

# Western Canada RoboCup Junior Rescue A Rules 2023

## Preface

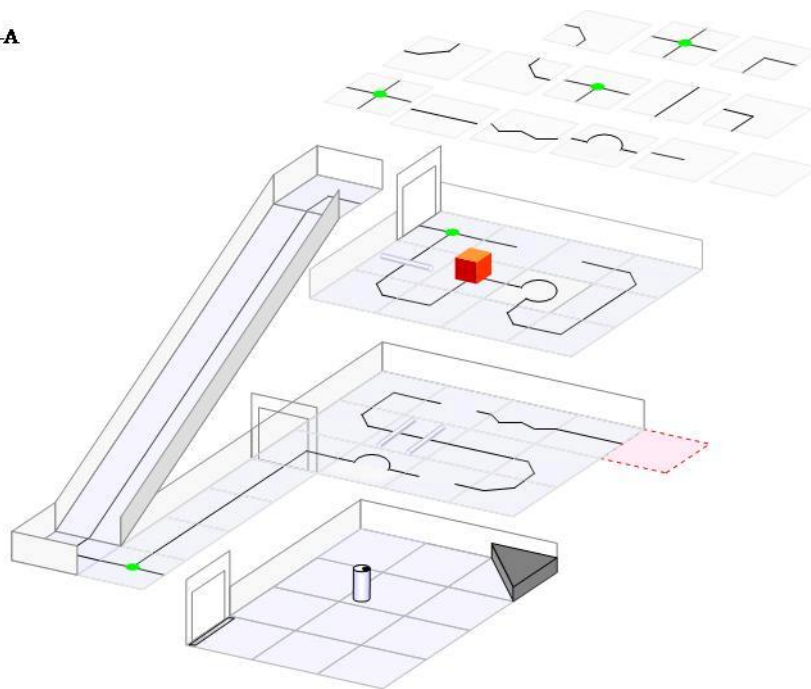
The mission can be seen as a real-world disaster, such as an avalanche, where the rescue personnel in place need robotic assistance in dangerous areas.

The robot has to be fully autonomous and carry out the mission with no help. This means that it must handle rough terrain (speed bumps) without getting stuck and cross snowstorms (gap in the line) where you can't see the road you're trying to follow. The robot also has to have the ability to climb mountains (the ramp).

When the robot finally finds the victim (a soda can) they have to carefully transport it to a safe area (evacuation point) where humans can take over.

## 1. Arena

**Rescue A**



## 1.1 Description:

1.1.1 The arena is modular. Each module can be thought of as a room in a building. **Rooms** may be placed adjacent to each other (on the same level horizontally) or may be stacked vertically. **Rooms** on the same level are connected by level hallways. **Rooms** on different levels are connected by a sloping hallway or ramp. A ramp will not exceed an incline of 25 degrees from the horizontal, and must have walls at least 10 cm high. The Ramp area (hereafter known as the Ramp) consists of the ramp itself and the top and bottom platforms that connect it to the other rooms.

Building plans are linked here - **Suggested building instruction can be found at the official RCJ website under Rescue rules.**

## 1.2 Dimensions:

1.2.1 Each **room** is approximately **120 cm by 90 cm**, with walls that are **at least 10 cm** high.

1.2.2 Hallways and the Ramp should also have walls **at least 10 cm** high, and approximately 30 cm **wide**.

1.2.3 Each room will have **one or two** doorways. Robots **may** enter and exit through the **same doorway if intersections are used**. Doorways are **25 cm x 25 cm** in size.

1.2.4 The First room in the **arena** may or may not have an entrance doorway. The Final room in the **arena** does not have an exit door.

## 1.3 Floor:

1.3.1 The floor of each room is light colour (white, or close to white). The floor may be either smooth or textured (like linoleum or carpet), and may have steps of up to 3 mm height at joins between **rooms**.

1.3.2 The arena should be **placed in the way that** the floors are **leveled**.

## 1.4 Line:

1.4.1 The floor of each room is composed of **30 cm x 30 cm** tiles with a black line for a robot to follow.. 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 are for reference only.)

**1.4.2 The line is always at least 10 cm from the nearest wall.**

1.4.3 Where the black line is used, it will enter and exit each room through the standard doorways. **Straight sections of the black line may have gaps with at least 5 cm of straight line before each gap. The gap is 20 cm at most. If a gap is running along a wall, it is 30cm at most.**

1.4.4 The arrangement of the tiles within each room may vary between rounds.

1.4.5 Due to the nature of the tiles, there may be a step and/or gap in the construction of the arena. These are not intentional and will **be** minimized **as much as** possible by the organizers.

## 1.5 Debris and Obstacles:

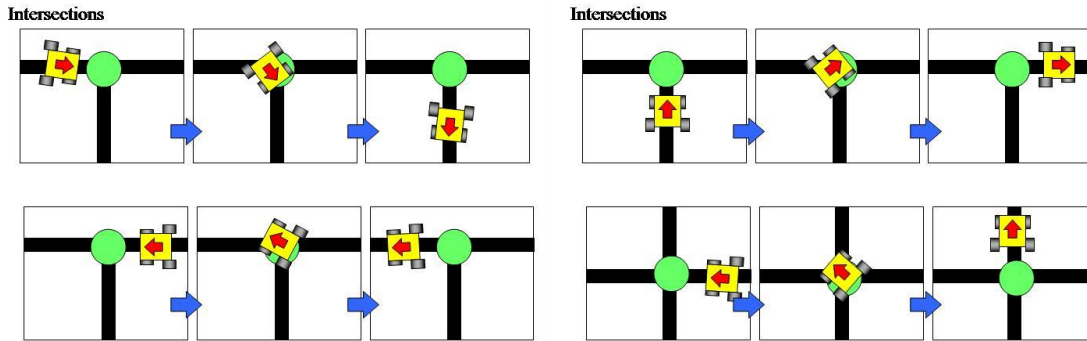
1.5.1 Debris may consist of speed bumps (made from a 10 mm plastic pipe or wooden dowel painted white) or wooden sticks less than 3 mm in diameter (e.g. cocktail sticks or kebab skewers). Robots may drive over or push aside debris as needed.

1.5.2 Debris may be attached to the walls.

1.5.3 Obstacles may consist of bricks, blocks, weights and other large, heavy items. Obstacles **will NOT** be located in hallways, **nor** on the ramp. Robots are expected to navigate around Obstacles. Obstacles that are

moved/knocked over will remain where they fall and will be reset only once the robot has completed its scoring run.

## 1.6 Intersections:



**1.6.1 Intersection Markers are green circles with an approximate radius of 2 cm, positioned over an intersection. They indicate the correct path to follow.**

**1.6.2 At an intersection a robot should always choose the right-most path, it can either be to the right or straight forward.**

**1.6.3 Intersection Markers is never placed in the first room.**

**1.6.4 The intersections is always perpendicular, but may have 3 or 4 branches.**

**1.6.5 Note that the robot may need to go down the ramp if intersections are used.**

## 1.7 The Evacuation room:

1.7.1 The black line **ends** at the entrance to the last room (**the evacuation room**), and robots are required to utilize some form of search strategy to locate a victim.

1.7.2 At the entrance to **the evacuation room**, there is a 25 mm x 250 mm strip of reflective silver tape on the floor.

1.7.3 For the primary competition, an Evacuation Point tile is placed at one corner of **the evacuation room**. The Evacuation Point tile is a right angled triangle with sides of **30 cm x 30 cm**, and it is painted in black.

1.7.4 For the Secondary competition, the Evacuation Point tile is a right angled triangle, sides of **30 cm x 30 cm** and elevated in **6 cm**, and it is painted in black.

1.7.5 **The evacuation room** have an entrance door only. The mission is considered complete once **a robot achieves a "successful rescue of a victim"**. (Refer to 3.4.13)

## 1.8 Victims:

1.8.1 A Victim may be located anywhere on the floor of **the evacuation room**, but will be at least 10 cm from the nearest wall, speed bumps or Obstacle.

1.8.2 The victim takes the form of a soft drink can, internally weighted to approximately 150 grams. The dimensions of the can is similar to those readily available in the country in which the competition is being held (i.e. Australia 375 ml, US 12 fl oz, Europe 330 ml etc.). Teams need to be prepared for minor variations.

1.8.3 The victim is covered in aluminum foil.

## 1.9 Environmental Conditions:

1.9.1 Teams must come prepared to adjust their robots to the lighting conditions at the venue.

1.9.2 Lighting **and magnetic** conditions may vary along the course in the rescue arena.

1.9.3 **The arena may be affected by magnetic fields (e.g. generated by under floor wiring and metallic objects).**

**1.9.4 Teams should prepare their robots to handle expected lightning interference. While the organizers and referees will try their best to minimize external lighting interference, it is not possible for them to foresee all unexpected ones such as camera flash from spectators.**

## 2. Robots

### 2.1 Control:

2.1.1 Robots must be controlled autonomously (use of a remote control to manually control or pass information to the robot is not allowed).

2.1.2 Robots must be started manually by **the team captain**.

### 2.2 Construction:

2.2.1 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 are primarily and substantially the original work of the students (see section 2.5. below).

**2.2.2 Any commercially produced robot kits that are specifically marketed to complete major tasks of Rescue, such as 'line following' or 'rescue', will be disqualified. If there is any doubt, teams should consult the Technical Committee (TC) at [the International RCJ Community Forum](#).** "

2.2.3 For the safety of participants and spectators, no lasers are allowed on any robot.

**2.2.4 Bluetooth Class 2 and ZigBee communications are the only radio types allowed in RoboCupJunior. Robots that have other types of radio communications on board will either need to remove these or disable them as other types of radio communication can interfere with other leagues competing in RoboCup. If the robot has equipment for other forms of radio communication, they must prove that they have disabled them. Robots that do not comply may face immediate disqualification from the tournament.**

**2.2.5 Pre-made sensors for line-following (line-leader) are not allowed. If you have any doubt about a specific sensor, please ask at [the International RCJ Community Forum](#).**

### 2.3 Team:

2.3.1 **The robot must perform its tasks 100% autonomously.**

**2.3.2 Each team must have only one robot in the field. (This rule can be modified in a Super Team Competition such that two or more robots are deployed together and have to cooperate in completing given tasks.)**

### 2.4 Inspection:

2.4.1 The robots will be examined 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 above.

2.4.2 It is the responsibility of teams to have their robots re-inspected, if their robots are modified at any time during the tournament.

2.4.3 Students will be asked to explain the operation of their robot in order to verify that the construction and programming of the robot are their own work.

2.4.4 Students will be asked questions about their preparation efforts, and may be requested to answer surveys and participate in video-taped interviews for research purposes.

## **2.5 Violations:**

2.5.1 Any violations of the inspection rules will prevent that robot competing until modifications are effected

2.5.2 However, modifications must be made within the time schedule of the tournament and teams must not delay tournament play while making modifications.

2.5.3 If a robot fails to meet all specifications (even with modification), it will be disqualified from that round (but not from the tournament).

2.5.4 If there is excessive mentor assistance or the work on the robots is not substantially original work by the students, the team will be disqualified from the tournament.

## **3. Play**

### **3.1 Pre-round Practice:**

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

3.1.2 Where there are dedicated competition and practice **arena, it** will be at the organizers' discretion if testing is allowed on the competition **arena**.

### **3.2 Humans:**

3.2.1 Teams should designate one human who acts as captain and be allowed to move the robot, based on the stated rules and as directed by the referee. 3.2.2 The captain can move robots only when told to do so by the referee.

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

**3.2.4 No one is allowed to touch the arenas intentionally during a scoring round.**

### **3.3 Start of Play:**

3.3.1 The round begins at the scheduled starting time whether or not the team is present/ready. Start times will be posted prominently around the venue.

3.3.2 Once the round has begun, Robots are not permitted to leave the competition area for any reason.

3.3.3 Robots will be given a maximum time of 8 minutes to calibrate their robot and complete the course. The time for each round will be kept by the referee.

3.3.4 Calibration is defined as the taking of sensor readings (and modifying of the robot programming to accommodate such sensor readings) for the purposes of robot searching of the arena and identifying victims, and not for pre-mapping of the arena and/or victim location. Any and all pre-mapping activities will result in immediate disqualification of the robot for the round.

3.3.5 Teams may calibrate their robot in as many locations as desired on the arena, but the clock will continue to count down. Robots are not permitted to move under power while calibrating and no points are scored while a team is calibrating.

3.3.6 Once teams are ready to perform a scoring run, they must notify the referee. To begin a scoring run, the robot is placed on the starting tile in the first room as indicated by the referee. Once a scoring run has begun, no more calibration is permitted.

### 3.4. Scoring:

3.4.1 Robots are awarded points for successfully negotiating **rooms**, hallways, ramps and each hazard (gaps in the line, speed bump, **intersections** and obstacles).

3.4.2 Successfully negotiating is defined as entering through one doorway, completely following the line, negotiating all line gaps, **intersections**, **speed bumps**, **obstacles**, and exiting through a doorway without human interaction.

3.4.3 Failed attempts at negotiating elements of the arena are defined as "Lack of Progress" (see 3.5).

3.4.4 Points available for successfully negotiating **rooms**:

(1st **Attempt**) = 60 pts

(2nd **Attempt**) = 40 pts

(3rd **Attempt**) = 20 pts

3.4.5 Points available for successfully negotiating hallways and ramps:

(1st **Attempt**) = 30 pts

(2nd **Attempt**) = 20 pts

(3rd **Attempt**) = 10 pts

**3.4.6 If intersections are used, the path may go to the opposite direction through a room/hallway/ramp (going back to the path that a robot already took). The points will be awarded as if it was a new room/hallway/ramp.**

**3.4.7 There is no points available for negotiating rooms/hallways/ramps beyond the evacuation attempt in each direction (see 3.5.6).**

3.4.8 Points available for successfully negotiating each gap in the black line. 10 pts per gap

3.4.9 Points available for successfully avoiding each obstacle blocking the black line. 10 pts per obstacle

3.4.10 Points available for successfully completing a tile that has speed bumps. 5 pts per speed bump tile

**3.4.11 Points available for successfully completing a tile that has an intersection. 10 pts per direction through intersection tile**

**3.4.12 Each gap, obstacle, speed bump and intersection tile can only be scored once per direction through the room, not each attempt through the room.**

**3.4.13 Successful rescue of a victim:** Robots are also awarded points for successfully rescuing victims. A successful victim rescue occurs when the victim is moved to the evacuation zone (it needs to be completely inside of the evacuation zone for Primary/free-standing for Secondary), in its original upright orientation, and no part of the robot is in contact with the victim (see figures below). Team captains may declare either a "Lack of Progress" or "End of Round" when a failed attempt at a victim rescue occurs (see 3.5).

Points available for a successful rescue:

(1st **Attempt**) = 60 pts

(2nd **Attempt**) = 40 pts

(3rd **Attempt**) = 20 pts

\*No points scored for rescue attempts beyond the third attempt.

3.4.14 Secondary Division Only - Additional Points for lifting the victim:

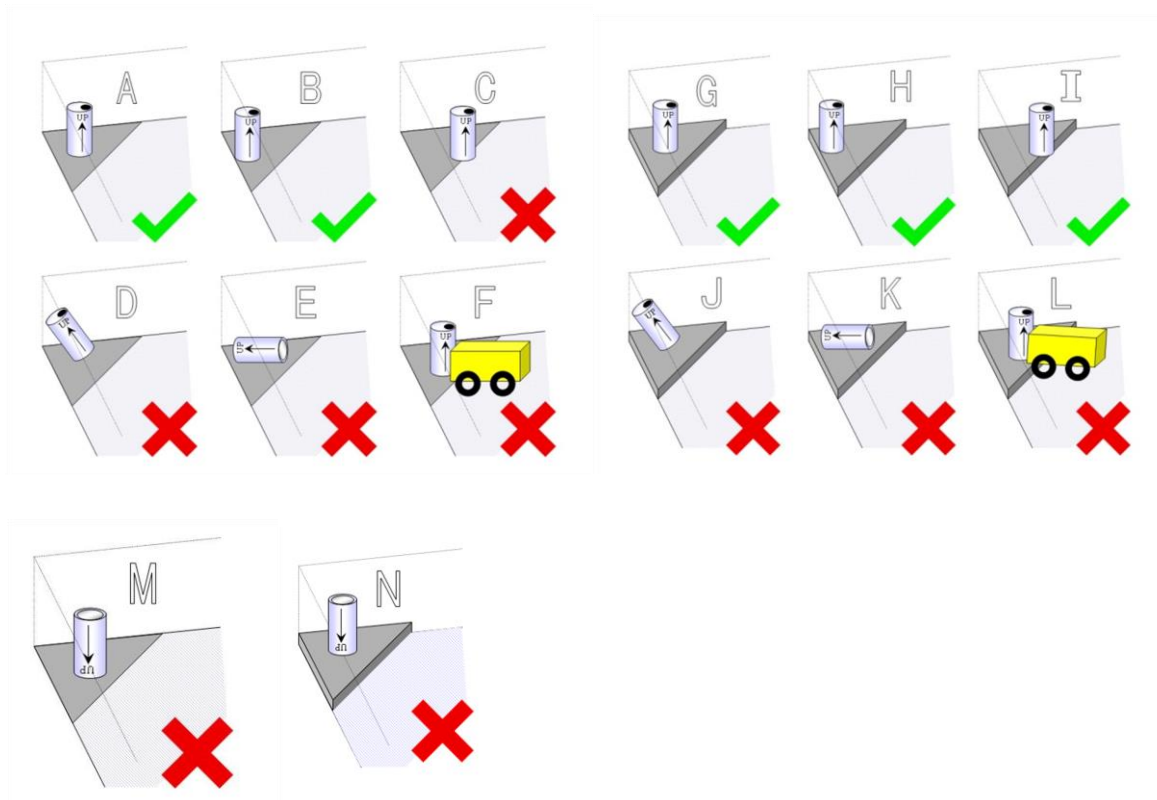
(Lifted victim, with no part of the victim touching the floor) = 20 pts

3.4.15 Ties in scoring will be resolved on the basis of the time taken by each robot (or team of robots) to complete the course (this includes calibration time).

3.4.16 Check [RoboCupJunior official website](#) for a score sheet template.

Primary Rescue A - A,B,C,D,E,F,M

Secondary Rescue A - G,H,I,J,K,L,N



### 3.5 Lack of progress:

3.5.1 The robot must follow the black line where it is present. Failure to follow the line is considered Lack of Progress.

3.5.2 Lack of Progress occurs if the robot is stuck in the same place or loses the black line without regaining it by the next tile in the sequence (see figures below).

3.5.3 Lack of Progress occurs if the robot does not follow the correct path after an intersection tile.

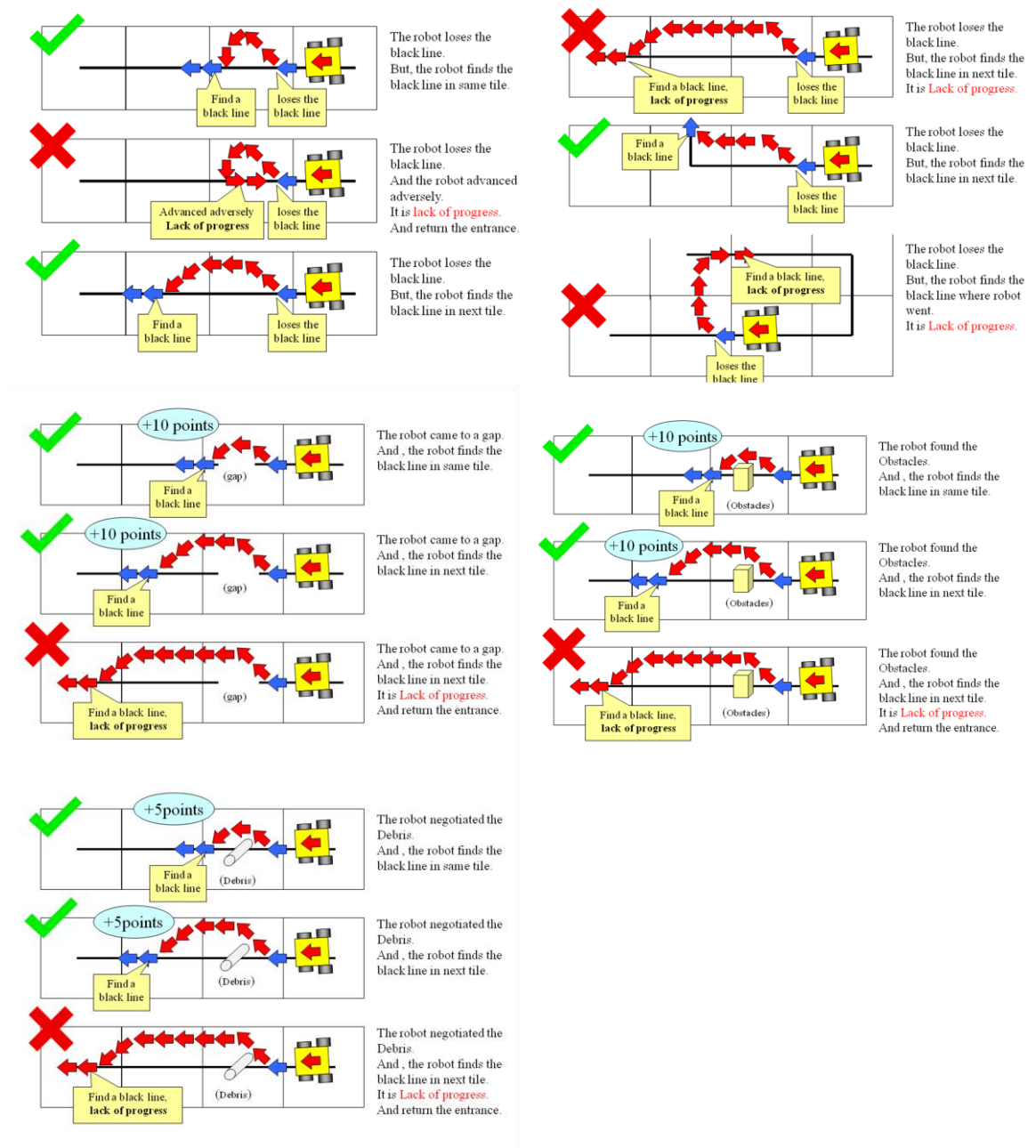
3.5.4 The team captain can also call for a Lack of Progress at any time (s)he wants (for example if the robot is in danger).

3.5.5 If Lack of Progress occurs the robot must **restart** the **room/hallway/ramp** where the Lack of Progress happens. **The robot should be placed in the last tile of the former room and re-enter the room/hallway/ramp once again. Only the team captain is allowed to restart the robot without changing programs and/or modifying the robot.**

3.5.6 If after the third attempt, the robot still fails to negotiate the **room/hallway/ramp** the team captain may choose to move the robot to the end of the room, hallway or ramp to continue on. The team captain may also choose to make further attempts at the failed room to earn the additional points available for overcoming

obstacles, debris, gaps in the line, and speed bump points that have not already been earned in the previous attempts at the **room**.

3.5.7 A team may elect to stop the round early at any time. In this case, the team captain must indicate to the referee the team's desire to terminate. The team will be awarded all points achieved up to the call for end of round. There is no Lack of Progress call for picking up the robot once end of round is called.





## 3.6 Victim Placement

- 3.6.1 Six different victim Placement Areas in **the evacuation room**, each approximately **30 cm x 30 cm** in size, will be designated on the day of the competition.
- 3.6.2 The location of each area will be made known on the day of the competition but will not be marked on the field. No Placement Area will come within 100mm of a wall.
- 3.6.3 Only 1 victim will be used in a round.
- 3.6.4 Once a robot begins its scoring round and has entered the Arena, the referee will roll a standard 6 sided dice to determine which Placement Area the victim will be located. The referee will place the victim randomly within the chosen **30 cm x 30 cm** Placement Area.
- 3.6.5 If the victim is moved from its spot by a robot attempting a rescue, and the robot subsequently requires a restart, the victim will remain where it moved to. If it has been knocked over, it will remain knocked over.
- 3.6.6 If the robot is in contact with the victim and the team captain calls for a Lack of Progress, the referee may roll the dice once more and place the victim at a new location.**

## 3.7 Evacuation Point Placement

- 3.7.1 The Evacuation Point is placed in any of the non-entry corners in the evacuation room.**
- 3.7.2 Once a robot begins its scoring round and has entered the Arena, the referee will roll a standard 6 sided dice to determine in which corner the Evacuation Point will be located.**
- 3.7.3 After a Lack of Progress happened in any room, the referee may roll the dice once more and place the Evacuation Zone at a new corner.**
- 3.7.4 The RCJ OC will try their best to secure the Evacuation Point down, but you should expect slight shift at times.**

## 3.8 End of Play

- 3.8.1 The round ends when the time expires, the team captain calls at the end of round, or the successful rescue of victim (refer to 3.4.13).**

## 4 Conflict resolution

### 4.1 Referee:

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

### 4.2 Rule clarification:

- 4.2.1 Rule clarification may be made by members of the International RoboCupJunior Rescue Technical Committee.

### 4.3 Special circumstances:

- 4.3.1 Specific modifications to the rules for **accommodating** special circumstances, such as unforeseen problems and/or capabilities of a team's robot, may be agreed upon at the time of the tournament, when a majority of the contestants agree.
- 4.3.2 If any of team captains/mentors do not show up to the teams meeting to discuss the problems and the modification to the rules, it is considered as an agreement.**

## 5. Documentation

### 5.1 Presentation:

5.1.1 Each team must bring an electronic presentation (e.g. in PowerPoint or Flash format) and/or a poster documenting the design, construction and programming of their robot. (For the details of the presentation contents, refer to 5.1.3.)

5.1.2 Presentations and/or posters are to be shown to the judges during the scheduled interview session before being put up for viewing by the judges, other teams and the visiting members of the public.

5.1.3 The presentation should provide information about the team and how they prepared for RoboCupJunior. Areas that could be covered include:

- Team name;
- League and Division (primary or secondary);
- Team members' names and (perhaps) a picture of the team members;
- Team's country and city/town where the team members are from;
- Team's school and district;
- Pictures of the robot prototypes;
- Information about the robot, including schematics, mechanical drawings and samples of code (programs);
- Any interesting or unusual features of the robot;
- What the team hopes to achieve in robotics.

**5.1.4 Guidelines may be provided at the [International RCJ Community Forum](#).**

5.1.5 Judges will review the presentation and discuss the contents with team members.

5.1.6 Competitors are requested to provide a digital version of their presentation and poster.

5.1.7 Prizes may be awarded to teams with outstanding presentations.

### 5.2 Sharing:

5.2.1 Teams are encouraged to view one another's posters and presentations.

## 6. Code of Conduct

### 6.1 Fair Play:

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

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

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

### 6.2 Behavior:

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

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

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

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

### **6.3 Mentors:**

6.3.1 Mentors (teachers, parents, chaperones, **translators** and other adult team members) are not allowed in the student work area.

6.3.2 The organisers will try to provide sufficient seating for mentors to remain in a supervisory capacity close to the student work area.

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

6.3.4 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

### **6.4 Sharing:**

6.4.1 The understanding that any technological and curricular developments should be shared among the RoboCup and RoboCupJunior participants after the tournament has been a part of world RoboCup competitions.

6.4.2 Any developments may be published on the RoboCupJunior website after the event.

6.4.3 This furthers the mission of RoboCupJunior as an educational initiative.

### **6.5. Spirit:**

6.5.1 It is expected that all participants (students and mentors alike) will respect the RoboCupJunior mission.

6.5.2 The referees and officials will act within the spirit of the event.

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