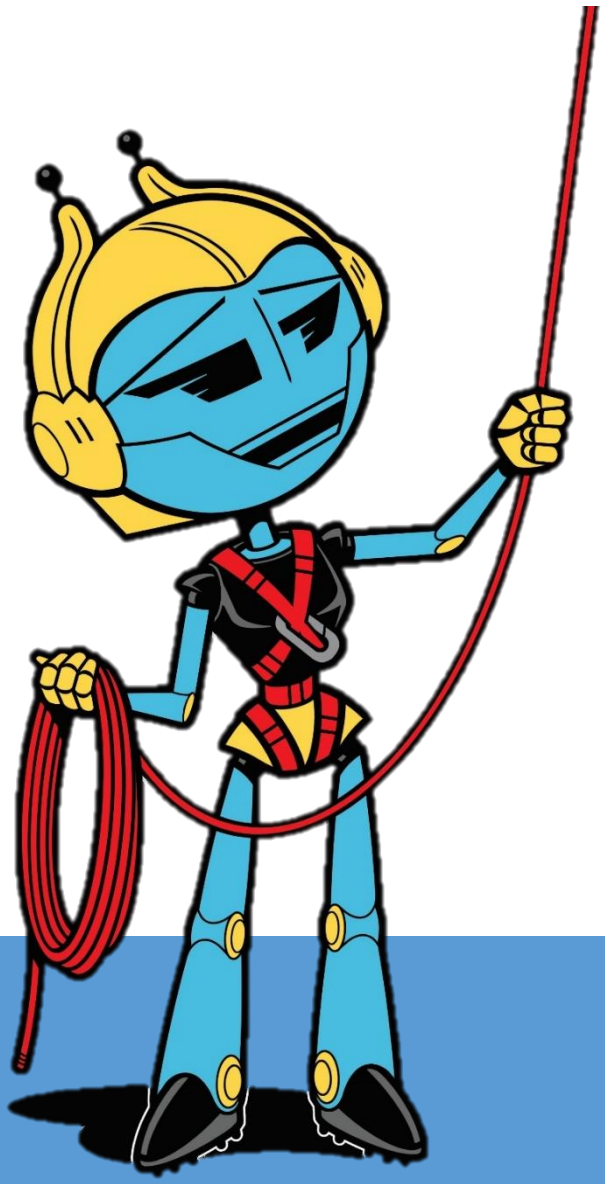
RoboCup Junior Australia

Rescue Maze Sprint 2021

Rev 1 Release: 1 September 2021



Welcome to the rapid pace world of Maze Sprint

There has been a terrible disaster and there has been massive damage to a plant trapping people inside.

It is too hazardous to send in human rescuers so robots have been called in to help the victims. The first thing that the rescue teams need to know is how many victims are trapped and how many are in critical condition.

In this competition your robot is required to negotiate the maze as quickly as possible finding and identifying the number of trapped and critical victims.

These numbers are then reported by the robot at the end of the maze.

And all this under a challenging time limit!

Speed and accuracy are critical.

The competition will be held in three divisions

- **Standard** where competitors provide software which is downloaded into Lego EV3 robots and ran through the mazes by the assistants. Competitors can observe their robot runs via a streamed coverage. The robot design is fixed and coding can only be done by
- **Virtual** competition where groups can use any robot design that is legal in Rescue Maze. They will record their 3 preliminary runs and submit the videos for scoring. Maze layouts will be provided with a 24-hour response window. The final three rounds will take place on the second day of the competition.

All events share common goals

- The robot must negotiate the maze in less than the Target Time to receive a time bonus.
- Mazes will be constructed to set designs preferably using reams of printer paper and paper boxes. Alternative materials and regular maze elements can be used if necessary
- While travelling through the maze the robot is required to find victims that are simulated as 50mm coloured squares centrally position on the floors in the maze. A victim is "found" by the robot stopping for 1 second and making a clear indication. Critical victims are represented by red squares while green squares are trapped but bot critically injured. Points are scored for each victim found. Each victim identified becomes a checkpoint.
- The robot must avoid black squares (holes) and any robot that enters these will be declared lack of progress. Any robot stuck against a wall or suffering weird behaviour will also be declared to have lack of progress.
- If a robot has lack of progress it can be returned to the last identified victim and released in any direction. But the clock keeps ticking!
- An accuracy bonus will be awarded if the robot can stop at the exit and indicate the number of each type of victim found.

Its Fast and furious – its Maze Sprint !

RoboCup Junior Australia Executive Committee

President	Susan Bowler (Tasmania)
Vice President	Karen Binns (New South Wales)
Minutes Secretary	Brenda Gahan (New South Wales)
Treasurer	Evan Bailey (Victoria)
Secretary	Steven Lau (Queensland)

RoboCup Junior Australia Rescue Technical Committee

Chair	Neil Gray (Western Australia)
Members	William Plummer (Queensland)
	Jason Flood (New South Wales)
	Andrew Mackerras (ACT)
	Tim Ronchi (Victoria)

Code of Conduct

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 website 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 Australian National Championships for the titled year. State and Regional competitions may implement minor variations with respect to age groups, divisions and judging. These variations will be communicated to the participants through email and/or on their relevant website prior to the state or regional competition.

Notes/Advice vs. Rules

This document includes notes/advice to the competitors and mentors, plus rules that are firm. This has been done to remove ambiguity. There is a notation to indicate whether the content of this document is to be read as a note/advice or as a rule. Notes/advice appear in green.

Table of Contents

1 The Challenge

1.1 The Scenario

1.1.1 There has been an accident at a manufacturing plant. There are a number of victims still trapped within the plant and it is too hazardous to send in human rescue teams. Markers have been placed to represent trapped survivors and those that are in critical condition.Your autonomous robot must be able to navigate through a treacherous building avoiding restricted areas to count number and type of victims and report their findings at the end of the maze.
In this challenge time is of the essence! Time and technical skills are essential! Come and prepare to be the most successful Rescue Maze Sprint Team.

1.1.2 The robot needs to search through a maze for colour identifiable victims. i.e. the robot should not find the fastest path through the maze, instead it should explore as much as possible of the maze. The robot will score points for each victim found. If the robot can correctly identifuy the number and type of victims found it will be awarded a bonus. The robot should avoid areas with black floor.

1.1.3 If the robot is stuck in the maze it can be restarted at the last correctly identified victim.

1.1.4 If the robot can find its way to the finishing tile in less than 2 minutes will receive an exit bonus.

1.1.5 Additional bonuses will be awarded if the robot can accurately report the red and green victims that it finds in the maze.

2 Playing Field

2.1 Maze Description

2.1.1 The maze will be on a single level of A4 printer paper reams laid on their long side
2.1.2 Mazes will be built to supplied designs
2.1.3 Walls will be located approximately 30cm apart.
2.1.4 Doorways are approximately 30 cm wide.

2.2 Floor

2.2.1 Floors should be smooth (eg vinyl) and lightly coloured.
2.2.2 The exit will be marked by aluminium foil approx. 30cm square.
2.2.4 Throughout the arena, there may exist black tiles that represent “no go” spaces.

2.3 Path

2.3.1 Walls may or may not lead to the entrance/exit. Walls that lead to the entrance/exit are called linear walls.
2.3.2 Paths will be approximately 30 cm wide, but may open into foyers wider than the path.

2.4 Debris, Obstacles and Stairs

2.4.1 **There are no Debris, Obstacles or Stairs in Maze Sprint.**

2.5 Environmental Conditions

2.5.1 This competition simulates a disaster area. There may be gaps and misalignments between wall panels, differences in flooring materials and heights, and changes may occur as the robot moves through the maze. Teams should expect the environmental conditions at a tournament to be different from the conditions at their home practice field.

3 Victims

3.1 Definition

3.1.1 Victims are represented by red or green coloured 5cm squares laid on the floor approximately 15cm from the nearest wall (as measured to the cantre of the square).

3.1.2 The trapped victims are depicted as green squares while the critically injured victims are red.

3.2 Locations

3.2.1 There will be a minimum of five (5) active victims in any round.

3.2.2 Victims can be located anywhere within the maze with the exception of black tiles.

3.2.3 Victims will be placed more than 10cm apart as measured from the edge of each square

4 Robot

4.1 Construction

4.1.1 The height of a robot must not exceed 30 cm.

4.1.2 Robots may not have any sensor or devices that enable it to 'see' over the walls.

4.1.3 Any robot kit or building blocks, either available on the market or built from raw hardware and materials, may be used, as long as the design and construction are primarily and substantially the original work of the students.

4.1.4 Any commercially produced robot kits or sensors components that are specifically marketed to complete any single major task of RoboCupJunior Australia Rescue Maze will be disqualified. If there is any doubt, teams should consult the Technical Committee (TC).

4.1.5 For the safety of participants and spectators, only lasers of class 1 and 2 are allowed. This will be checked during inspection.

4.1.6 Robots must be autonomous in operation. If the robot has the capability for remote or other forms of remote control either by Bluetooth, Wi-Fi or some other form of wireless communication, the team must prove that they have disabled the capability for third party operation in some way. This could be by software, hardware or degree of human interaction. Robots that do not comply may face immediate disqualification from the tournament. Distributed control is allowed but must operate without human interaction after the robot has started the round.

4.2 Rescue Kits

4.2.1 **There are no Rescue Kits in Maze Sprint.**

5 Inspection

5.1 Electronic Submission

5.1.1 **Not required for this event**

5.2 Interviews

5.2.1 The teams will be required to attend a technical interview to explain the operation of their robot in order to verify that the design, construction and programming of the robot is the students' work. There are no set questions. The students and their mentors should be available on the two days of the competition and a schedule will be released prior.

5.2.2 The interview will take place as a video conference in the presence of the mentor.

5.2.3 Interviews are not scored and do not contribute to team overall score.

5.3 Journal/Logbook

5.3.1 **Not required for this competition**

6 Teams

6.1 Definition

6.1.1 A team should have a minimum of 2 members and a maximum of 5 members.
Note: An individual participant is allowed to compete in a RoboCup Junior Australia National Rescue Challenge as an individual only once. To do so the individual must seek approval from the Challenge Committee. If a team can only afford, or due to extenuating circumstances, cannot send more than one member to a competition, then this is allowed as the Journal / Log book will show that they have been part of a team.

6.1.2 RoboCup Junior Australia Rescue Maze Sprint is an Open Challenge: Open to all students studying at a recognised secondary or primary study provider.

6.1.3 In each round one team member is nominated as the Robot Handler. Only the robot handler is permitted to enter the game zone and handle the robot during the round. All other team members must remain outside the game zone unless authorised by the Referee.

6.1.4 The Robot Handler is the only team member permitted to communicate directly with the referees and officials.

7 Game Play

7.1 Pre-round Practice

7.1.1 Where possible, competitors will have access to practice arenas for calibration, testing and tuning throughout the competition.

7.1.2 Whenever there are dedicated independent arenas for competition and practice, it is at the organizers' discretion if testing is allowed on the competition arena.

7.2 Humans

7.2.1 Teams should designate one of its own team members as Robot Handler. Only this team member will be allowed access to the practice/competition arenas, unless otherwise directed by a referee. Only the robot handler will be allowed to interact with the robot during a scoring run.

7.2.2 The robot handler can move the robot only when s/he is told to do so by the referee.

7.2.3 Other team members (and any spectators) within the vicinity of the rescue arena have to stand at least 150 cm away from the arena while their robot is active, unless otherwise directed by the referee.

7.2.4 No one is allowed to touch the arenas intentionally during a scoring run.

7.3 Start of Play

7.3.1 A run begins at the scheduled starting time whether or not the team is present/ready. Start times will be posted online.

7.3.2 Once the scoring run has begun, the playing robot is not permitted to be taken from the competition area for any reason.

7.3.3 Each maze configuration will have a target time based on the complexity of the maze, path length and number of dead-ends and black squares. The robot will receive a Time Bonus if they can exit the maze within this period.

7.3.4 Calibration is defined as the taking of sensor readings and modifying a robot's program to accommodate such sensor readings. Once the clock has started, a team may calibrate their robot at as many locations as desired on the arena, but the clock will continue to count down. A robot is not permitted to move using its own power while calibrating.

7.3.5 Calibration time is not for pre-mapping the arena and/or the locations of the victims. Pre-mapping activities will result in immediate robot disqualification for the round.

7.3.6 The maze will have a single entry. This entry will be a hallway style (that is walls on either side).

7.3.7 The maze layout must be as close as possible to the assigned design for this round.

7.3.8 Once a scoring run has begun, no more calibration is permitted (this includes changing of code/code selection) without penalty as per section 7.5.3.

7.3.9 The Run will be declared over 60 seconds aftyer the Taget Time.

7.4 Scoring Run

7.4.1 Modifying a robot during a run is prohibited; which includes remounting parts that have fallen off.

7.4.2 All parts that the robot is losing intentionally or unintentionally will be left in the arena until the run is over. Neither the team nor the judge are allowed to remove parts from the arena during a run.

7.4.3 Not applicable

7.4.4 The scoring run ends when:

7.4.4.1 The Run Time expires. The Run Time for each round will be the Target Time plus 60 seconds.

7.4.4.2 The Robot Handler declares an end of their scoring run. The team will be awarded all points achieved up to the call for end of round.

7.4.4.3 The robot returns to the start tile and gets the exit bonus. To collect points, the robot must stop on the exit tile and indicate in some way that it has completed the round. Robot indication should be

distinct from the victim indication as detailed in section 7.6.2. The operator should be prepared to demonstrate the exit indication to the referee if required.

7.4.4.4 A team member touches the arena or their robot without permission from a referee. If a team member is in breach of this rule the referee can declare a Restart where the robot is returned to the Start tile as per 7.5.3.

7.5 Lack of Progress

7.5.1 A Lack of Progress occurs when:

7.5.1.1 The Robot Handler can request a Lack of Progress from the referee provided that the robot can genuinely not continue through either a stoppage or recursive (looping) behaviour.

7.5.1.2 A Lack of Progress will be assigned when the robot fails to retreat from a 'visited' black tile. A robot is deemed to have entered the tile when more than half the robot is within the tile as determined by the referee. For a successful retreat, it needs to back up without turning inside the black tile (it has to move straight backwards inside of a black tile). (See definition of visited tile on rule 7.4.3.) If a robot is deemed to have visited the black tile it must return to the last visited checkpoint (or the start tile if never reached a checkpoint). All points scored to that stage are still valid but obstacles and debris will not be reset.

7.5.1.3 A robot or a team member damages the arena.

7.5.2 If a Lack of Progress occurs the robot must be returned to the last identified victim (or the Start tile if the robot has not found a victim). The robot can be placed in any direction but must be wholly over the square.

7.5.3 After a Lack of Progress or when Rule 7.4.4.4 is breached, the Robot Handler may declare a **Restart**. The team can reset the power supply (turn the robot off and on), change programs, and the maze will be returned to original condition.

Note: All points earned prior to a call of restart are invalid.

Note: The round timer remains running.

7.6 Scoring

7.6.1 Successful Victim Identification. Robots are rewarded points for each Successful Victim Identification in the arena:

- 10 points per green victim.
- 25 points per red victim.

7.6.2 A robot can carry out the following action to successfully identify a victim by stopping for 1 second over the victim and clearly indicating by either visual indicator or sound.

7.6.3 Once identified a voctim can be used as a checkpoint for lack of progress.

7.6.4 **Exit Bonus.** A successful exit bonus will be awarded if the robot reaches and stops on the Exit Tile

7.6.5 **Time Bonus.** A bonus will be awarded for finding and stopping at the Exit (as defined in 7.6.4) in under the Time target. A bonus will be awarded of 2 points for every second under the time limit.

7.6.6 **Count Bonus.** The robot will be awarded a further bonus of 25 points if it stops on the Exit tile and clearly indicates the number of trapped (green) victims found. A bonus of 50 points will be awarded if the number of critical (red) victims is clearly indicated.

State	Indicator	Points
Trapped (green) victim found	Stop for 1 second and clear indication of victim identification	10 per victim
Critical (red) victim found	Stop for 1 second and clear indication of victim identification	20 per victim
Exit Bonus	The robot will be awarded 25 points for reaching and stopping on the Exit tile if it dies so in less than the Target Time plus 60 seconds	25
Exit Time bonus	If the robot stops on the Exit tile within the Target Time it will be awarded 2 points for every second under the limit.	2 points per second
Trapped (green) Victim Count Bonus	The robot will be awarded 25 points for an accurate count of green victims	25 points
Trapped (green) Victim Count Bonus	The robot will be awarded 50 points for an accurate count of green victims	50 points

7.6.8 Total cumulative scores at the end of all the competition rounds will decide the overall positions of the teams.

7..6.9 Ties at the end. Ties in scoring will be resolved on the basis of the cumulative time each robot took to complete the runs.

7.6.9 No duplicate rewards. Each victim can only be scored once.

8 Conflict Resolution

8.1 Referee and Referee Assistant

8.1.1 All decisions during game play are made by the referee or the referee assistant who are in charge of the arena, persons and objects surrounding them.

8.1.2 During game play, the decisions made by the referee and/or the referee assistant are final.

8.1.3 At conclusion of game play, the referee will ask the robot handler to sign the score sheet. The robot handler should be given a maximum of 1 minute to review the score sheet and sign it. By signing it, the robot handler accepts the final score on behalf of the entire team; in case of further clarification, the robot handler should write their comments in the score sheet and sign it.

8.2 Rule Clarification

8.2.1 If any rule clarification is needed, contact the RoboCup Junior Australia Rescue Technical Committee.

8.2.2 If necessary even during a tournament, a rule clarification may be made by members of the RoboCup Junior Australia Rescue Technical Committee and Organising Committee.

8.3 Special Circumstances

8.3.1 If special circumstances, such as unforeseen problems or capabilities of a robot occur, rules may be modified by the RoboCup Junior Australia Rescue Organizing Committee Chair in conjunction with available Technical Committee and Organizing Committee members, if necessary, even during a tournament.

8.3.2 If any of the team members/mentors do not show up to the team meetings to discuss the problems and the resulting rule modifications described at 8.3.1, it will be considered as an agreement.

9 Code of Conduct

9.1 Spirit

9.1.1 It is expected that all participants (students and mentors alike) will respect the aims and ideals of RoboCup Junior as set out in our mission statement.

9.1.2 The volunteers, referees and officials will act within the spirit of the event to ensure the competition is competitive, fair and most importantly fun.

9.1.3 It is not whether you win or lose, but how much you learn that counts!

9.2 Fair Play

9.2.1 Robots that cause deliberate or repeated damage to the arena will be disqualified.

9.2.2 Humans that cause deliberate interference with robots or damage to the arena will be disqualified.

9.2.3 It is expected that the aim of all teams is to participate fairly.

9.3 Behaviour

9.3.1 Participants should be mindful of other people and their robots when moving around the tournament venue.

9.3.2 Participants are not allowed to enter setup areas of other leagues or other teams, unless explicitly invited to do so by team members.

9.3.3 Teams will be responsible for checking update information (schedules, meetings, announcements, etc.) during the event. Update information will be provided on notice boards in the venue and (if possible) on the local competition website and/or the RoboCup or RoboCup Junior websites.

9.3.4 Participants who misbehave may be asked to leave the building and risk being disqualified from the tournament.

9.3.5 These rules will be enforced at the discretion of the referees, officials, tournament organizers and local law enforcement authorities.

9.4 Mentors

9.4.1 Adults (mentors, teachers, parents, chaperons, translators and other adult team members) are not allowed in the student work area.

9.4.2 Sufficient seating will be supplied for mentors to remain in a supervisory capacity close to the student work area.

9.4.3 Mentors are not permitted to repair robots or be involved in programming of their team's robots.

9.4.4 Mentor interference with robots or referee decisions will result in a warning in the first instance. If this recurs, the team will risk being disqualified.

9.4.5 Robots must be mainly students' own work. Any robot that appears to be identical to another robot may be prompted for re-inspection.

9.5 Ethics and Integrity

9.5.1 Fraud and misconduct are not condoned. Fraudulent acts may include the following:

9.5.1.1 Mentors working on the software or hardware of students' robot(s) during the competition.

9.5.1.2 "Higher league group" and/or more advanced group of students may provide advice, but should not do the work for "Lower league group". For example, a secondary group helped to fix its peer wwprimary group's work, software or hardware prior to and/or during the competition. This may also risk disqualification for the secondary group. See "Code of Conduct, 9.4.3 & 9.4.5". This applies not just to mentors, but also to higher league (advanced) groups of students as well.

9.5.2 RoboCup Junior Australia reserves the right to revoke an award if fraudulent behaviour can be proven after the award ceremony took place.

9.5.3 If it is clear that a mentor intentionally violates the code of conduct, and repeatedly modifies and works on the students' robot(s) during the competition, the mentor will be banned from future participation in RoboCup Junior competitions.

9.5.4 Teams that violate the code of conduct can be disqualified from the tournament. It is also possible to disqualify only a single team member from further participation in the tournament.

9.5.5 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 a warning.

9.6 Sharing

9.6.1 The spirit of world RoboCup competitions is that any technological and curricular developments should be shared with other participants after the tournament.

9.6.2 Any developments may be published on the RoboCup Junior website after the event.

9.6.3 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.

9.6.4 This furthers the mission of RoboCup Junior as an educational initiative.