USD Robotic Programming Contest
(Guidelines and maze solving robot rules)

Updated, Jan. 17, 2019

USD robotic programming project

Students will design a program for a programmable robot based on logical thinking, problem solving skills, and high school math and science knowledge. The programming project should be designed and implemented by team members at their home/school and will be presented at USD during the Robotic Programming Contest. Student teams will have approximately 15 weeks to work on their programming project.

Team composition

A representative of the sponsoring high school must serve as the team coach. The coach certifies the eligibility of the contestants and serves as official point-of-contact with the team prior to and during contest activities. A team may have only one coach. Students currently enrolled in South Dakota, North Dakota, Nebraska, Iowa, and Minnesota high schools are eligible. Each team may consist of up to three contestants. Each contestant must be the same student who appears on the registration form. Each school can be multiple teams.

Training sessions for coaches

The Department of Computer Science for the following areas will provide on-line training videos:

1) Assembling the robot kit
2) Installing and using program development tools
3) Basic techniques for robotics programming
4) Using sensors for robotics programming
5) Advanced algorithms and techniques for robotics programming

Maze solving / programmable robot rules

1) *Name of Event:* Maze Solving
2) *Robots per Event:* One
3) *Length of Event:* 10 minutes (maximum)

4) *Robot Weight Range:* Any
5) *Robot Dimensions:* 13 cm x 8.5 cm (frame size)
6) *Arena Specifications:* 1.05 m x 2.05 m
7) *Robot Control:* Autonomous
8) *Scientific Principles:* Computer Science, Programming

Summary: A robot is placed at the entrance on top of a large, randomly drawn maze consisting of 18 cm square segments. Junctions are akin to standard mazes - dead ends, T-intersections, right and left hand turns, etc. There may be some special areas, which are positioned in such a way that left-turn only or right-turn only robots can never reach the exit. The goal is to reach the exit of the maze in the fastest time possible, across several attempts.

The department of computer science (at the event) will be adapting the official rules for North American Programmable Robot Contest with a few modifications that reflect the changes in technology.

What does maze look like (at the event)?

1) The maze is composed of multiples of an 18 cm x 18 cm unit square. The walls of the maze are 9 cm high and 1.2 cm thick (**assume 5% tolerance for mazes**). Thus, the internal navigable area within a square is 16.8 cm, not 18 cm. The maze comprises up to 16 x 16 unit squares, for a total maze size of up to 2.88 m square. The outside wall encloses the entire maze.

2) The maze is made of wood and may be painted.
WARNING: Do not assume the walls are consistently white, or that the tops of the walls are consistently white/red, or that the floor is consistently white. Fading may occur; parts from different mazes may be used. Do not assume the floor provides a given amount of friction. It is simply plywood and may be quite slick. There may be a seam between the two sheets on which any low-hanging parts of a robot may snag.
3) The start of the maze is located at the top of the maze. The destination goal is the exit gate at the other end of the maze.
4) Multiple paths to the destination are allowed and are to be expected. The destination gate will be positioned so that a wall-hugging robot will NOT be able to find it.
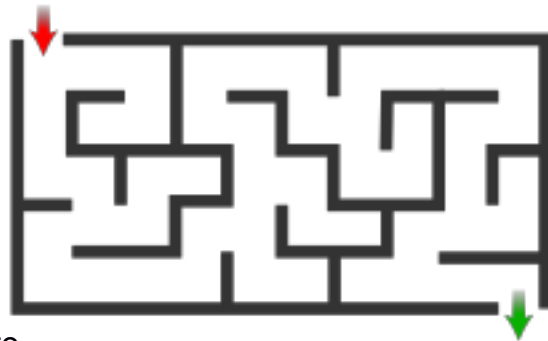
Objective

The team writes a program to automate the robot (Parallax ActivityBot or similar within the size limit) to reach the exit in the shortest possible time. For scoring, two major criteria will be taken into account: the shortest path and time.

Rules for the maze

1) Fully autonomous Robot is expected (no remote control).
2) No additional energy source can be used (e.g. combustion process).
3) A Programmable Robot shall not leave any part of its body behind while negotiating the maze.
4) A Programmable Robot shall not jump over, fly over, climb, scratch, cut, burn, mark, damage, or destroy the walls of the maze.
5) Additional parts and sensors can be added onto the robot. A Programmable Robot shall not be larger either in length or in width, than 16 centimeters. The dimensions of a Programmable Robot that changes its geometry during a run shall not be greater than 16 cm x 16 cm.
6) Any violation of these rules will constitute immediate disqualification from the contest and ineligibility for the associated prizes.

Rules for the contest (general)

1) Two major criteria will be taken into account: the shortest path and time.
2) Contestants have specified time (max. 10 minutes) total to complete as many runs as they wish.
3) For scoring one of the best runs will be considered.
4) The entrance and exits gates can be changed from one maze layout to another, and their corresponding shortest paths are provided. This will help compute the scores.
5) The judges have the right to ask the operator for an explanation of the Programmable Robot. The judges also have the right to stop a run, declare disqualification, or give instructions as appropriate (e.g., if the structure of the maze is jeopardized by continuing operation of the robot).
6) During the contest, contestants are allowed to:
   a. Change switch settings (e.g. to change algorithms, for example from left-turning to right turning - again, entering data on maze size or content is NOT inclusive of this rule.)
   b. Replace batteries between runs
   c. Adjust sensors

       d. Change speed settings
       e. Make repairs
7) The illumination, temperature, and humidity of the room shall be those of an ambient environment. (40 to 120 degrees F, 0% to 95% humidity, non-condensing).
BEWARE: Do not make any assumptions about the amount of sunlight, incandescent light, or fluorescent light that may be present at the contest site.

Important NOTE: Specific rules about "how to compute score" will be provided before we start the event.

For more information, contact us at ph: 605-677-5388 and e-mail: cs@usd.edu.

The department of computer science is willing to provide support for high schools for this Programming Contest. Alternatively, robot programming contest director can be reachable at santosh.kc@usd.edu.