RoboCup Junior Australia

Rescue / Premier Rescue Rules

- 2009 V2.0 -

http://www.robocupjunior.org.au

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Introduction

Spirit

It is expected that all participants, students and mentors, will respect the aims and ideals of RoboCup Junior as set out in our mission statement. In turn, the volunteers, referees and officials will act within the spirit of the event to ensure the competition is competitive, fair and most importantly fun.
“It is not whether you win or lose, but how much you learn that counts.”

Sharing

It is the overall desire of RoboCup Junior competitions, that any technological and curricular developments will be shared with other participants after the competition. Any developments including new technology and software examples may be published on the RoboCup Junior web site after the event, furthering the mission of RoboCup Junior as an educational initiative.
Participants are strongly encouraged to ask questions of their fellow competitors to foster a culture of curiosity and exploration in the fields of science and technology.

Local Variations

These rules will be in use for the 2009 Australian National Championships. State and Regional competitions may implement minor variations with respect to age groups, running of the rescue rounds or other rule modifications. These variations will be communicated to the participants through email and/or on their relevant website prior to the state competition.

1. The Challenge

1.1. The Scenario

1.1.1. A terrible earthquake has hit the city and caused a large chemical storage unit to rupture spilling thousands of litres of toxic chemicals in the centre of the city. There is a person trapped on a sinking water tank in the middle of the chemical spill. Rescue crews are having trouble entering the city with the amount of rubble around and rescue from the air has also been ruled out due to the noxious gases rising around the city.
1.1.2. Rescue: It has been decided that the best form of rescue is the deployment of an autonomous robot that can navigate to the scene and rescue the stranded person by pushing or dragging the water tank out of the chemical spill.
1.1.3. Premier Rescue: Remove the water tank from the chemical spill and place it in its original orientation safely on the evacuation platform for later collection by an aircrew.

1.2. Age Limit

Students should participate in one of two divisions, Rescue or Premier Rescue. Due to age differences in school years across Australian States, the age limits for the Rescue divisions are defined as follows:

1.2.1. A student will be regarded as being eligible to compete in the Rescue division if they are 13 years of age or under as of the published date of the RCJA Australian Open.

1.2.2. A student will be regarded as being eligible to compete in the Rescue Premier division if they are undertaking a primary or secondary school course at the time of the published date of the RCJA Australian Open.

1.3. The Field:

1.3.1. The field will consist of 594mm x 594mm tiles, with differing 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.

1.3.2. There will be a minimum of 4 tiles in a competition field.

1.3.3. There are different tile designs (see examples below). Tile size has been selected so that each tile can be manufactured from an A1 sheet of paper (594x841)

1.3.4. The background colour of each tile is white with the line 15mm in width and black in colour.

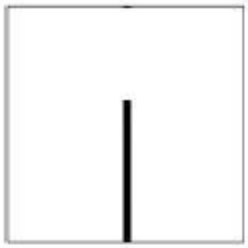
1.3.5. All lines meet the edge of the tile halfway along its length.

1.3.6. Shortcut markers are green and 40mm x 40mm in dimension and indicate the correct path to follow.

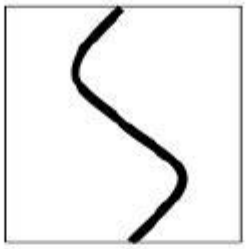
1.3.7. The organising committee will make every possible attempt to ensure there are no ‘bumps’ between tiles although there may be slight deviations in height of up to 3mm. Competitors must be prepared to deal with these slight imperfections in height.

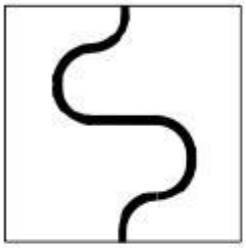
1.3.8. Rescue: The tiles will be selected from Pool A only (see examples below), although competitors can expect tiles to be duplicated and/or omitted. Please note that for 2009, the speed bumps will be a part of the Rescue tile set.

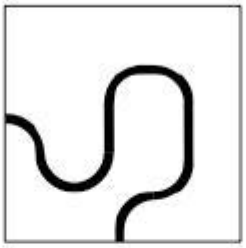
1.3.9. Premier Rescue: The tiles and obstacles will be selected from both Pool A and Pool B, although competitors can expect tiles to be duplicated and/ or omitted.

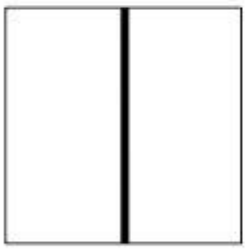


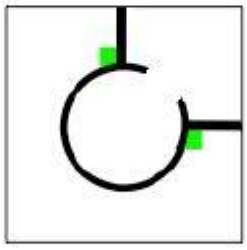
Start Tile

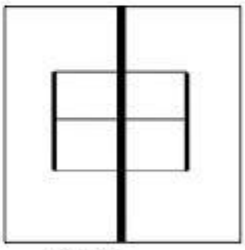




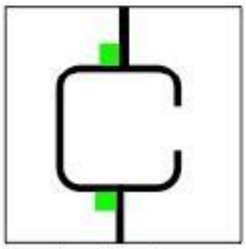




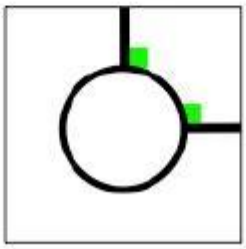




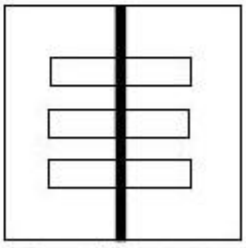
Bridge



Dead End

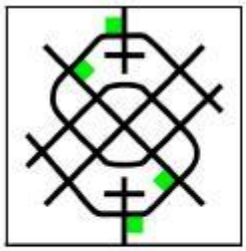


Roundabout

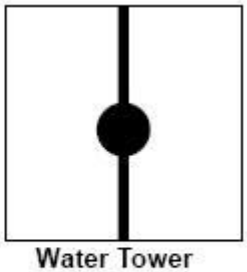


Speed Bumps

Pool A



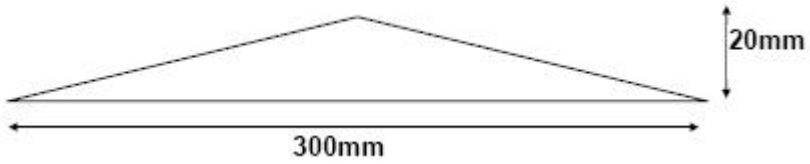
Gridlock



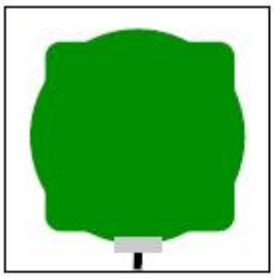
Water Tower

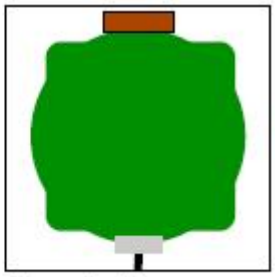
Pool B

1.3.10. The “Bridge” tile will consist of a white raised section with the following dimensions with a black line across the middle of the bridge;



1.3.11. The “Speed Bumps” will consist of rectangular sections, 200mm x 30mm, white in color, with a height of 5mm. A black line will run across the top surface of the speed bump.
1.3.12. The “Water Tower” will be a clear 1.25L PET soft drink bottle filled with water. The tower is not to be intentionally moved from its location. When navigating the water tower, robots must regain following the line before the robot fully exits the tile. The water tower will be clear with all external labels removed if possible. No provision will be made to assist robots that leave a tile whilst avoiding the water tower, from getting back on the tile.
1.3.13. The final tile will be a 594mm x 594mm tile, white background with the chemical spill indicated by the green area.
1.3.14. At the point where the black line meets the green area, there will be a piece of reflective aluminium foil, 40mm x 15mm in dimension.
1.3.15. Premier Rescue: The End Tile will also have the evacuation platform, 70mm high, 200mm wide and 70mm deep located at the rear of the chemical spill. The platform will be painted the same colour as the location rectangle on the finishing tile.


Rescue


Premier Rescue

1.4. Lighting

1.4.1. Teams must come prepared to calibrate their robots based on the lighting conditions available at the venue.
1.4.2. The organising committee will make a reasonable effort to keep ambient light to a low level with infra-red (IR) sources from incandescent lights and natural lighting minimised.
1.4.3. Teams must also be prepared for other form of light interference from electronic devices and should take steps to protect their robot.

2. Robots

2.1. Size

2.1.1. The robot must fit within a 180mm diameter cylinder for the rescue division. The robot must fit within a 270mm diameter cylinder for the premier rescue division.
2.1.2. The robot must be upright in its normal running position.
2.1.3. The robot must be fully extended. (see section 3.2)
2.1.4. The robot must be no more than 180mm in height for rescue division and no more than 270mm for premier rescue division. (see section 3.2)

2.3. Control

2.3.1. Robots must be controlled autonomously.
2.3.2. Robots must be started manually by humans.
2.3.3. The use of remote control of any kind is forbidden.

2.4. Construction

2.4.1. Any robot kit or building materials may be used, as long as the robot fits the above specifications and as long as the design and construction are primarily and substantially the original work of the student(s) (see section 3.3)
2.4.2. Robots should be well engineered and constructed. The robot should not fall apart during the game.

3. Inspection

3.1. Schedule

3.1.1. The robot will be examined by a panel of referees before/during or after the tournament to ensure that the robot meets the constraints described above.
3.1.2. It is the responsibility of teams to have their robot re-inspected if their robot is modified at any time during the tournament.

3.2. Robot Configuration

3.2.1. While being inspected, each robot must be at its maximum size; i.e., anything that protrudes from the robot must be fully extended. The robot must be standing upright in its playing configuration. If the robot has a moving part that extends in two directions, it will need to be inspected with this part operating. The robot must be able to operate without touching the measuring cylinder.
3.2.2. A robot entered into the premier rescue division must have a demonstrable mechanism with the potential to rescue the victim as specified in section 1.1.3.

3.3. Students

3.3.1. Team members will be interviewed and asked to explain the operation of their robots in order to verify that the construction and the programming of the robot is their own work. Logbooks or design diaries must be provided. (see section 7)
3.3.2. Students may be asked questions about their preparation efforts, and they may be requested to answer surveys and participate in videotaped interviews for research purposes.
3.3.3. Commercial robot kits may be used but must be substantially modified by the students.
3.3.4. It is highly unlikely that a team will be able to legally use a robot identical to another team's robot from previous years, or use a robot that is identical to another team's robot.

3.4. Violations

3.4.1. Any violations of the inspection rules will prevent the robot from competing until modifications are effected.
3.4.2. Modifications must be made within the time schedule of the tournament.
Game play will not be delayed due to late teams.
3.4.3. If a robot fails to meet all specifications (including modifications) the robot will be disqualified from that game (but not the tournament).
3.4.4. If there is excessive mentor assistance or the work on the robots is not substantially original work of the students, the team will be disqualified from the tournament. 4. Victim

4. The Victim

4.1.1 The victim will be represented by either a standard 375ml aluminium can, standing upright, with no markings OR a standard 375ml aluminium can wrapped in aluminium foil or aluminium foil tape.
4.1.2. The can will contain material such as rice bringing the weight of the victim to 100gms. A liquid should not be used to add weight to the can.

5. Game Play

Games will be organised into rounds, then a finals series.

5.1. Pre-game Set-up

5.1.1. Organisers will make a reasonable effort to provide the teams access to the competition area at least two hours before the start of the competition.
5.1.2. Organisers will make a reasonable effort to allow at least 10 minutes of setup time before each game. Participants should be aware, however, that situations may arise where these conditions cannot be met; and so participants should arrive prepared to cope under conditions that are less than ideal.

5.2. Length of a Game

5.2.1. A time limit of 120 seconds will be imposed. Organisers will ensure that the competition maze design will be of adequate length for this time limit.

5.3. Game Zone

5.3.1. An area around the field will be designated as the “game zone”. No one is allowed inside the game zone except for the robot handlers and the referee.

5.4. Start of the game

5.4.1. One team member is elected as the robot handler. Only that team member is permitted to handle the robot during the game. All other team members must remain outside the game zone.
5.4.2. The robot is placed at the starting position and checked by the referee.
5.4.3. At the instruction of the referee, the robot’s handler is to start the program on the robot.
5.4.4. A start tile consisting of a lead in black line will be used, although it will not count for any points. Robots are to start behind the join between the start tile and the first course tile.

5.5. Restarts

5.5.1. A robot may re-start the run as the handlers deem necessary within the 120 seconds game time.
5.5.2. The robot must be positioned back at the start and checked by the referee
5.5.3. The game clock will continue to run during all restarts.
5.5.4. There is no limit to the number of restarts within the 120 seconds game.
5.5.5. Points are awarded for each successfully completed tile. Points not gained in one run can be gained in subsequent runs adding to the accumulated points until all tiles have been successfully completed.
5.5.6. A robot must restart if:

- The robot ceases to follow the line,
- the robot is touched by a human,
- the robot moves off the field.

5.5.7 For the National Competition, the restart location will be the start tile of the course. For state and regional competition, organisers *may* implement the Alternative Restart rule. This decision will be announced to competitors well in advance of the competition day.

Alternative Restart rule. Restarts, when required, are placed at the beginning of the maze. If the robot fails to complete a tile after 60 seconds of the game clock has elapsed, the robot will then be permitted to be restarted on the tile directly following the uncompleted tile. Points will not be awarded for the tile that was missed.

5.6. Following the Line

5.6.1. The robot must follow the line completely to enter the chemical spill.
5.6.2. Where there are multiple paths, the robot may take any path.
5.6.3. Where the line is discontinuous, and there is no continuous path through the tile, the robot may search for the recommencement of the line, but must not completely leave the tile before re-finding the line.
5.6.4. For the purposes of determining if a robot has left the line or left the tile, the referee will use the "convex hull" of the robot. This measure is done by stretching an imaginary rubber band around the extremities of the robot, and using the enclosed space as a silhouette.
5.6.5. Some portion of the continuous line segment must be under the robots convex hull. Or, in the case of a discontinuous line, some part of the tile must be under the robot silhouette.
5.6.6. Once the robot has entered the chemical spill tile it is no longer required to "follow the line". It may enter the chemical spill in any direction in its efforts to rescue the victim. However, if the robot leaves the final tile, it will have to restart.

5.7. Scoring

5.7.1. Teams will be awarded 10 points for each tile that their robot successfully negotiate. Eg, robots reaching the 4th tile would have successfully negotiated 3 tiles and be awarded 30 points.
5.7.2. Teams will gain an extra 2 points for each shortcut marker they correctly follow. Eg, if a robot correctly follows both shortcut markers on the roundabout, it will be awarded 14 points, 10 points for completing the tile and 4 points for correctly following the shortcut markers.
5.7.3. For Rescue, teams will be awarded an additional 20 points for successfully rescuing the victim. The victim is considered rescued when it is completely outside the chemical spill.
5.7.4. For Premier Rescue, teams will be awarded an additional 50 points for successfully gaining control of the victim eg: grasping and lifting the victim to a height that may allow the victim to be placed on the platform and then begin to move showing full control of the victim. Another 50 points will be awarded for successfully placing and releasing the victim on the evacuation platform, maintaining the victim's original upright orientation.
5.7.5. If the robot fails to rescue the victim in the allocated time, it will be given a time score of 120 seconds.
5.7.6. A robot must have a full score on a field before a time of less than 120 seconds is given, ie the clock stopped. eg. If a robot completes a rescue but does not have a full score they must restart and attempt to complete the missing section/s. Only when the maximum possible points for the round is achieved will the clock be stopped.
5.7.7 For each round, a Percentage Score is determined which is calculated by dividing the points obtained by the maximum number of points available on that round.
5.7.8. The team's worst Percentage Score is discarded and the Overall Percentage Score is calculated as the sum of the remaining rounds.
5.7.9. After the preliminary rounds have been run, teams will be ranked according to their Overall Percentage Score for their best four rounds.

5.7.10. Should two or more teams have the same Overall Percentage Score, further ranking will be performed by finding the sum of the time taken to rescue the victim in the scoring rounds.

5.8. Preliminary Rounds

5.8.1. There may be multiple preliminary rounds, depending on the time constraints of the tournament.
5.8.2. Each team will play one game per round.
5.8.3. Officials at the competition will determine the order and nature of how each round will be conducted. All teams must consult with the officials at the start of the competition to be informed on how the preliminary rounds will be run.
5.8.6. The victim will be located in a new position in the chemical spill for each round. It will be in the same position for every game in that round.

5.9. Finals series

5.9.1. The top eight ranked teams will be in the quarter-finals.

- 1st ranked team vs 8th ranked team
- 2nd ranked team vs 7th ranked team
- 3rd ranked team vs 6th ranked team
- 4th rankd team vs 5th ranked team

5.9.2. Quarter-finals shall be a head-to-head competition on two separate fields with the victim in the same position on both fields.
5.9.3. Teams in the quarter-finals shall contest 2 games.
5.9.4. Teams will swap fields between games.
5.9.5. The victim will be in the same position for all games. This position will be different to those in the preliminary rounds.
5.9.6. The winners of the quarter-finals will move to the semi-finals, with ranking determined by the scores from the scoring preliminary rounds.
5.9.7. The winner of the 1st/4th and 2nd/3rd match will play off in the Grand final
5.9.8. The losers of the 1st/4th and 2nd/3rd match will play off for 3rd place.
5.9.9. The Grand Final will consist of 2 games, with the team with the highest cumulative score judged the winner. If scores are tied then the lower cumulative time will determine the winner.

6. Conflict Resolution

6.1. Referee

6.1.1. During game play, the referee's decisions are final.

6.2. Officials

6.2.1. Rule clarification, but no handling of protests, may be made by a committee of three officials.
6.2.2. The three officials will be designated prior to the tournament.
6.2.3. An official must declare any relationship with any of the teams entered in the tournament and shall not referee any team they have a relationship with.

6.3. Special Circumstances

6.3.1. Specific modifications to the rules to allow for special circumstances, such as unforeseen problems and / or capabilities of a team's robots, may be agreed to at the time of the tournament, provided a majority of the contestants agree.

7. Documentation

7.1. Log Books

7.1.1. Any team that has original (custom) construction of robots or sensors (not freely or commercially available to all competitors) must supply full documentary proof that the developments were wholly the work of the students. This should be in the form of a logbook showing all stages of design, development, testing and construction.
7.1.2. All teams must maintain a logbooks detailing the design, development and construction of the robot and its programs.
7.1.3. Failure to produce documentary proof may result in the robot or sensor not being allowed to be used in the tournament.

8. Code of Conduct

8.1. Fair Play

8.1.1. Robots that cause interference with other robots or damage to the field or the victim will be disqualified.
8.1.2. Humans that cause deliberate interference with robots or damage to the field or the victim will be disqualified.
8.1.3. No wireless or infra-red (IR) communication devices will be allowed during the game in

the vicinity of the playing field.
8.1.4. It is expected that the aim of all teams is to play a fair and clean game of robot rescue.

8.2. Behaviour

8.2.1. All movement and behaviour is to be of a subdued nature within the tournament venue.
8.2.2. Participants who misbehave may be asked to leave the building and risk being disqualified from the tournament.
8.2.3. These rules will be enforced at the discretion of the referees, officials, conference organizers and local law enforcement authorities.

8.3. Mentors

8.3.1. Mentors, Teachers and adults are not allowed in the student work area.
8.3.2. Sufficient seating will be supplied for mentors to remain in a supervisory capacity around the student work area.
8.3.3. Mentors are not to repair robots or be involved in programming of student's robots.
8.3.4. Mentor interference with robots or referee decisions will result in a warning in the first instance. If this reoccurs, the team will risk being disqualified.

Appendix

Each robot must be labelled with an official RoboCup Junior Identification tag. This tag must be attached to the competing robot at all times. team members must show the timing official the robot tag prior to competing in each round.