

# RoboCupJunior Rescue A Rules 2012

## RoboCupJunior Rescue - Technical Committee 2012

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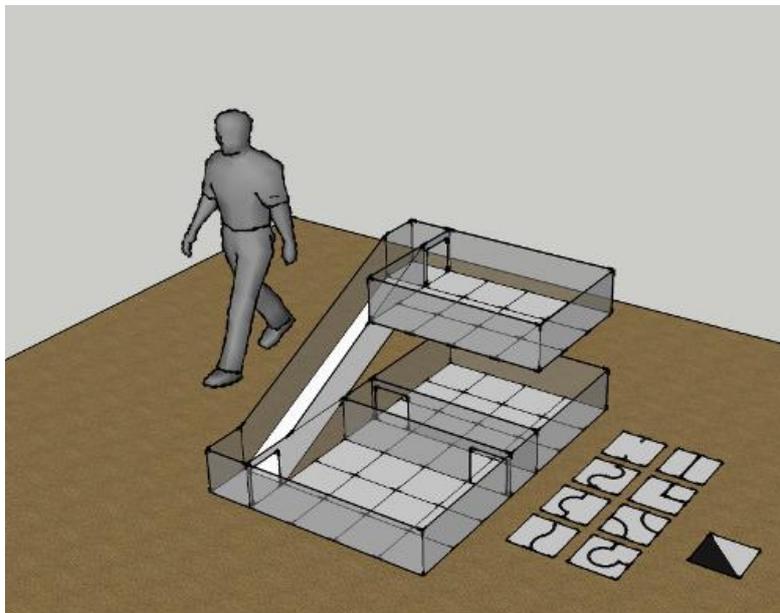
## 1. Arena

Changes from the 2011 rules are highlighted in red

### 1.1 Description:

1.1.1 The arena is modular. Each module can be thought of as a **room** in a building. Modules may be placed adjacent to each other (on the same level horizontally) or may be stacked vertically. Modules on the same level are connected by level hallways. Modules 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 Instructions](#)



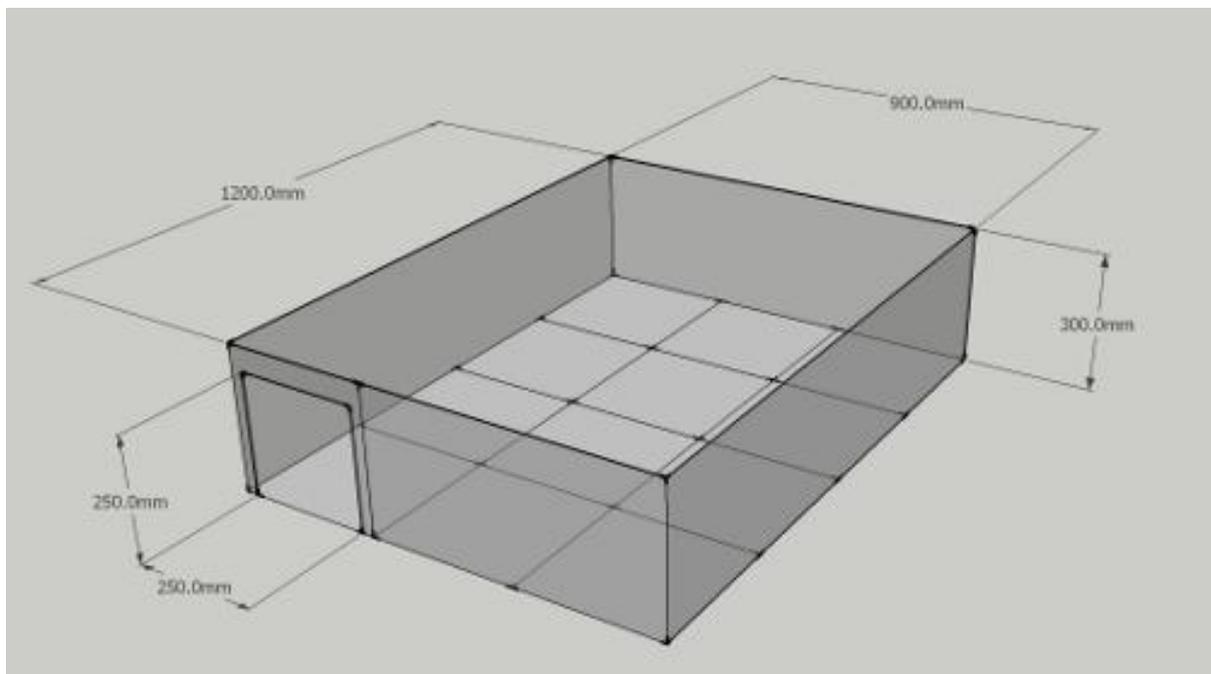
## 1.2 Dimensions:

1.2.1 Each module is approximately 1200mm by 900mm (47 inches by 36 inches), with walls that are approximately 30 cm (12 inches) high.

1.2.2 Hallways and the Ramp should also have walls approximately 30 cm (12 inches) high, and the width of approximately 30cm.

1.2.3 Each room will have two doorways in standard locations (see building plans). Robots will enter through one doorway and exit through the other. Doorways will be 250mm x 250mm in size

1.2.4 The First room in the maze may or may not have an entrance doorway. The Final room in the maze will not have an exit door.



## 1.3 Floor:

1.3.1 The floor of each room will be a 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 in height at joins between modules.

1.3.2 The arena should be placed so that the floors are level.



## 1.4 Line:

1.4.1 On the floor, there will be a black line for the robots to follow, composed of 300mm x 300mm tiles. The black line may be made with standard electrical (insulating) tape, 1 - 2 cm wide or printed onto paper or other material. The black line traces a maze on the floor. (The grid lines indicated in the drawings are for reference only, and will not physically be on the arena)

1.4.2 Where the black line is used, it will enter and exit each room through the standard doorways. Any straight section of the black line running alongside a wall (in a room or on a ramp) may have gaps of up to 20 cm in it.

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

1.4.4 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 minimised where possible by the organisers.

## 1.5 Debris and Obstacles:

1.5.1 Debris may consist of speed bumps (made from 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) and may be located in the Orange or Red Zones or in Hallways and the Ramp.

Robots may drive over or push aside debris as needed.

**1.5.2 Debris may be attached to the walls of Rooms, Hallways or the Ramp.**

1.5.3 Obstacles may consist of bricks, blocks, weights and other large, heavy items.

Obstacles may be located anywhere in the Orange and Red Zones (but NOT in hallways or 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 Red Zone

1.6.1 The black line may end at the entrance to the last room (the **Red Zone**) or the bottom of the ramp, so that robots are required to utilise some form of search strategy to locate the victim.

1.6.2 At the entrance to the Red Zone, there will be a 25mm x 250mm strip of reflective silver tape on the floor.

1.6.3 An **Evacuation Point** tile will be used within one corner of the Red Zone. It will take the form of a right angled triangle, with sides of 300mm x 300mm and a black floor.

1.6.4 For the Secondary competition, the 'Evacuation Point' tile will consist of a right angled triangle, sides of 300mm x 300mm and a height of 60mm, painted black.

1.6.5 The Red Zone will have an entrance door only. The mission will be considered complete once the victim is successfully moved to the evacuation area.



## 1.7 Victims:

1.7.1 The Victim may be located anywhere on the floor of the Red Zone, but will be at least 10 cm from the nearest wall, speedbumps or Obstacle.

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

1.7.3 Victims will be covered in aluminium foil

## 1.8 Lighting and magnetic conditions:

1.8.1 Teams must come prepared to calibrate their robots based on the lighting conditions at the venue.

1.8.2 Lighting conditions may vary along the course in the rescue arena.

1.8.3 Every effort will be made by the organisers to locate the rescue arena away from magnetic fields such as underfloor wiring and metallic objects. However, sometimes this cannot be avoided.

1.8.4 Spectators take pictures, and cameras will introduce IR and Visible light into the arena and to the robots. Whilst efforts will be made to limit this, it is not possible for organisers to strictly control factors outside of the competition arena. Teams are strongly encouraged to build and program their robots so that sudden changes (eg. camera flash) do not cause major problems. This is good practice in all robotics, both in competitions and in real life situations.

**Hint:** It is recommended that teams design their robots to cope with variations in lighting and magnetic conditions, as these vary from venue to venue. Teams should come prepared to calibrate their robots based on the conditions at the venue.

## 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 humans.

2.1.4 BlueTooth Class 2 and ZigBee communication modules within/between robots on the same field is permitted. No other form of radio communication is allowed. Robots that have radio communications on board, whether they are used during the duration of the competition or not, will be immediately disqualified



## 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 robot fits the above specifications and 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 as 'line followers' or 'rescue' robots will likely to be disqualified unless \*significant\* modifications to both the mechanical design and provided software. If there is any doubt as to the legitimacy of a particular commercial product, participants must contact the International RoboCupJunior Rescue Technical Committee several months prior to any competition to confirm. Organisers will treat all inquiries with the utmost privacy, and will not release details to any 3rd parties.

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

## 2.3 Team:

2.3.1 In each round, a single robot is deployed which must perform its tasks autonomously. (In certain international competitions, this rule can be modified such that two or more robots are deployed together and have to cooperate in fulfilling the task. Check the bylaws for the competition.)

## 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, then 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 fields, it will be at the organisers' discretion if testing is allowed on the competition fields.

### 3.2 Humans:

3.2.1 Teams should designate one human who will act 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 150 cm (approximately 60 inches) away from the arena while their robot is active, unless otherwise directed by the referee.

### 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 modules, hallways, ramps and each hazard (gaps in the line, speed bump and obstacles).

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

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

3.4.3 Points available for successfully negotiating modules:

(1st Module Attempt) = 60pts

(2nd Module Attempt) = 40pts

(3rd Module Attempt) = 20pts

\*No points scored for negotiating the module beyond the third attempt.

3.4.4 Points available for successfully negotiating hallways and ramps:

(1st Hallway/Ramp Attempt) = 30pts

(2nd Hallway/Ramp Attempt) = 20pts

(3rd Hallway/Ramp Attempt) = 10pts

\*No points scored for negotiating hallways/ramps beyond the third attempt.

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

\*Each gap can only be scored once per round (not each attempt through the module)

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

\*Each obstacle can only be scored once per round (not each attempt through the module)

3.4.7 Points available for successfully completing a tile that has speedbumps. 5 pts per speedbump tile

\*Each speedbump tile can only be scored once per round (not each attempt through the module)

3.4.8 Robots are also awarded points for successfully rescuing victims. A successful victim rescue occurs when the victim is moved within the evacuation zone (completely 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 Rescue Attempt) = 60pts

(2nd Rescue Attempt) = 40pts

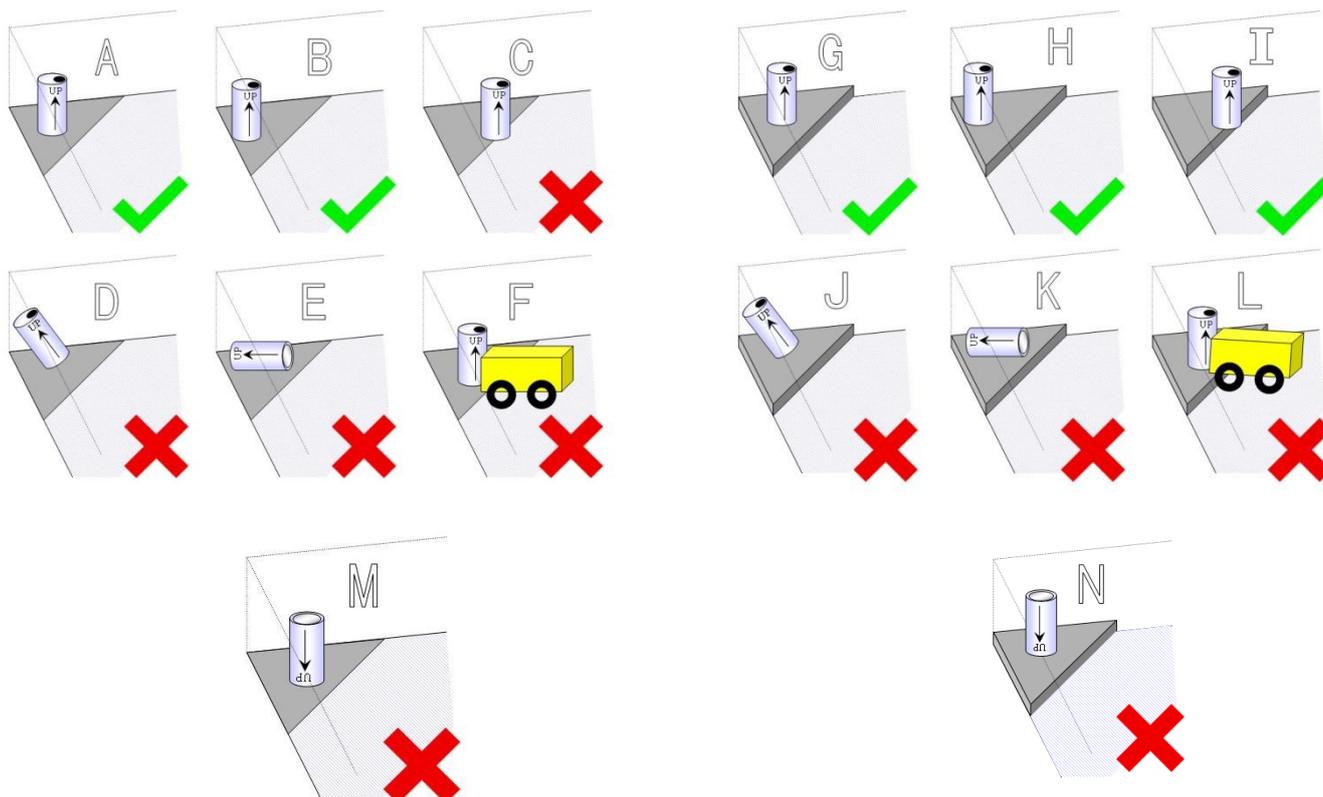
(3rd Rescue Attempt) = 20pts

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

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

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

3.4.10 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).



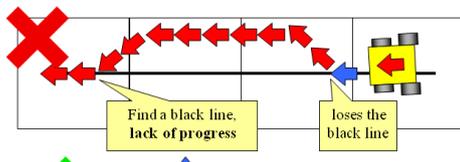
### 3.5 Lack of progress:

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

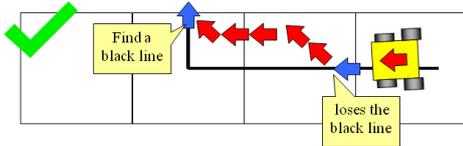
3.5.2 Lack of Progress also occurs if the robot is stuck in the same place or loses the black line without regaining it by the next tile in the sequence (see figures below).

3.5.3 If Lack of Progress occurs the robot must be returned to the start of the module/hallway/ramp where the Lack of Progress happens. If after the third attempt, the robot still fails to negotiate the module/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 module.

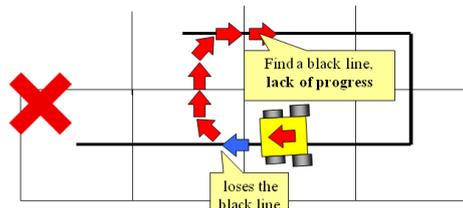
3.5.4 A team may elect to stop the round early at any time. In this case, the team captain must indicate to the referee the team's desire to terminate. The team will be awarded all points achieved up to the call for end of round. There is no Lack of Progress call for picking up the robot once end of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



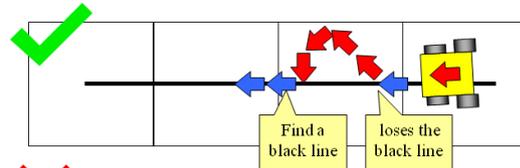
The robot loses the black line. But, the robot finds the black line in next tile. It is **Lack of progress**.



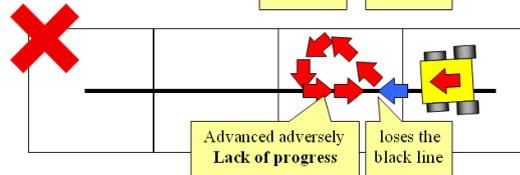
The robot loses the black line. But, the robot finds the black line in next tile.



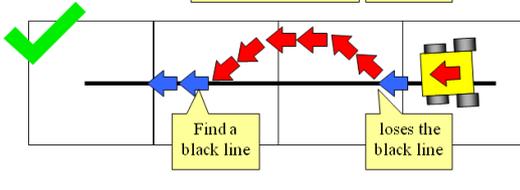
The robot loses the black line. But, the robot finds the black line where robot went. It is **Lack of progress**.



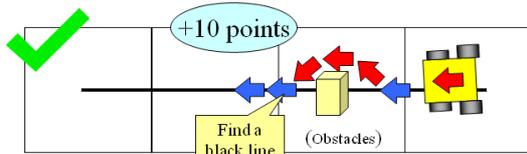
The robot loses the black line. But, the robot finds the black line in same tile.



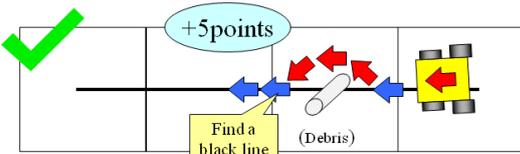
The robot loses the black line. And the robot advanced adversely. It is **lack of progress**. And return the entrance.



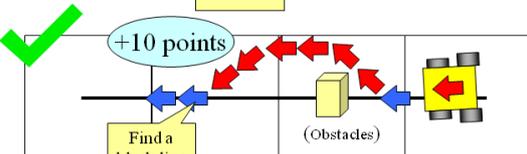
The robot loses the black line. But, the robot finds the black line in next tile.



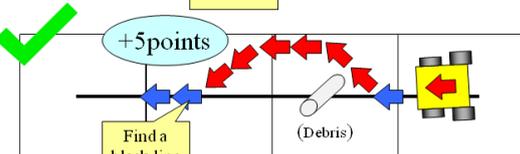
The robot found the Obstacles. And, the robot finds the black line in same tile.



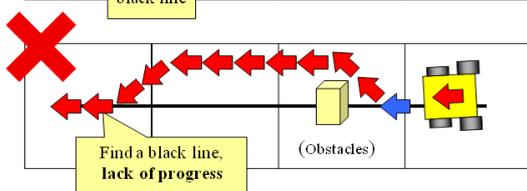
The robot negotiated the Debris. And, the robot finds the black line in same tile.



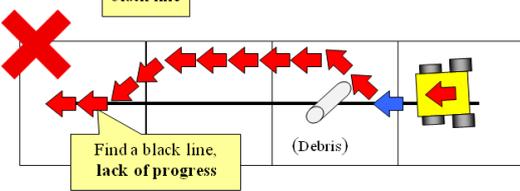
The robot found the Obstacles. And, the robot finds the black line in next tile.



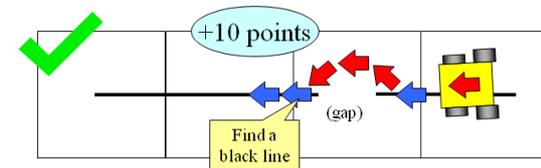
The robot negotiated the Debris. And, the robot finds the black line in next tile.



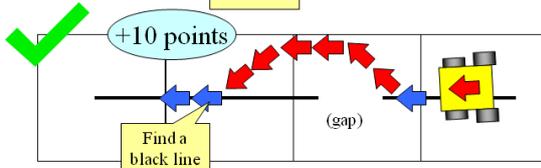
The robot found the Obstacles. And, the robot finds the black line in next tile. It is **Lack of progress**. And return the entrance.



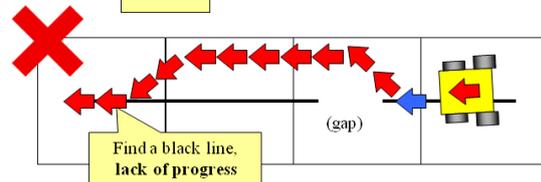
The robot negotiated the Debris. And, the robot finds the black line in next tile. It is **Lack of progress**. And return the entrance.



The robot came to a gap. And, the robot finds the black line in same tile.



The robot came to a gap. And, the robot finds the black line in next tile.



The robot came to a gap. And, the robot finds the black line in next tile. It is **Lack of progress**. And return the entrance.



## 3.6 Victim Placement

3.6.1 Six different victim Placement Areas in the Red Zone, each approximately 300mm x 300mm 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 300mm x 300mm Placement Area. **The victim placement will occur after the robot has begun its scoring round**

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 has grabbed the victim and subsequently requires a restart, the victim will be placed upright, at the location where the robot requested a restart.

## 3.7 End of Play

3.7.1 The round ends when time expires, the team captain calls end of round, or the victim is successfully moved to the Evacuation Point.

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



## 5. Documentation

### 5.1 Presentation:

5.1.1 Each team must bring an electronic presentation (e.g. in PowerPoint or Flash format) and/or an A3 poster documenting the design, construction and programming of their robot.

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;
- Division (primary or secondary);
- Team members' names and (perhaps) a picture of the team members;
- Team's country and location within country;
- Team's school and district;
- Pictures of the robot under development;
- Information about the robot, including schematics, mechanical drawings and samples of code;
- Any interesting or unusual features of the robot;
- What the team hopes to achieve in robotics.

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

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

5.1.6 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 Behaviour:

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 and other adult team members) are not allowed in the student work area.

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

6.3.3 Mentors are not to repair robots or be involved in programming of students' 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 An understanding that has been a part of world RoboCup competitions is that any technological and curricular developments should be shared with other participants after the tournament.

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!



## 7.0 Superteam Challenge. Mexico City 2012

This competition is for the primary and secondary robots that perform best in the individual competition. The challenge will make use of the existing arenas and focus on team cooperation

A superteam will be made up of 2 individual teams and the pairings will be decided by a draw once the results of the individual competition are known.

The details of the challenge will be released in Mexico City 24 hours before the Superteam competition starts.