2013 – 2014 Maryland Science Olympiad SUMO BOT Rules

1. **DESCRIPTION:** Students will design and construct an autonomous robot that will attempt to move an opponent's robot from the competition area.

- **A TEAM OF UP TO:** 3
- **IMPOUND**: No
- **APPROXIMATE TIME:** 2 minutes, 30 seconds competition time.
- **SAFETY GLASSES:** No

2. **CONSTRUCTION OVERVIEW**:
   A. Robots must operate in the autonomous mode.
   B. The power for the robot may not exceed 14.4 volts for all batteries. All batteries must be located inside the robot.
   C. The robot's maximum dimensions will be 9 inches (22.86 cm) long by 9 inches (22.86 cm) wide by 9 inches (22.86 cm) high and may not exceed these dimensions at any time during competition. Teams are encouraged to include the school name on the robot.
   D. The maximum weight of the robot is 2 pounds (0.90 kg) including batteries.
   E. The robot may not use any projectiles, sharp objects, magnets or pneumatic devices.
   F. The robot may not use any device that intentionally damages the opposing robot or will cause injury to opposing team members.

3. **COMPETITION**:

   A. The competition area will be 36 inches (91.44 cm) in diameter with designated starting positions on opposite sides of the competition area.

   B. The competition area will contain a 1-inch black boundary around the competition area to enable sensors to detect the edge of the competition area.

   C. Robots will be weighed and measured prior to each round of competition.
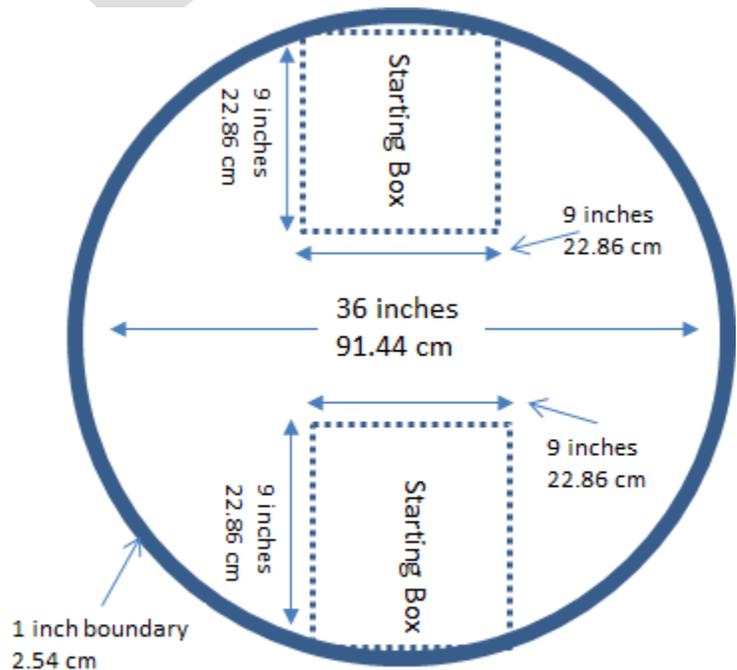
Sumo Bot Competition Area

D. A 30-minute practice session will be scheduled prior to competition.
E. Competition will proceed in tournament fashion: double elimination with random pairings for the first round.
F. When a round of the double-elimination tournament has an odd number of teams, one team will be randomly selected to receive a bye. A bye does not count as either a win or a loss. No team will receive more than one bye in a tournament unless a round is reached with an odd number of participants and all participating teams have already received a bye. In that case, the second bye will be issued on a random basis.
G. Once called to compete, teams will have a maximum of 2 minutes to prepare their robot and have the robot on the field. Any robot not ready to compete after the call will forfeit the match.
H. Students may make repairs to the robot between matches.
I. Teams will have 2 minutes 30 seconds to force the opponent from the arena.
J. If no robot has been declared a winner at the end of the competition, then the lighter of the two robots will be declared the winner. If the weights of the robots are equal, the robot with the least number of sensors and motors will be declared the winner.
K. If robots are unable to detect one another because of sensor or programming problems, the match may be stopped. This will be counted as a loss for the robots and the robots will be moved to the next round(s) of competition until they are eliminated.
L. If robots become entangled so that neither robot can move for 10 seconds, the judge will stop the clock, the teams will place their robot in the starting box and the competition will resume. If robots continue to become entangled after the restart, the match will be stopped. The robot with the least number of sensors and motors will be declared the winner. In cases of a tie, the match will be decided with a coin toss.
M. If a robot experiences mechanical problems and is unable to continue, the match will be stopped and the match awarded to the opponent.
N. A robot is declared the winner when the opposing robot is completely out of the competition area or the opposing robot has any of its wheels out of the competition area when time expires.
O. If a robot inadvertently leaves the competition area, the robot remaining in the competition area will be declared the winner.
P. If both robots inadvertently leave the competition area, the robot leaving the competition area last, will be declared the winner.

4. SCORING:

The final rankings will be determined as follows.

        A. The team that wins the tournament will be awarded first place.

        B. The team defeated by the winning team in the last match of the tournament will be awarded second place.

        C. If teams are tied for third place, the teams will compete for third and fourth places.

        D. Ranking for positions fifth through the remainder of the field will be determined by the round the team loss in.

Recommended Resources:

Description	Links
Lego NXT MINDSTORMS product information	http://mindstorms.lego.com/en-us/Default.aspx
Oregon Robotics - Interactive introduction to the NXT-G programming system	http://www.ortop.org/NXT_Tutorial/
Learn the NXT-G programming system	http://www.nxtprograms.com/help/learn.html
The Garrett Engineering And Robotics Society (GEARS), check out the free downloads and technical tips	http://www.sugobot.com/
Tufts University Lego building and programming resource	http://www.legoengineering.com/program/nxt-g/
Introduction to the VEX IQ robotics platform	http://www.vexrobotics.com/vexiq
Physics by Design with NXT MINDSTORMS	http://www.legoeducation.us/eng/product/physics_by_design_with_nxt_mindstorms/1893
Carnegie Mellon Robotics Academy	http://www.education.rec.ri.cmu.edu/
MIT Media Lab – Introduce students to programming with Scratch by programing their own interactive stories, games, and animations	http://scratch.mit.edu/about/
Learn about commercial applications of robotics	http://www.irobot.com/us/ http://www.learnaboutrobots.com/

Competition Preparation Tips:

A. Plan to spend about 6 weeks on the building and programming of the robot.
B. Construct a completion area are using presentation board and 1 inch wide black tape for testing sensors. Presentation board is available in 36-inch by 46-inch foldable sheets for about $6.00 from office supply stores (e.g., Staples).
C. Both team coach and students should take the programming classes.
D. Reach out to First Lego League (FLL) teams in your area for assistance in programming.
E. Develop a plan for building your robot and stick to the schedule.
F. Sensors will be the most difficult topic to understand so plan to spend more time on sensors when preparing your plan.
G. Document the development of your robot by photos or drawings, showing each option you tried and the results of it on your robot.
H. Explore the use of different wheel sizes and tracks on your robot. Document the effect each change had on the robot.
I. Assign each team member a responsibility.
J. Develop your program(s) in stages.
   1) Write a program to detect the presence of another robot using the ultrasonic sensor. A box or other object similar in size can be used to simulate the other robot.
   2) After the program for the ultrasonic sensor is working, add to the program the logic needed to detect the black line using a color or other sensor. Remember to, always save the working copy of the program, then save a new version of the program for the additional logic required for the additional sensor. You can experiment with other sensors to learn more about how different sensors work.
   3) Test the ability of the robot to push different weights by using gears, or different wheel diameters, or wheel widths. Comparisons between wheels and tracks may also be of interest to explore.
   4) Develop different programs using different strategies for defeating the opposing robot. (e.g., attack from either side instead of head-on).
   5) Develop defensive strategies (e.g., moving to the side or away from the area your opponent thinks you will be).
   6) Use the references provided and YouTube to research building options, software, and ideas for improving your robot.
   7) Encourage teams to prepare a poster board to present to classmates and teachers on the building of their robot. Once completed, show your classmates and teachers your robot and the things it can do.
   8) Continue to build other versions of your robot throughout the year and explore other science, engineering and technology ideas.
   9) Remember, the goal is to have fun while you learn about science and technology.