Texas 4-H Robotics Challenge

(last revised: August 6, 2020)

Description

The Robotics Challenge is structured as a sumo-style competition. The sumo format will test teams' strategy, engineering design, and programming skills.

Teams will bring a fully assembled and programmed robot to compete against others in the tournament until a winner is declared. Two robots will "wrestle" in a *dohyō* (sumo ring) designed for robots. As with human Sumo wrestling, the goal of sumo-style robotics is to gain leverage over an opponent and force it out of the ring.

Please note, this is NOT a "battle bots" style competition. In other words, intentionally destructive robots are not allowed.

Definitions

Round – a head-to-head battle between two robots
Match – made up of 3 rounds (new: no time limit)
Field (ring) - the structure upon which the robots compete
Arena - the surface below the playing field (the floor, mat, or table for example)
Swiss Tournament - This type of non-elimination tournament guarantees each team a minimum number of matches (more when compared to a single or double elimination tournament). The number of matches will be announced the day of the contest. Teams earn points for match wins and draws. Teams will be randomly paired for their first match. Subsequent pairings are based on a team's points and standings. Teams will be matched with other teams who have the same or nearly the same points. The team with the highest point total at the end of the tournament is declared the winner. Contest officials will use a web-based tournament management program to determine pairings and rankings.
Median-Buchholz system – A tie-breaking system used by the tournament program, where the value displayed in the standings table is the sum of a player's opponents' scores, with the best and worst scores discarded.
Points Differential – a secondary tie-breaking system used by the tournament program that calculates the total number of points scored minus points given up.
Wins vs Tied - this tie break looks at the match record between tied participants. For example, if Team A and Team B are tied based on statistics but Team A won when they played during the tournament, Team A wins the tie break. When more than 2 teams are tied, they're ranked by the number of wins each one had against the others.

Eligibility

This is an invitational contest open to intermediate and senior 4-H members only. It is a team-based contest. A team must be comprised of 2 or 3 members. For this contest, intermediates may move up to the senior age division so long as at least one other member is a senior. When registering, members must designate their team members.

The Robot

At check-in, the robot will be inspected by contest officials to ensure it meets the guidelines outlined in these rules. The robot will be inspected to ensure it meets all parts, dimensions, weight, programming, and other requirements listed below. If the robot fails to pass the first inspection, the team will be allotted up to 10 minutes to make corrections and resubmit the robot for a second inspection. Failure to meet requirements after a second inspection will result in disqualification from the tournament.

Requirements/Limitations:

1. The robot must be fully assembled at check-in using all parts. Only the parts on the robot at check-in may be used during the tournament. No additional parts may be brought in or used after check-in. This is to ensure each robot will meet weight restrictions for the duration of the tournament.
2. Teams can reconfigure their robot between matches using only the parts used on their robot presented at check-in.
3. The robot must be entirely constructed from Lego brand manufactured parts. No non-Lego parts of any sort allowed. Pieces must be in its original factory condition (not cut, bent, reshaped, etc.). Only standard Lego construction methods are allowed. Pieces cannot be glued, taped, wired or otherwise held together.
4. Only 1 EV3 or NXT brick can be used in the construction and autonomous control of the robot.
5. The robot must be 100% controlled autonomously by the onboard EV3 or NXT brick. No remote controls of any type allowed.
6. There is no limit to the number of Lego brand sensors or motors.
7. The robot can weigh up to 1.5 kilograms. There is no minimum weight. A tolerance may be given by contest officials.
8. Throughout the tournament, and at the beginning of each match, the robot must be able to fit inside a 10”x10” square box. There is no height limit. The robot may autonomously expand to any size once the round starts and the 5-second programming delay has expired (see *The Program* section).
9. The robot must not physically separate into pieces. It must remain a single centralized robot throughout the match.
10. No pieces can be purposely dropped or placed onto the playing field by the robot that might impede the mobility of its opponent. Robots may not throw anything at its opponent nor drop items onto the playing field. Any part used to purposely entangle the

opponent's robot is not allowed. In the event a piece falls off during the round, the judge may elect to remove the piece if he/she deems such action will not impede the progress of the two robots; otherwise, it will remain on the playing field until the end of the round.

11. The robot must possess a form of mobility and use that mobility throughout the match. Stationary robots will be deemed disabled (see Scoring).
12. The robot cannot have parts or mechanisms that intentionally cause damage to its opponent. Normal pushes, lifts, and collisions are not considered intentional damage.
13. No sharp edges or pointed pieces allowed. If the part could easily cause physical damage to a person, the playing field, or the opponent's robot, it is not allowed.
14. After the programmed 5-second delay (see The Program section, rule 2 below), the robot must move or attempt to move continuously throughout the match or it will be declared disabled; thus, losing the round.
15. The robot must not have any parts or adhesives that adhere, fasten, or somehow secure the robot to the playing surface or its opponent. Sticky substances that might improve traction or grip are not allowed. Tires and other parts of the robot that will come into contact with the playing surface will be tested during inspection using an index card. The robot must not pick up and hold the card for more than 2 seconds.
16. The competitor/robot must not use any device, such as jammers or using strobe lights, that may obstruct the control of the opponent robot's operation,
17. No powders, gases, or liquids may be stored/used by the robot.
18. Robots may be re-inspected at any time during the tournament for any reason.
19. Failure to adhere to these rules may result in forfeiture of the match. A second violation will result in disqualification from the tournament as well as forfeiture of all awards and standings.

The Program

1. The robot must be pre-programmed to have a 5-second delay after pressing the start button before any physical action by the robot takes place. This delay will allow time for the contestants to back away from the ring so that robot sensors do not detect contestants.
2. Every robot's program will be tested for the 5-second delay during inspection and may be re-inspected at any time during the tournament.
3. Teams may use any firmware or software language for their NXT or EV3 brick.
4. Teams may change or update their program(s) between matches, so long as the team's robot is not currently needed in the staging area or about to compete in a match.

Tournament Format

For this contest, the Swiss Tournament format will be used (see definition above). Teams will be divided into and only compete within their age division.

Once divided into an age division and provided a general tournament orientation, each team will be paired against a random opponent for their first match. If there is an odd number of

teams in the age division, some teams may or may not have a bye at some point during the tournament. Each team will have the opportunity to earn points in each match. A match win is worth 2 points. A bye is worth 2 points. A match draw is worth 1 point for each team. A match loss will yield 0 points. Following the first match, teams will be paired against other teams with similarly earned points.

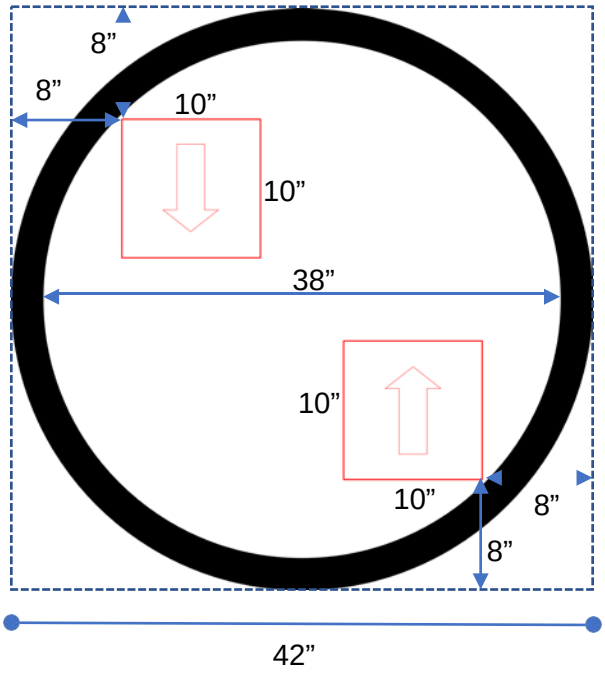
The Median-Buchholz system, Points Differential, and Wins vs. Tied Participants will be used to break ties. If a tie (within an award position) remains after all matches have been played, the tied teams will play a sudden death match until a winner is declared and the tie is broken.

The Playing Field

The platform in which robots will compete upon will have the following specifications:

- The substructure will be constructed from MDF, plywood, plastic, or similarly rigid material. Short legs may be fastened to the bottom of the substructure to raise it off the floor.
- The surface will be covered a printed vinyl material, which will be adhered to the substructure.
- Total diameter is 42”
- Top center is white (38” in diameter) with a 2” black border (see Figure 1)
- The playing field surface will be approximately 2-4” above the arena floor.
- Two 10”x10” starting boxes will be located 8” from the outer edges of the ring (see Figure 1).
- Measurements may vary slightly from ring to ring and will have a tolerance of up to ½”.

Figure 1. Playing Field Dimensions and Colors



Inner Circle: White

Outer Ring: Black

Starting Boxes: Red

Rounds and Matches

1. Within a match, teams will play up to 3 separate rounds. The team that wins the most rounds, wins the match. See Scoring section for further details.
2. Teams will be randomly paired in their first match.
3. Following a team's first match, they will be paired against teams with similar points using the Swiss tournament program.
4. The team with the greatest number of points at the end of the tournament will be declared the winner.
5. A round begins at the command of the contest official.
6. A round ends in a win/loss/draw when one of the following occurs:
    a. One or both robots touch the arena floor
    b. When both robots are entangled for 10 seconds
    c. When one or both robots is not engaged for 10 seconds
    d. A robot has become disabled for 10 seconds
    e. A player interferes with the match (gets too close to the ring, touches the ring, touches a robot in play, etc.)
    f. A rule has been violated

Scoring

During a round, a robot may push, shove, lift, grab, or knock over its opponent while attempting to push it out of the ring. Sumo is a game of pushing and leverage, not intentional destruction. Wedges are allowed, because it is a means to gain leverage while pushing an opponent. Flipping an opponent onto its side, back, or off the ring is also allowed.

A team wins a round when one of the following occurs:

1. The opposing team's robot, on its own or by force from its opponent, is the first to touch (with any part) the arena floor.
2. The opposing robot becomes disabled and fails to engage for 10 or more seconds.
3. An opposing team member violates a rule

A team wins a match when it has 1 or more round wins than the other team.

A match draw occurs when both teams have the same win-loss-draw record.

Match Point Values

- A win is worth 2 points
- A bye is worth 2 points
- A draw is worth 1 point
- A loss is worth 0 points

Below are sample round/match scoring scenarios. Note: this does not cover every possibility.

Round	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
1	Team A wins	Team A wins	Draw	Draw	Team B
2	Team A wins	Team B wins	Draw	Draw	Time expires before next round begins
3	Team B wins	Draw	Team A	Draw	n/a
Match Result	Team A wins	Draw	Team A wins	Draw	Team B wins
Points Awarded	Team A = 2 Team B = 0	Team A = 1 Team B = 1	Team A = 2 Team B = 0	Team A = 1 Team B = 1	Team A = 0 Team B = 2

A piece or pieces of a robot that breaks off the main structure of the robot during a match and lands on the arena floor does not constitute the opponent leaving the arena.

If both robots become entangled for 10 seconds, or if it is determined that both robots touched the arena floor at the same time, the round will be declared a draw. Entanglement is defined as engaged robots that are not making significant progress toward the edge of the arena.

Matches will be scored by a single judge. Immediately following a round, any match competitor may challenge the outcome or rule. All challenges must be resolved with the judge and/or contest official prior to the next round beginning. Challenges should be used sparingly, and if abused, contest officials reserve the right to revoke a team's use of future challenges. At the end of the match, once the score card has been signed by both team captains, the results are final and cannot be challenged.

If a team fails to report to the staging area and/or their assigned ring when called, they will forfeit the match and not be awarded any points. In such cases, the opposing team will be awarded a match win.

A penalty may be declared by the judge if he/she is witness to unsportsmanlike conduct by a team member or determines a rule has been violated. In such cases, 1 point will be deducted from the team in violation.

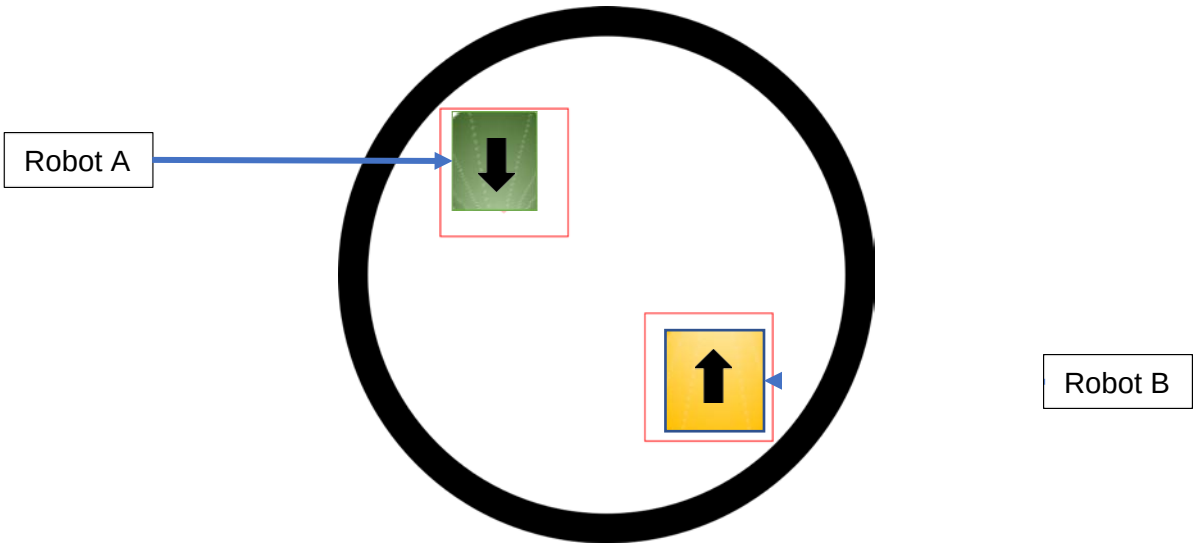
Team Procedures

1. When announced, teams will bring their robot (powered up and ready to compete) to the designated staging area. Teams that fail to report to the staging area after the third call will forfeit their match.
2. Teams will be directed to a playing field and place their robots in one of the two starting squares.
3. The team captain will place the robot in its ready position. Other team members must

stay in the designated contestant spectator area. Team captains can change between matches if desired.

4. Each robot must be placed completely within the 10” x 10” square with the front of the robot facing in the same direction as the arrow. (see Figure 2)
5. A contest official will countdown to start the match.
6. When the first round begins, the team captain will press the start button on his/her robot and then move to the designated contestant spectator area during the 5-second programming delay. At this point, the robot may not be touched by any team member until the judge announces the results of the round.
    a. If there is a false start (one team pushes the button before the other), a restart will be ordered by the judge.
    b. If a team false starts a second time within a round, the opposing team will be awarded a round win.
7. The judge will monitor the round until it ends.
8. The judge will then instruct both team captains to retrieve his/her robot and reset it for the remaining rounds.
9. At the conclusion of the match (3 rounds), the judge will announce and record the match results. Both team captains will review and initial the scorecard.
10. Depending on the tournament schedule, the team will either proceed to the next playing field, return to the staging area, or to the team holding area.

Figure 2. Robot Placement Example



Other Contest Details

- Teams are only allowed to bring the following:
  - 1 Pre-built, pre-programmed robot (see The Robot section above)
  - 1 empty container to transport robot and/or listed store supplies in
  - Unlimited number of replacement batteries
  - Battery charger
  - 1 power strip
  - 1 laptop or tablet for programming only (no internet access will be provided for teams)
  - Electronic devices used for medical reasons are permitted.
- Teams are NOT allowed to bring the following:
  - Extra Lego parts or pieces
  - Cell phones, except for medical reasons. In such cases, please notify contest officials prior to the contest
  - Food or beverages of any sort. This applies to food purchased outside of Reed Arena. The exception is for those who require food for medical reasons or food purchased at the concession stand located within Reed Arena.
- Depending on the number of teams that register and the tournament schedule, lunch may or may not be provided. In either case, the team will receive notification prior to the contest.
- Contest officials will not have nor provide any parts, supplies, or computers for teams to borrow/use.
- No communication will be allowed between spectators and teams during the tournament.
- No adults (includes coaches) are allowed on the arena floor once the tournament begins.
- Team-to-team communication is allowed and encouraged.
- If programming or construction problems arise, teams are highly encouraged to communicate and assist one another.
- Tips for inspection:
  - Have your robot powered up and ready.
  - Be ready to demonstrate the required 5-second programming delay.
  - Make sure ALL pieces you may use during the tournament are attached to your robot at check-in.
  - Ensure your robot meets all rules outlined above.
  - Make sure all firmware is up to date prior to the tournament.

Teams wishing to purchase the same vinyl decal used in this tournament can contact CC Creations in College Station and request the Texas 4-H Sumo Robotics vinyl decal. Contact:

Kelsey Dabney
P: 979-693-9664 x701
k.dabney@cccreationsusa.com

A video example on how to adhere the decal to a subsurface can be viewed on the Texas 4-H Science Facebook page by clicking on this link.