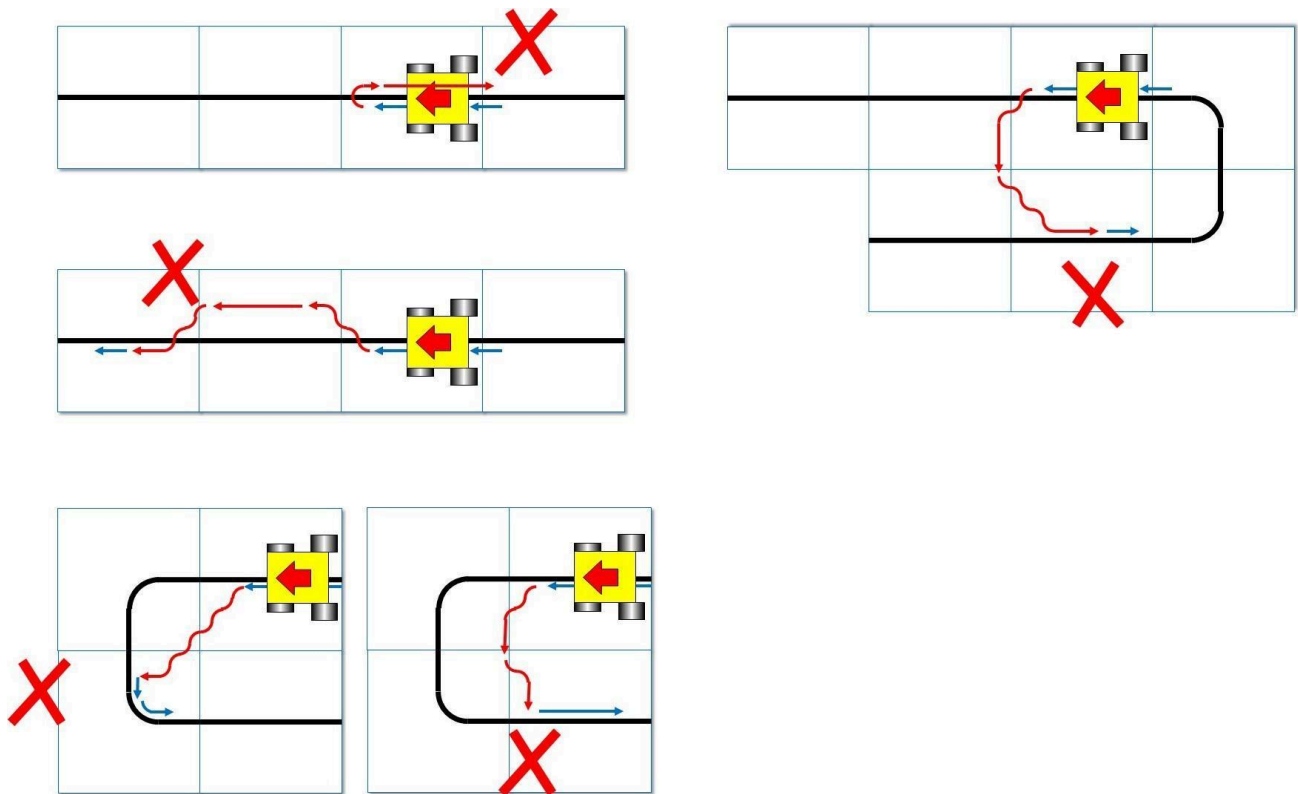


Power OFF & ON



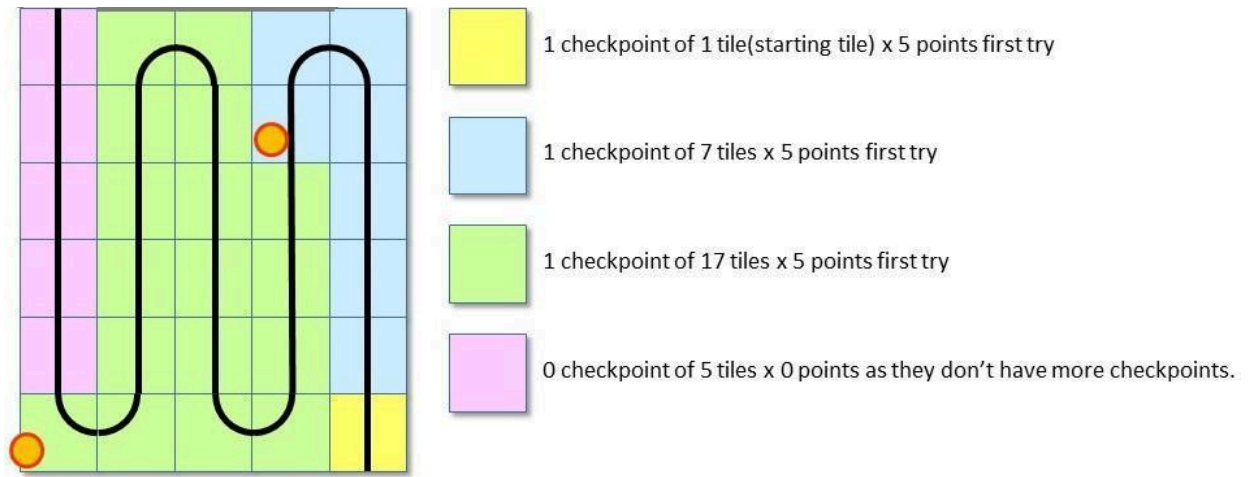
Change program

4. There is no limit to the number of lack of progresses within a round.
5. After three failed attempts to reach a checkpoint, a robot is allowed to proceed to the next checkpoint.
6. The team captain may choose to make further attempts at the course to earn the additional points available from scoring elements that have not already been earned before reaching the next checkpoint.



4.6. Scoring

1. A robot is awarded points for successfully navigating each hazard (gaps in the line, intersections and obstacles). Points are awarded per hazard when the robot has reached the subsequent tile in sequence. Point allocations are: 10 points per tile with gaps, 20 points per obstacle, and 10 points per intersection.
2. Failed attempts at navigating hazards in the field are defined as a Lack of Progress (see [Section 4.5, "Lack of Progress"](#)).
3. When a robot reaches a checkpoint tile it will earn points for each tile it has passed since the previous checkpoint. The points per tile depend on how many attempts the robot has made to reach the checkpoint:
 - 1st attempt = 5 points/tile
 - 2nd attempt = 3 points/tile
 - 3rd attempt = 2 points/tile
 - 4th attempt and beyond = 1 point/tile
4. Each gap, intersection and obstacle can only be scored once per intended direction through the course. Points are not awarded for subsequent attempts through the course.
5. Ties in scoring will be resolved based on the time taken by each robot (or team of robots) to complete the course (this includes calibration time).



4.7. End of Game

1. A team may elect to stop the game early at any time. In this case, the team captain must indicate to the referee the team's desire to terminate the game. The team will be awarded all points earned up to the call for the end of the game. The referee will stop the time at the end of game which will be recorded as the game time.
2. The game ends when:
 - a. the 5 minutes of allowed game time expires
 - b. the team captain calls the end of the game
 - c. the robot has successfully evacuated all victims.

5. Conflict Resolution

5.1. Referee and Referee Assistant

1. All decisions during game play are made by the referee or the referee assistant, who are in charge of the field, persons and objects surrounding them.
2. During game play, the decisions made by the referee and/or the referee assistant are final.
3. At the conclusion of game play, the referee will ask the captain to sign the score sheet. Captains will be given a maximum of 1 minute to review the score sheet and sign it. By signing the score sheet, the captain accepts the final score on behalf of the entire team. In case of further clarification, the team captain should write their comments on the score sheet and sign it.

5.2. Rule Clarification

1. If any rule clarification is needed, please contact the RoboCup Singapore RCJ Rescue Line Entry Committee.
2. If necessary even during a tournament, a rule clarification may be made by members of the RoboCupJunior Rescue Line Entry Organizing Committee (OC).

5.3. Special Circumstances

1. If special circumstances, such as unforeseen problems or capabilities of a robot occur, rules may be modified by the RoboCup Singapore Junior Rescue League Chair in conjunction with available Technical Committee and Organizing Committee members, even during a tournament.
2. If any of the team captains/mentors do not show up to the team meetings to discuss problems and the resulting rule modifications described in 5.3.1, it will be understood that they agreed and were aware of the changes.