

MICROMOUSE COMPETITION

INTRODUCTION

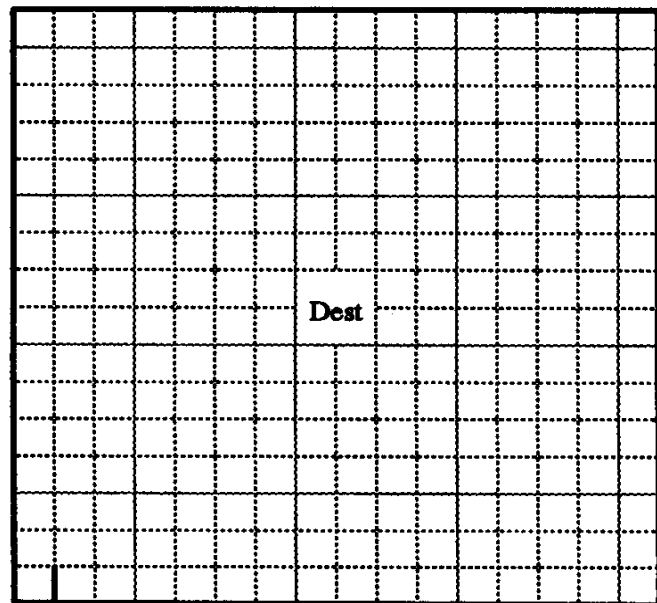
The objective of the competition is to build a micromouse, which is a small autonomous robot vehicle, that is able to navigate its way through an unknown maze to search for the quickest path from the start to destination points and to negotiate this path in the shortest time.

The main challenge for the micromouse handler is to impart to the micromouse an adaptive intelligence to explore different maze configurations and to work out the optimum route for the shortest run time from start to destination; and to design a reliable micromouse which will negotiate the optimum route at a very speed without crashing into the walls of the maze.

1. MAZE SPECIFICATIONS

1.1 The maze shall be laid out by placing pieces of walls along the grids formed by multiples of 18cm x 18 cm unit square arranged in a 16 x 16 row-column matrix. The walls constituting the maze shall be 5 cm high and 1.2 cm thick. Passageways between the walls shall be 16.8 cm wide. outside wall shall enclose the entire maze.

1.2 The sides and top of the maze walls shall be white. The floor of the maze shall be made of wood and finished with a non-gloss black paint. The coating on the top and sides of the walls shall be selected to reflect infra-red light and the coating on the floor shall absorb it.



Start

Figure 1: Start and Destination Points and Grid Lines for Maze

1.3 The start of the maze shall be located at one of the four corners. The starting square shall have walls on three sides. The starting square orientation shall be such that when the open wall is to the "north", outside maze walls are on the "west", and "south". At the centre of the maze shall be a large opening which is composed of 4 unit squares. This central square shall be the destination.

1.4 Small square posts, each 1.2 cm x 1.2 cm x 5 cm high, at the four corners of each unit square are called lattice points. The maze shall be constituted such that there is at least one wall touching each lattice point, except for the destination square.

1.5 The dimensions of the maze shall be accurate to within 5% or 2 cm, whichever is less. Assembly joints on the maze floor shall not involve steps of greater than 1 mm. The change of slope at an assembly joint shall not be greater than 4°. Gaps between the walls of adjacent squares shall not be greater than 1 mm.

2. MICROMOUSE SPECIFICATIONS

- 2.1 The length and width of the micromouse shall be restricted to a square region of 25 cm x 25 cm. The dimensions of a micromouse which changes geometry during a run shall never be greater than 25 cm x 25 cm. There is no restriction on the height of the micromouse.
- 2.2 The micromouse must be completely self-contained and must receive no outside help.
- 2.3 The method of wall sensing is at the discretion of the builder; however, the micromouse must not exert a force on any wall likely to cause damage. The method of propulsion is at the discretion of the builder, provided the power source is non-polluting.
- 2.4 The micromouse shall not leave anything behind while negotiating the maze.
- 2.5 A micromouse shall not jump over, climb, scratch or damage the walls of the maze.

3. RULES FOR THE CONTEST

The primary task of the micromouse is travel from the start to the destination square. This is called a run and the time taken is called the run time. Traveling from the destination square back to the start square is not considered a run. The total time taken from first activation of the micromouse until the start of each run is also measured. This is called the search time. If the micromouse require any manual assistance at any time during the contest, it is considered touched. By using these three parameters the scoring of the contest is designed to reward speed, intelligence, efficiency of maze solving, and self-reliance of the micromouse.

- 3.1 Each contesting micromouse shall subject to a time limit of 10 minutes on the maze. Within this time limit, the micromouse may make as many runs as possible. The judges have the discretion to request a micromouse to retire early if by its lack of progress it has become boring, or if by erratic behaviour it is endangering the state of the maze.
- 3.2 The scoring of a micromouse shall be obtained by computing a handicapped time for each run as follows: $\text{Handicapped Time Score} = \text{Run Time} + \text{Search Penalty} + \text{Touch Penalty}$. $\text{Search Penalty} = 1/30$ th of the search time, in seconds, associated with that run, and $\text{Touch Penalty} = 3$ seconds if the micromouse has been touched at any time prior to the run. For example, if a micromouse, after being on the maze for 4 minutes without being touched, starts a run which takes 20 seconds; the run will have a handicapped time score of $20 + 1/30$ th of $(4 \times 60) = 28$ seconds. However, if the micromouse had been touched before the run, an additional touch penalty of 3 seconds is added giving a handicapped time score of 31 seconds. The run with the fastest handicapped time score for each micromouse shall be the official time of that micromouse.
- 3.3 The time for each run (run time) shall be measured from the moment the micromouse leaves the start square until it enters the destination square. The total time on the maze prior to a run (search time) shall be measured from the time the micromouse is first activated. A run is complete only if the whole of the micromouse enters the destination square.

- 3.4 The time taken to negotiate the maze shall be measured either manually by the contest officials or by infra-red sensors set at the start and destination. If infra-red sensors are used, the start sensor shall be positioned at the boundary between the start square and the next unit square. The destination sensor shall be placed at the entrance to the destination square. The infra-red beam of each sensor shall be horizontal and positioned approximately 1 cm above the floor.
- 3.5 The starting procedure of the micromouse should be simple and must not offer a choice of strategies to the handler. The micromouse shall be started by pressing a "start" button once. The micromouse shall be placed at the start square and started by the handler under the contest officials' instructions. Throughout the duration of the micromouse's performance, the handler shall not enter any information into the micromouse (e.g. change in search strategy, speed or maze data).
- 3.6 The micromouse handler is given 1 minute to make adjustments, if any, to the sensors. However, no selection of strategies must be made and no information on the maze configuration entered or captured into the micromouse. The maze search time clock will commence after the expiry of the 1-minute time limit if the micromouse handler is still making adjustments to the sensors.
- 3.7 When the micromouse reaches the destination square, it may stop on its own and remain at the maze centre, or it may continue to explore other parts of the maze or make its own way back to the start square. If the micromouse chooses to stop at the destination square, it may be manually lifted out and restarted by the handler. Manually lifting it out shall be considered touching the micromouse and will cause a touch penalty to be added on all subsequent runs. If the micromouse chooses not to remain in the destination square, it may not be manually stopped and restarted (see also paragraph 3.8).
- 3.8 If a micromouse appears to be malfunctioning, the handlers may ask the judges for permission to abandon the run and restart the micromouse from the beginning. A micromouse may not be restarted merely because it has taken a wrong turn - the judges' decision is final. If a micromouse elects to retire because of technical problems, the judges may, at their discretion, permit it to perform again later in the contest. Also, there shall be no changes made to the program or exploration strategies when the micromouse resumes its runs. This permission is likely to be withdrawn if the programme is full or behind schedule.
- 3.9 Before the maze is unveiled, the micromice must be accepted and caged by the contest officials, and no replacement of any parts of the micromouse shall be allowed. Once the micromouse has started on its runs, no replacement of batteries shall be allowed.

4. CLONING (APPLIES ONLY TO OPEN CATEGORY)

- 4.1 In accordance with the spirit of the competition, clones among the winning entries will only be awarded one prize. Clones will be identified during the "caging" procedure.
- 4.2 Clones are robots with substantially identical physical appearance and working principles.
- 4.3 When in doubt, the decision of the Judges will be final.