

Rules of Robotics Pentathlon during Robot-SM 2010

Summary of the competition

The Robotic Pentathlon is a new form of competition where an autonomous robot is to compete in five different disciplines all with their unique sets of difficulties and challenges. These five disciplines are created so that the builder will probably have to compromise with different solutions to be able to complete all challenges in the best way.

The goal of the pentathlon is to gather as many points as possible in order to get the highest total. The robot will receive 0-9 points plus an additional bonus of 20 % of the final score if no physical modification is made on the robot between the different disciplines.

If you have any doubts about the rules, please contact us as soon as possible at info@crf.nu so that we may answer any questions as soon as possible.

Rules for Robotics Pentathlon

1. Goal

1. The robot is supposed to collect as many points as possible during the whole competition. The robot with the largest amount of points wins.

2. The Robot

1. The robot has to be completely autonomous after the start, which may be done by, for example, the push of a button. In some disciplines there are lines in the course to help the robot navigate and in some disciplines the robot has to navigate with the help of the walls.
2. For the robot to be able to pass all the moments of the competition, which are 25 cm in the narrowest space, the recommended maximal dimensions are 20 x 20 cm. There is no height limit. The maximum weight is 5 kg, and the robot is not allowed to harm the spectators and/or the course.
3. If the robot separates (or drops any parts), all different parts of the robot are still considered a part of the robot. This means that if a robot separates itself to act as two or more separate robots, it is sufficient if one of the parts manages to complete the challenge correctly (as long as the part that manages to complete the challenge and can still be considered an autonomous robot)

3. The course (see pictures at the bottom)

1. The Pentathlon takes place on five courses, all with the dimensions 240 x 120 cm, except for the Labyrinth, which has the dimensions 240 x 240 cm. All courses, except the Terrain Course, have a black surface. The black surface is painted with a black Capacryl enamel paint V 25 (low reflection colour). The walls of the Labyrinth are also painted with this colour. There are often white lines or other marks for the robot to navigate after. These lines are painted with a white Capacryl enamel paint V 75 (highly reflective colour) for the disciplines Collection (the edge lines) and Free Performance. For the disciplines Line Following and Labyrinth these lines consist of white electrical tape. Some lines in Collection are also white electrical tape. The cans in Collection are covered in white printer paper. For the Labyrinth there are grey lines on the walls. These are painted with an equal mix of the black and the white colour (defined above).

2. The Pentathlon consists of the following disciplines:

Line Following

Collection

Terrain Course

Labyrinth

Free Performance

These will be explained in more detail below.

4. Points

1. The robot will be awarded 0-9 points in each discipline, with an additional 20 % of the final score if no physical modification is made on the robot between the different disciplines. The robot can by that receive a maximum score of 54 points during the whole competition.
2. If two or more robots have the same total score at the end of the competition, the robot with the lowest total clear time in the disciplines with a time limit (all disciplines except for Free Performance) wins. The robot will only receive a clear time if it completes the discipline.
3. Example: If a robot receives a total score of 30 points during the Pentathlon and has not had any physical modification, an additional 20 % will be added to the score, which means that the robot's total score is 36 points.

5. Start-up time

1. The robot is not allowed to move until at least five seconds after the referee has given a start sign. The reason for this is that so the competitor must get away from the robot to minimize the risk of external influence on the robot. This time is included in the total clear time for the discipline.

6. Several tries

1. The robot may have a maximum of three tries in all the disciplines, except for Free Performance. For all other disciplines, only the best score will be added to the total score. If there is a shortage of time, the number of tries might be lowered.

7. Time limit

1. There is a time limit of 60 seconds in all disciplines except the Labyrinth, where the time limit is 120 seconds.
2. Walking robots has an advantage in several disciplines due to extended time limit. This is 50% longer, which means 90 seconds in Line Following, Collection and Terrain Course and 180 seconds in the Labyrinth. In Free Performance, the time limit is unchanged.

From the point of view of the referees, a walking robot is not walking as walking is usually done. I.e. if a robot moves forward using four sticks on a motor-axis and setting it to do a circular movement it is not considered a walking robot. If the same sticks were to be put on servos moving back and forth the robot might be considered walking. As in all rules, the main referee has the final word, so use your common sense. If you doubt that your solution will be as legs, they probably won't. If you would still like your solution to be valued as valid, please send in pictures and a description, or rather a movie, and we will give you an answer as soon as possible.

8. Rule conflicts

1. Use your common sense when reading the rules. If there are any rule conflicts about how to use the rules, the main referee has the final word to say what is right and what is wrong.

9. Quick reference

1. Limitations on the robot
 - a. Mass: Maximum 5 kg
 - b. Recommended Width, Length and Height: 20 x 20 x 25 cm
2. Dimensions of the course
 - a. Length and width: 240 x 120 cm (240 x 240 for the labyrinth)

(If anything is unclear in this table, please look in the above sections and on the pictures below)

10. Line Following

1. Goal

In the Line Following the robot is supposed to follow an about **2 cm wide, white** line on a **black surface** from the start to the end of the course. There is **small yellow dot** marking the **en of the course**, which some part of the robot has to pass for the robot to receive points.

2. Points

The robot will receive **3 points** if it, according to the above section, gets from the start to the end of the course. If it manages this in **less than 30 seconds (45 seconds for walking robots)** the robot will receive a total score of **6 points**, or if in **less than 20 seconds (30 seconds for walking robots)** the score will be **9 points**.

The robot may have a maximum of **3 tries** in this discipline and only the **best score** is added to the total score.

11. Collection

1. Goal

The robot is supposed to **collect cans** which are distributed on the course. The course is all black with a white edge (the same as Free Performance) though one of the corners has a **grey floor with an area of about 60 x 60 cm** (the “start area”). The robot may start anywhere in this area (without touching the white edge). A can is considered collected if it touches the **grey start area** but **not the white edge**.

2. The cans

The cans are **standard 33cl soda cans**. These are not opened, so the **weight is about 330 g**. The colour is **white** (a white paper covers the surface). There are a total of **9 cans**.

3. Points

The robot is awarded **1 point** for **each of the 3 cans closest** to the start area, and **2 points** for **each of the 3 cans furthest** from the start area collected at the end of the time limit or when the contestant chooses to abort. The time limit is **60 seconds (90 seconds for walking robots)**. The robot may have a maximum of **3 tries** in this discipline and only the **best score** is added to the total score.

12. Terrain Course

1. Goal

The robot is supposed to get through a **course** with **uneven surface**.

2. Points

The course is divided into **3 zones** and the robot will be awarded with **3 points per zone** it manages to pass. The time limit is **60 seconds (90 seconds for walking robots)**. The robot may have a maximum of **3 tries** in this discipline and only the **best score** is added to the final score.

13. Labyrinth

1. Goal

The robot is supposed to get from one out of three start positions (“the start-square”) to a certain location (“the turn-square”) inside the Labyrinth and then back again. The robot has to have touched the grey circle in the turn-square and then the start-square from which it started to complete this task.

2. Goal

The size is **7 x 7 squares**, where every square is **at least 30 x 30 cm** (the more exact dimensions are $(244-12.8)/7 \approx 33.0$ cm).

The **surface is black** with straight **white lines** with the width **2 cm** (same as in Line Following) of tape **at the centre of all paths**. At a **dead end**, the **line ends** in the **middle of the square**. The walls are **about 15 cm tall** and **painted black**, with a **grey line at the bottom** of the wall (see pictures below for more information). These lines are supposed to help robots that navigate by a camera to find the wall.

Small, through going holes are distributed across the entire course. These have a **diameter of 0.85 cm**. The inside of the holes are black and they are **1.6 cm deep**. Under the holes there will be a grey carpet. Please be aware that there might be some **errors** with the walls as **gaps**. These gaps have a maximum width of **1 cm**. To make things extra clear, please take a look at the enclosed pictures.

3. Points

The robot will receive points depending on how far into the labyrinth it manages to get. Getting to the **turn-point** is worth a total of **3 points**. Getting from there and back to the start-square in less than **120 seconds (180 seconds for walking robots)** is worth a total of **6 points**. If the robot manages this in less than **90 seconds (135 seconds for walking robots)** the total score is **9 points**. The robot may have a maximum of **3 tries** (one from each start position) in this discipline and only the **best score** is added to the final score. The contestant may choose in which order his or her robot starts from the different start positions.

14. Free Performance

1. Goal

The robot is supposed to do a free performance to impress on a jury. This means that it will show of something impressive, funny and/or entertaining. Example of a free performance might be blinking lights or some interesting show.

2. Categories

The robot is judged in three categories: **Performance, design and technology**.

3. Performance

The competitor will have access to a **completely empty course** with **black surface** and a **white line at the edge**. The competitor may make a short presentation of the robot for the jury. He or she can for example talk about the features of the robot or his or her thoughts about solutions of problems etc. After that, the robot may make a short performance (maximum 60 seconds) to impress the jury in some way. The competitor may also choose a piece of background music to be played during the performance. This choice of music

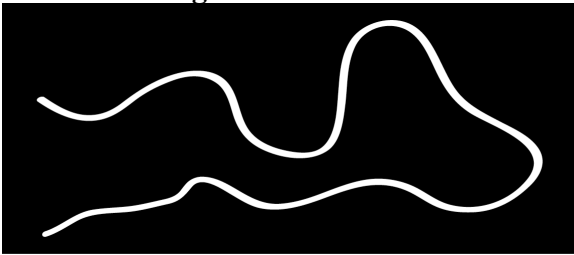
must be available by the competition board at least 3 days before the competition.
(preferably sent to the e-mail address info@crf.nu)

4. Points

The jury will award a score of **0 to 3 points** for every category. **The maximum** score for this discipline is **9 points**. In this discipline the robot may compete only once.

15. Pictures

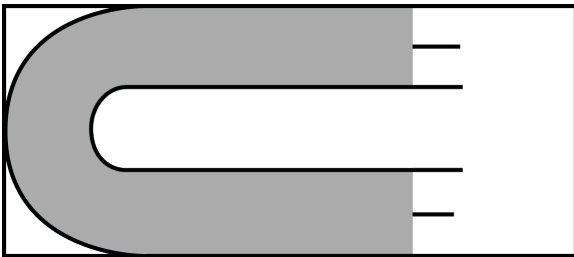
1. Line Following



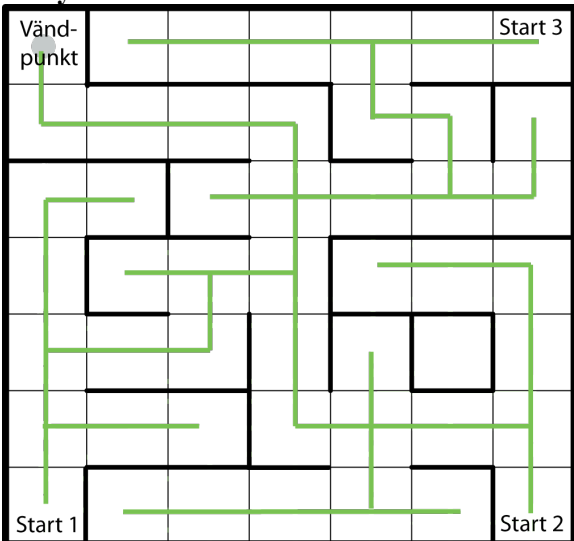
2. Collection



3. Terrain Course



4. Labyrinth



5. Free Performance

