

20th Singapore Inter-School Micromouse Competition Competition Rules

1. Categories of Participation

1.1 The competition shall have 3 categories:-

Category A: Singapore Secondary Schools Category Divisions 1, 2 and 3

Participating teams shall be full time students of the following institutions during the preliminaries and finals of the competition.

- Government Secondary Schools
- Government-aided Secondary Schools
- Autonomous Secondary Schools
- Independent Secondary Schools
- Full Schools (Secondary Level)

Category B: Singapore JC/ITEC Category

Participating teams shall be full time students of the following institutions during the preliminaries and finals of the competition.

- Government Junior Colleges
- Government-aided Junior Colleges
- Independent Junior Colleges
- ITE Colleges

Category C: Open Category Divisions 1 and 2

Participating teams shall comprise of persons who are all from one of the following:

(a) Singapore School/Institution Entry:

Participating teams shall be full time students of the institutions listed in both Category A and Category B, where their school/institution has registered the maximum entries allowed (see Paragraph 5).

The requirement that schools must have registered the maximum entries allowed does not apply to participation in Category C - Division 1.

2. Divisions for Secondary Schools Category

The schools from the Secondary Schools Category will be grouped into three divisions based on the performance of their entries in the last two competitions.

2.1 Secondary Schools Division 1

Schools that had at least one entry that was a finalist in Division 1 in either of the last 2 competitions.

Schools that had at least one entry that was a prize winner in Division 2 at the last competition.

2.2 Secondary Schools Division 2

Schools that had at least one entry that was a finalist in Division 2 in either of the last 2 competitions.

Schools that had at least one entry that was a prize winner in Division 3 at the last competition.

Schools that just moved down from Division 1 at the last competition but all teams failed to make it to the finals.

2.3 Secondary Schools Division 3

Schools that did not participated in any of the past three competitions.

Schools that participated in Division 3 at the last competition but none of the entries were in the top 8 placing (prize winners plus the next four best performing entries).

Schools that do not meet the conditions for moving up from or remaining at the division based on their participation at the last 2 competitions shall move down one division level.

They shall also include the following:

Schools that had been transferred up from Division 2 to Division 1 or from Division 3 to Division 2 at the last competition but all teams failed to make it to the finals.

Schools which had not participated in the last two competitions but participated in the competition before that will move down one division level from their latest grouping irrespective of their entries' performance in past competitions.

Schools will always be placed in the highest possible division based on the guidelines given in paragraph 3.1 to 3.3. Division 1 shall be highest division level and Division 3 the lowest.

For the purpose of grouping into respective divisions, prize winners refers to those finishing in the top 4 positions based on the rules of the competition.

Fastest Mouse, Cutest Mouse and other such achievements will be referred to as special award winners and are not for considerations of grouping.

3. Divisions for Category C - Open Category

The participating teams are grouped into two divisions based on the development tool used.

3.1 Open Category Division 1

Participating teams will program the micromouse in C programming language using the MKITC or IDE2K program development tool supplied with the micromouse kit.

3.2 Open Category Division 2

Participating teams will program the micromouse using the MIGS program development tool supplied with the micromouse kit.

Participating teams must indicate the division in the entry form and no changes will be allowed after the submission.

4. Limit on Number of Entries and Team Composition

4.1 Each school/institution in Categories A and B can register up to a maximum of 3 entries and schools in Category A (Singapore Secondary Schools category) cannot be participating in more than one division.

4.2 Each entry must have a minimum of 2 members and a maximum of 6 members in the teams in all the categories.

4.3 A student taking part in Categories A or B can take part in Category C - Division 1 and/or Category C - Category Division 2.

4.3 A student is NOT allowed to participate in more than one team within any given category.

4.4 Each team must submit its own micromouse entry and except for batteries, there shall be no transfer of any mechanical or electronic components from one micromouse to another throughout the competition irrespective of categories or divisions.

5. Micromouse Entry

5.1 Each micromouse entry must be assembled from the micromouse kit-set developed and supplied by Ngee Ann Polytechnic or the Polytechnic's authorized supplier. The micromouse program must be developed solely using the software development tools that comes with the kit-set.

5.2 Participants in the Singapore Secondary Schools Categories, JC/ITE Categories and Category C - Division 2 shall use the MIGS software development tool.

5.3 Participants may develop the micromouse program in C language using the MKITC or IDE2K development tool but they can only take part in Category C – Division 1 and Robot Performer event.

5.4 Mechanical changes to the robot are permitted. They include modification or replacement of wheels or body frame and relocation of sensors. Any changes to the battery pack must not increase the number of cells beyond 16 in series based on a cell-type with nominal voltage of 1.2 volts/cell. If other cell types with a different nominal voltage are used, the number of cells used must not result in the battery pack's nominal voltage exceeding 20 volts. If in doubt, please obtain the organizer's approval as to its suitability and the maximum number of cells allowed for the battery pack.

6. Prizes

6.1 There will trophies for the top four (4) schools based on the final score result in each category/division of the Secondary Schools and JC/ITEC categories but they may not be uniform in size and design between the divisions. Please be informed that each school will **only** be given **ONE** (1) prize. In the event that more than one entries from the same school winning more than one prizes, all the winning entries will receive the same prize obtained by the best entry of the school, ie A trophy will be given to the school and all students will receive the plaques.

6.2 For the Open Category, there will trophies for the top three (3) micromouse entries only based on the final score result.

6.3 For Division 1 of Category A (Secondary Schools) and Category B (JC/ITE), there will two (2) winners each for the two fastest micromouse based on a fixed path which will be made known one week before the competition. The performance will be based on the best run in 3 attempts.

- 6.4 For Division 1 and 2 Category C (Open Category), there will one (1) winner each for the two fastest micromouse based on a fixed path which will be made known one week before the competition. The performance will be based on the best run in 3 attempts.
- 6.5 There will be two "Cutest Mouse" award for each for the divisions in the Secondary Schools Category. The "dressed-up" mouse must be able to move along the maze.
- 6.6 For Division 3 of the Schools Category, there will a special award for the entry with the best performance score among all the schools who are participating for the first time in the competition.

7. Organizer's Decision

The organizer reserves the right to make changes to any of the above in the interest of fair-play and "mousemanship", and in keeping with the prime objective of promoting the development of an automation culture among as many students as possible in our pre-tertiary institutions.

The above rules and guidelines are pertinent to this year's event and there may be modifications or additions for future competitions.

In the event of ambiguity, the organizer's interpretation of any clauses of the rules and regulations shall prevail.

8. Official Contest Rules

The objective of the competition is to assemble a micromouse, which is a small microprocessor-controlled robot vehicle. It must be able to navigate its way through an unknown maze to search for the quickest path from the start to destination points in the maze and to negotiate this path in the shortest time. It is a typical product of "mechatronics" embodying within itself an integration of computer and electronic technology and mechanics. Please check our links on the purchasing of Micromouse Kit Set.

1 Maze Specifications

- 1.1 The maze shall comprise 16 x 16 multiples of an 18cm x 18cm Unit Square. The walls constituting the maze shall be 5cm high and 1.2cm thick. Passageways between the walls shall be 16.8 cm wide. The 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 infrared light and the coating on the floor shall absorb it.
- 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 1.2cm x 1.2cm x 5cm 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 2cm whichever less is. Assembly joints on the maze floor shall not involve steps of greater than 0.5mm. 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 25cm x 25cm. The dimensions of a micromouse that changes geometry during a run shall never be greater than 25cm x 25cm. 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-polluted.
- 2.4 The micromouse shall not leave anything behind while negotiating the maze.
- 2.5 A micromouse shall not jump over, climb, scratch, damage or destroy the walls of the maze.

3 Rules for the Contest

The basic function of the micromouse is travel from the Start Square 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 requires 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 (or any such time limit that the organizer decides before the start of the event) on the maze. Within this time limit, the micromouse may not make more than 5 unsuccessful or aborted runs. The micromouse entry must retire immediately after the 5th unsuccessful attempt to reach the destination. There is no limit on the number of successful runs within the time limit. 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 behavior 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:

Handicapped Time Score = Run Time + Search Penalty + Touch Penalty

Search Penalty = 1/60TH of the search time associated with the run being scored.

Touch Penalty = 2 seconds if the micromouse has been touched at any time prior to the run whose score is being computed.

For the touch penalty, a fix amount of 2 seconds is added to the score irrespective of the number of times the micromouse had being touched prior to the run being scored.

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 $20 + (4 \times 60) / 60 = 24$ seconds. However, if the micromouse had been touched before the run, an additional touch penalty of 2 seconds is added giving a handicapped time score of 26 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.
- 3.4 The time taken to negotiate the maze shall be measured either manually by the contest officials or by infrared sensors set at the start and destination. If infrared 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 infrared 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.
- 3.6 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.
- 3.7 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. The imposition of search or touch penalties and their amounts shall be at the sole discretion of the judges. 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.
- 3.8 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, except for batteries shall be allowed. However, once the micromouse has started on its runs, no replacement of batteries shall be allowed. The handlers will place the micromice at the Start Square of the maze under the officials' instructions.
- 4 Manual and Electronic Timing and Arbitration of Identical Scores
- 4.1 When electronic timing is used, there is a possibility that it may malfunction during the course of the competition. It may also be possible that for a given entry, some of the runs may be time electronically, while others timed manually.
- 4.2 All electronically timed runs shall be compared with timing resolutions to the nearest 100th of a second.
- 4.3 All manually timed runs shall be compared with timing resolutions to the nearest 10th of a second.

- 4.4 Electronically timed runs shall be rounded to the nearest 10th of a second (five 100th second shall be rounded up one 10th second) when compared with manually timed runs.
- 4.5 If within the top 4 entries, a tie in the scores exist, their performance shall be arbitrated using first the fastest run achieved without including penalties, then by the faster first search run into the destination square.
- 4.6 In the eventuality that there is still a tie after using the arbitration factors in paragraph 4.5, then the judges will make a decision on the result that will be final.

5 Changes to Rules

The organizer reserves the right to makes changes to the any of the above rules. In the event of ambiguity, the organizer's interpretation of any of the clauses of the rules shall prevail.

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