



11th Annual Robotics Competition

For...

High School and Middle School Teams

Tuesday, April 5th , 2022

Event Rules Booklet

Sponsored by...



Contents

1	Competition Overview	3
2	Competition Schedule	3
3	Large Swept Away Challenge	4
4	Large Swept Away Robot Restrictions	4
5	Large Swept Away Scoring/Timing/Rules of Play	4
6	Large Swept Away Board Layout	4
7	Small Swept Away Challenge	5
8	Small Swept Away Robot Restrictions	5
9	Small Swept Away Scoring/Timing/Rules of Play	6
10	Small Swept Away Board Layout	6
11	Small Swept Away Challenge Wiffle Balls	7
12	Autonomous Task Challenge	7
13	Autonomous Task Robot Restrictions	7
14	Autonomous Task Scoring/Timing/Rules of Play	7
15	Autonomous Task Rules of Play	7
16	Autonomous Task Timing	8
17	Autonomous Task Scoring	8
18	Autonomous Task Board Layout	9
19	Autonomous Line-Following Challenge	10
20	Autonomous Line-Following Robot Restrictions	10
21	Autonomous Line-Following Scoring/Timing/Rules of Play	10
22	Autonomous Line-Following Board Layout	10
23	Forklift Challenge	11
24	Forklift Robot Restrictions	11
25	Forklift Scoring/Timing/Rules of Play	12
26	Forklift Rules of Play and Timing	12
27	Forklift Scoring	12
28	Forklift Board Layout	12

29	Maze Programming Challenge	13
30	Maze Programming Robot Restrictions	13
31	Maze Programming Scoring/Timing/Rules of Play	13
32	Maze Programming Board Layout	13
33	Awards	14
34	Robotic Competition Committee Members	15

35 Competition Overview

Regional schools have collaborated to create an event to showcase and test their talent with building and designing robots. The competition provides a STEM focused event for local schools. SUNY Broome Community College has taken charge as the host for this great event. The intent of the competition is to provide a spotlight for students to showcase their ingenuity and talents in the STEM field. The main focus is on the students. The spirit of the competition is to get students excited about STEM. All schools are expected to follow the highest level of sportsmanship during the event. Advisors and teachers are expected to enforce the intent of the event rules. If there are questions about the rules they should be clarified before the event. This year there will be a small committee of three teachers that will decide if robots are qualified for a certain event if questions arise at the event.

The competition consists of six main events. In each challenge the teams compete for points or best time. The team with the most points or the best time wins. They win bragging rights for the next year along with a trophy or plaque.

Robots this year must have their team name on the robot. The names will be simplified this year. For example a team from Chenango Forks in the Line Follow Event will have a team name of CF-LF-1 for the first team registered in that event from that school. Sticker Labels will be pre-printed in your registration box. These labels need to be placed on the robot in a visible location.

A registration Google Form will be sent out about a month before the competition for schools to register teams for events. If for some reason we reach our capacity of people, we may enforce a limit of three teams per event per school. That would mean a school could only bring a max of eighteen teams. If the limit is reached schools will be notified.

36 Competition Schedule

8:15 – 9:15 AM	Teams Check In Sign up for Testing Time
9:30 AM – 9:45 AM	SUNY Broome Opening Welcome
9:45 AM – 10:00 AM	Board Open for Trial Runs
10:00 AM – 11:30 AM	Ticket 1 - 10:00 - 10:30 Ticket 2 - 10:30 - 11:00 Ticket 3 - 11:00 - 11:30
11:30 AM – 11:45 AM	Clean Up Judges Tally Points
11:45 AM – 12:15 PM	Lunch
12:15 PM – 12:45 PM	Awards Presentations

37 Large Swept Away Challenge

- [Link to Large Swept Away Rules](#)
- Bracket Style Knockout Competition
- Brackets decided by Qualifying Rounds
- ***** Remind App will be used to notify team of when they compete. *****

SCORING	
Soccer Ball	1 point
Soccer Ball in Tower	3 points
Football	3 points
Football balanced on top of opponent's tower	7 points
A team scores points by placing balls on their opponent's side of the wall.	

37.1 Large Swept Away Robot Restrictions

- Metal Only Robots. (i.e. VEX)
 - Robot has to be made of metal.
 - Robots must be checked-in by judges.
 - Judges may disqualify robots.
- Robots must start under 18 inches x 18 inches x 12 inches high.
 - Robots may unfold to something larger.
- Robots may use string, tape, cardboard etc. It may use other metal parts not in the VEX Kit.
 - We use all of VEX Rules except making the robot adhere only to VEX parts.
- Robots can only have 6 motors.
- Maximum battery size is 7.2 Volts at 3000 milliAmps.

37.2 Large Swept Away Scoring/Timing/Rules of Play

- Run Time: 2:30 minutes
- Scoring follows VEX Rules.
- Judges only wait 30 seconds for teams. You may be disqualified if you are late to your time slot.
- Resetting Robots:
 - Only Judges Reset Robots
 - Any balls being carried are removed from play at no penalty. They can't count for future points.

37.3 Large Swept Away Board Layout

- 8 ft x 8 ft Metal Platform on Floor

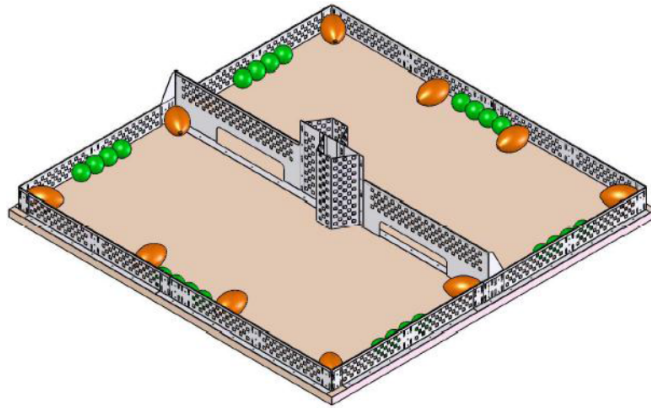


Figure 1 – Large Swept Away Board

38 Small Swept Away Challenge

- [Link to Large Swept Away Rules](#)
- Bracket Style Knockout Competition
- Brackets decided by Qualifying Rounds
- ***** Remind App will be used to notify team when they compete. *****

SCORING	
Small White Whiffle Ball	1 point
Small White Whiffle Ball in Tower	3 points
Large Yellow Whiffle Ball	3 points
Large Yellow Whiffle Ball balanced on top of opponent's tower	7 points
A team scores points by placing balls on their opponent's side of the wall.	

38.1 Small Swept Away Robot Restrictions

- Lego and VEX IQ only. All other robots must be cleared by the committee.
- Plastic Only Robots.
 - Robot has to be made of plastic.
 - Metal is allowed only for the axles. Not gears or any other structure part.
 - Robots must be checked-in by judges.
 - Judges may disqualify robots.
- Robots initially must be within 14 x 14 x 12 inches.
 - Robots may unfold to something larger.

38.2 Small Swept Away Scoring/Timing/Rules of Play

- Run Time: 2:30 minutes
- Judges only wait 30 seconds for teams. You may be disqualified if you are late to your time slot.
- Resetting Robots:
 - Only Judges Reset Robots
 - Any balls being carried are removed from play at no penalty. They can't count for future points.
- Breaking Ties in Small Swept Away
 - Robots will be placed in far opposite corners of the board with back against the wall.
 - Yellow ball placed in center of board.
 - First robot to get the yellow ball over the center wall wins.

38.3 Small Swept Away Board Layout

- 4 ft x 8 ft Plywood Platform
- 24 White Golf Ball Size Wiffle Balls
- 12 Yellow Softball Sized Wiffle Balls
- Scale is in inches.
- Circle Tube Towers will be 3 inch PVC tubes.
 - They will have a stop in the center, it will only hold so many of the small golf ball size wiffle balls.
 - The yellow sized wiffle balls will not fit in the circle towers.
- Link to actual DWG file: [Swept Away Drawing 1](#)

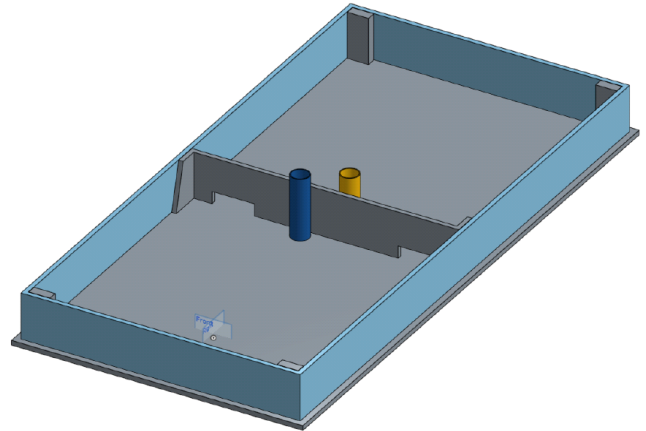


Figure 2 – Small Swept Away Board

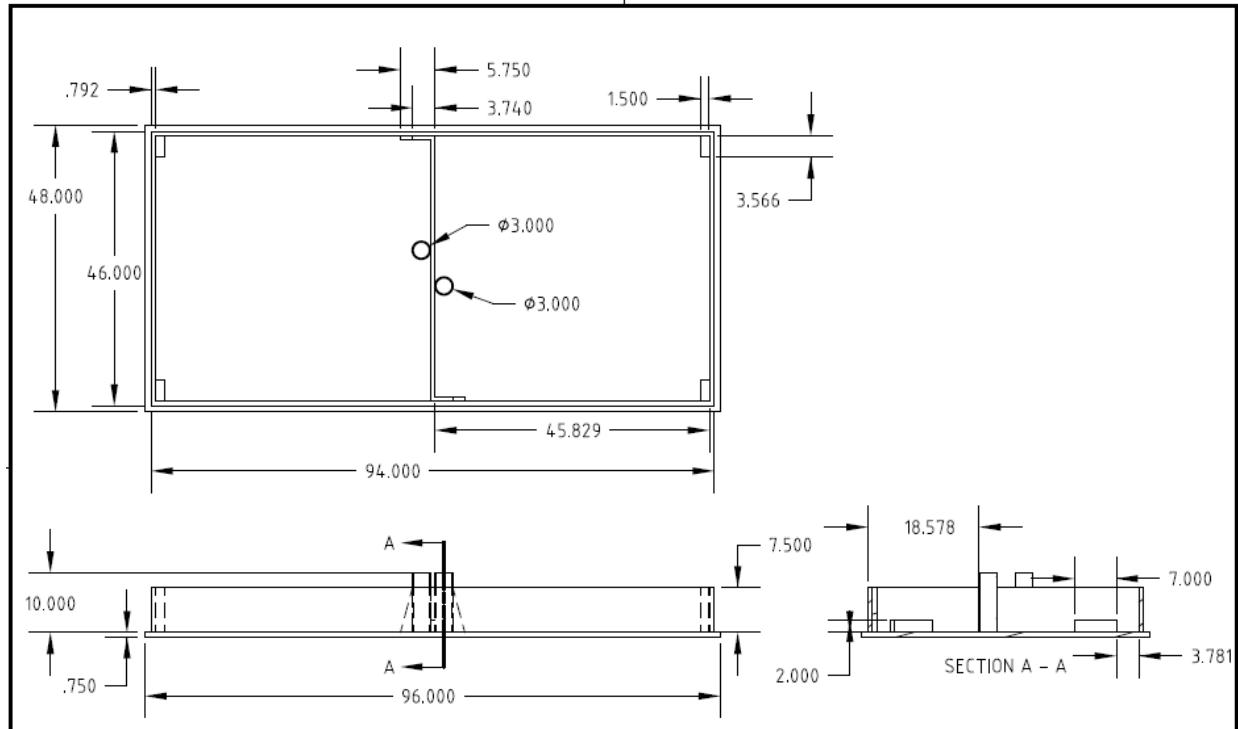


Figure 3 – Small Swept Away CAD Drawing

38.4 Small Swept Away Challenge Wiffle Balls

- White golf ball sized wiffle balls used in place of the green soccer ball.
- Yellow softball sized wiffle balls In place of the larger orange football.

24 Polyurethane White Plastic Golf Balls by Crown Sporting Goods	12 Athletic Specialties Perforated Softballs Yellow
	
Sold at Amazon Link to Amazon	Sold At Amazon Link to Amazon

39 Autonomous Task Challenge

39.1 Autonomous Task Robot Restrictions

- No remote control, completely autonomous.
- Robots initially fit with in Size: 16 in x 16 in x 12 in high.
- Robots weigh less than 30 lbs or less.

39.2 Autonomous Task Scoring/Timing/Rules of Play

39.2.1 Autonomous Task Rules of Play

- Robot Starts completely **inside the tape** of the Home Zone
- **TEAMS ARE REQUIRED TO SETUP THE BOARD TO THEIR SATISFACTION.**
- **PLACEMENT OF BLOCKS MUST BE ON LINES.**
- **Teams may touch or change the robot while it is in the Home Zone at no penalty.**
- **Teams can change out the robot with another robot as long as the first robot made it to Home Zone.**
- **Tasks**
 - Task 1 – Soda Can:
 - The soda can is a 12 oz. empty aluminum soda can. The tab will remain in place. The soda can starts in the Home Zone and may start placed on the robot.
 - Task 2 – Block Stack:
 - This consists of 1 - 1.5 inch 3-D printed plastic cubes. The robot lifts and carries the block to the top of the 3 x 3 inch 1.5 inch tall platform.
 - Task 3 – Block Knock Over:

- This consists of 6 - 1.5 inch 3-D printed plastic cubes stacked in a pyramid with 3 on bottom, then 2 then 1 on top. **The three on the bottom will be screwed to the table and are spaced ¾ inch apart.**
- Task 4 – Ring Pick Up:
 - The base of the ring is a 1” cube with a 2” diameter ring on top of it. The height from the bottom of the base of the cube to the center of the hoop is 3”. See Figure 5 below. 3D printed ring file: [3D Ring Stand STL](#)



Figure 4 – Autonomous 3D Printed Ring

39.2.2 Autonomous Task Timing

- Timing will start as soon as the robot leaves the Home Zone.
- Maximum time allowed to complete all 4 tasks is **5 minutes**.
- Time STOPS when:
 - **Team Calls STOP. (Even if robot is not working, teams call stop.)**
 - **Time will stop once robot breaks the plane of the Home Zone after completing all tasks.**

39.2.3 Autonomous Task Scoring

- Each team is allowed three trial tickets.
- Best trial wins. Best trial is most points with the least amount of time.
- A total of 100 points can be earned in this event.
- **Scoring Tasks**
 - **Task 1 – Soda Can (25 pts)**
 - 25 pts for placement on top center pedestal. The can must be upright and does not have to be centered.
 - 18 pts for placement on top pedestal and the can is not upright.
 - 11 pts for placement of can off the pedestal and can remains upright in outer box.
 - 5 pts for placement of can off pedestal and can is not upright but any portion still remains in outer box.
 - 2 pts for placement of can anywhere on or off pedestal but can falls over and rolls out of designated area.
 - **Task 2 - Block Lift (25pts)**
 - 25 points for lifting block to top of a pedestal.
 - 15 points successful lift but block falls off robot, or block falls off of pedestal.
 - **Task 3 - Block Knock Over (25 pts)**
 - 25 points for all blocks knocked down to the bottom level from on top of the pyramid.
 - 5 points for each if only 1 or 2 blocks knocked down.

o **Task 4 - Ring Pick Up (25 pts)**

- 25 points for the ring being carried or dragged to the Home Zone. The ring does not have to be in Home Zone, but any portion of the robot has to be in the Home Zone and it still can be moving when the team removes the ring from the robot. **This is all or nothing.**

39.3 Autonomous Task Board Layout

- 4 ft x 4 ft Plywood Platform
 - o ¾ black electrical tape used to outline the Home Box
- Board Layout
 - o Soda Can Drop circle is ¾ plywood screwed to table.
 - o Block Stack Platform is screwed to the table.
 - o 3 bottom blocks of the pyramid are screwed to platform.
 - o Ring Pick up Block is free to move.
 - o Ring is made of 3D printed material.
 - o Blocks are made of 3D printed material.

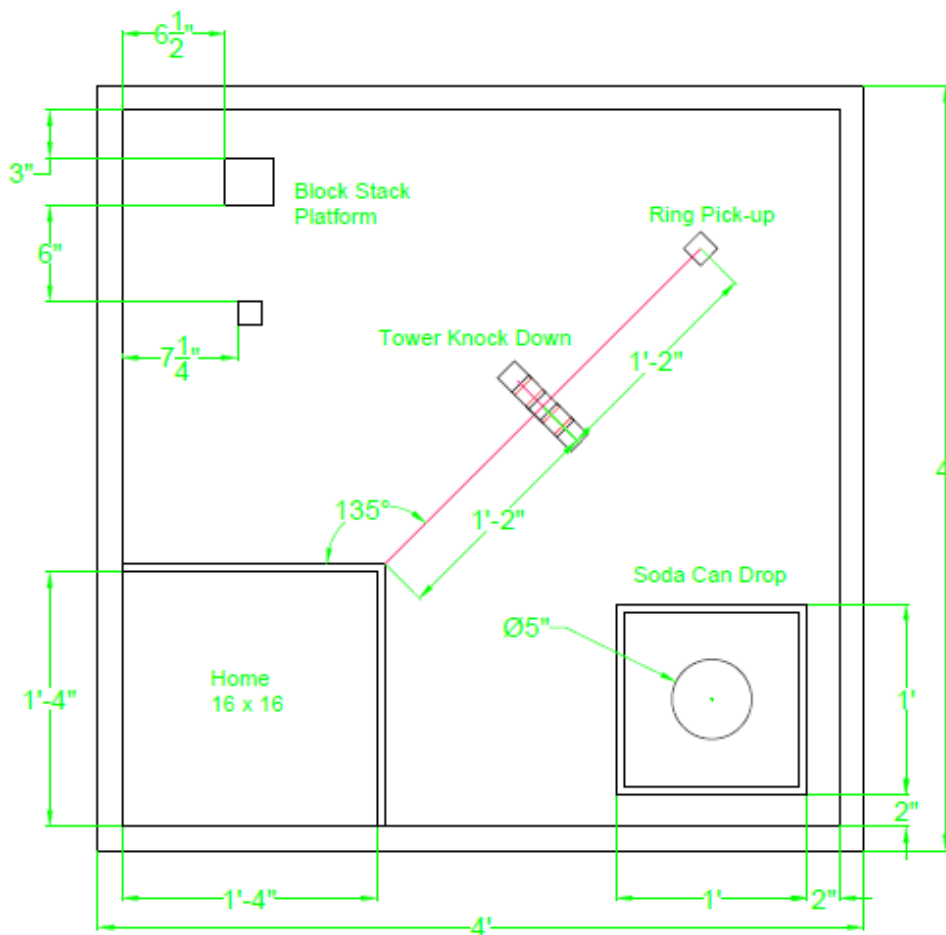


Figure 5 – Autonomous Task CAD Drawing

40 Autonomous Line-Following Challenge

40.1 Autonomous Line-Following Robot Restrictions

- Initial maximum Robot Size is 16 inch x 16 inch x 12 inch high and 30 lbs or less.
- **Robot (including the sensors) must start entirely within the tape line of the Home Zone.**
- **No remote control. Completely Autonomous.**
- **Team can choose to go around the course in either direction.**
- **Team will place the puck in the first zone such that the entire puck is within the lines of the zone. The puck must lie flat initially.**

40.2 Autonomous Line-Following Scoring/Timing/Rules of Play

- Team Robot follows a line to the first box zone where there will be a plastic 3D printed puck (which was placed in the zone by the team).
 - The robot then pushes, picks up and carries, or otherwise transfers the puck to the next box zone. The puck will be left in the second box zone.
 - Robot continues following the line after the drop puck zone back to Home Zone.
 - 3D File for Puck: [3D Puck IPT](#)
 - [Puck SAE STL](#) ([Puck METRIC STL](#))
- Timing will start once the robot breaks the plane of the Home Zone.
- Timing will stop once the robot returns and breaks the plane of the Home Zone.
- The robot must follow the line, keeping the line between its outside edges of wheels.
- Least amount of time wins.
- Each team is allowed 3 attempts at the line follow, with their best time being recorded.
- The teams may take time between runs to re-program or otherwise adjust their robot.
- Maximum time allowed to complete a circuit of the line and make the drops is 5 minutes.
- Scoring:
 - 30 seconds **removed** if the puck ends up entirely inside the drop zone.
 - 20 seconds **removed** if the puck is only partially inside the drop zone or touching the boundary of the drop zone.
 - 10 seconds **removed** if the puck ends up totally outside of all of the zones.
 - 5 seconds **added** if the puck ends up all the way in the home zone (or touching the boundary of the home zone).
 - 10 seconds **added** if the puck remains in or touches the boundary of the initial zone.
 - 15 seconds **added** if the puck leaves the board.
 - It may be possible for negative times.
 - The team with the least amount of time or the most negative time wins.
- **If the robot is touched, malfunctions, or drives off the line, or if 5 minutes has expired, it fails that run.**

40.3 Autonomous Line-Following Board Layout

- Board Layout
 - Black paint will delineate the line to be followed

- Red and green paint will outline the drop zones. Only three sides of the drop zones will be red or green, the side that is the line will remain black.
- All curves have a 5 inch radius.
- The puck placement in the diagram is for when the team chooses to traverse the course in the counterclockwise direction, their positions would be reversed if the team chooses to traverse the course in the clockwise direction.

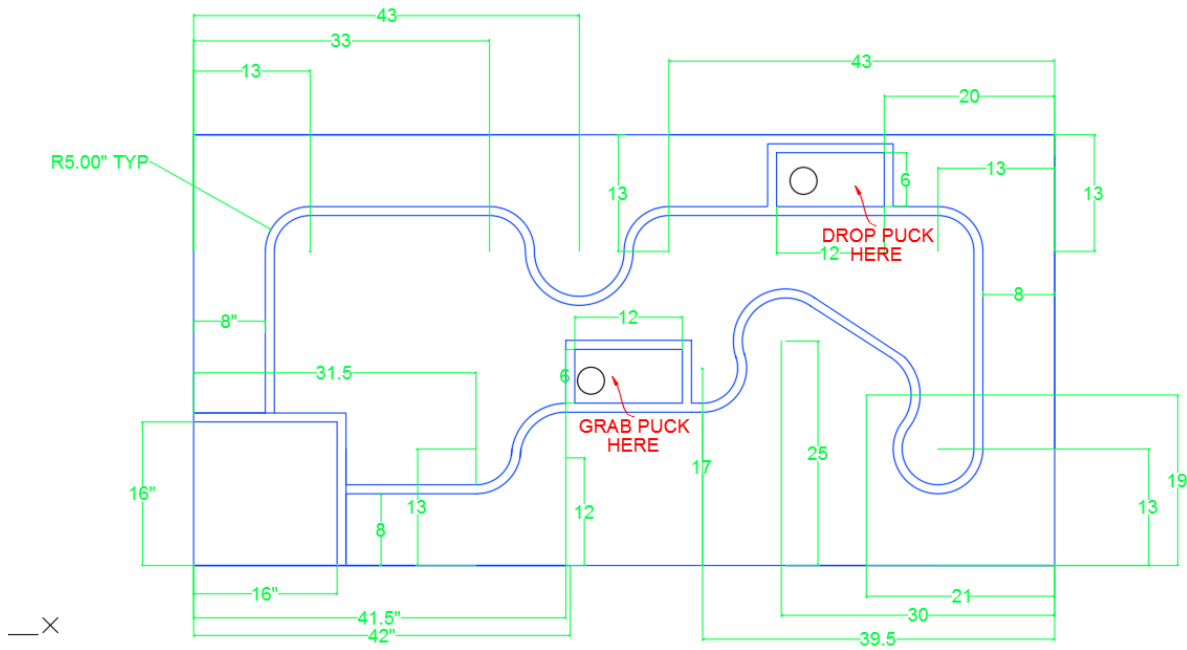


Figure 6 – Autonomous Line-Following CAD Drawing

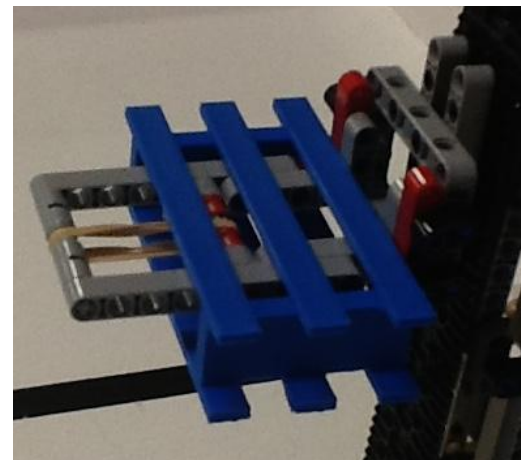
Course can be driven either way. This image shows only one scenario.

41 Forklift Challenge

- Pallets will be printed on a 3D printer and made of PLA or ABS plastic.
- [Pallet DWG File with Dimensions](#)
- [STL 3D Print File](#)

41.1 Forklift Robot Restrictions

- Remote control challenge. Not autonomous.
- **Robot must lift from the middle of the pallet.**
 - **Robots will be checked for correct lift mechanism at registration.**
 - **Robots may be disqualified if the lift is a grabber, or claw.**
- Initial Robot size within: 16 inch x 16 inch. No height limit.
- The robot cannot be over 30lbs.



41.2 Forklift Scoring/Timing/Rules of Play

41.2.1 Forklift Rules of Play and Timing

- Each team is allowed three trials.
- Best trial wins.
 - Best trials is most points with the least amount of time.
- Moving Pallets
 - The robot may deliver the pallets to **any** color coded unloading zone and stack as high as desired.
 - Robots may move or lift multiple pallets in a trip. Robots may stack pallets, then move or lift the stack.
 - Robots continue retrieving pallets from **any** loading zones and place in **any** color coded unloading zone.
 - Each stack can have only one pallet as its base.
 - The team can choose to have 1, 2 or 3 stacks.
 - Each loading zone can have only 1 stack.
 - If a pallet falls outside of the board, it is out of play and cannot be retrieved.
 - Once the last pallet is stacked, time will end.
- Stacked means one on top of the other. (Can be messy stack or neat, as long one on top of the other.)
- **Time will end when last available pallet is placed or operator calls 'TIME.' If operator calls time, points will be awarded based on properly stacked pallets defined as "pallet supported by pallet entirely within unloading zone.**
- **There is a 3 minute time limit.**

41.2.2 Forklift Scoring

- Scoring
 - Level 1, Base Row Pallet..... 1 point
 - Level 2, Second Row Pallet..... 2 points
 - Level 3, Third Row Pallet..... 3 points
 - Level 4, Fourth Row Pallet..... 4 points
 - Level 5, Fifth Row Pallet..... 5 points
 - Level 6, Sixth Row Pallet..... 6 points
 - Level 7, Seventh Row Pallet..... 7 points
 - Level 8, Eighth Row Pallet..... 8 points
 - Level 9, Ninth Row Pallet..... 9 points
 - *Maximum Point Value: 45 points*
- **In the event that there are multiple robots with a maximum score, quickest time will be the tie breaker.**
- **No points will be awarded for pallets that are not stacked in one of the color coded unloading zones.**

41.3 Forklift Board Layout

- 4 ft. x 4 ft. plywood platform.
- Board Layout.

42 Maze Programming Challenge

You will need to **build** a robot that can be programmed to travel autonomously through a maze. You will need to build a robot who can make turns and traverse the course. The Maze will not be revealed until the day of the challenge. Teams will be allotted a certain amount of time to initially program their robots for the Maze. After each trial run Teams will get more time to make programming tweaks.

42.1 Maze Programming Robot Restrictions

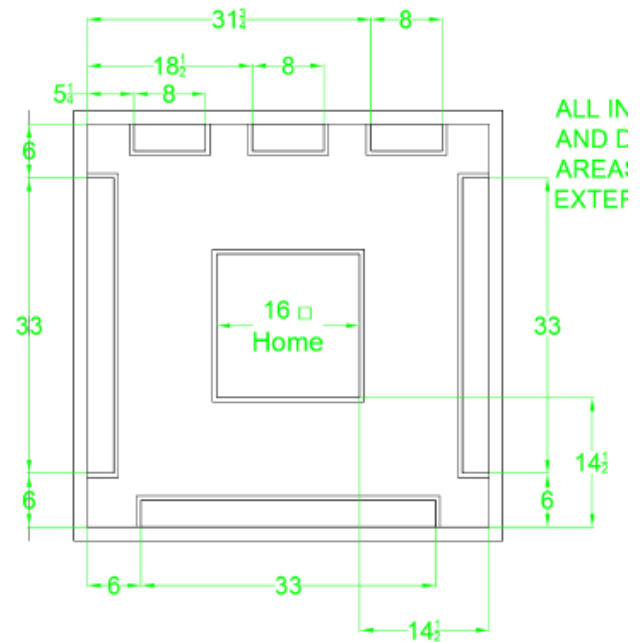
- Must move autonomously
- Robot must fit within size: 16 inches x 16 inches and height limit.
- Robot must weigh less than 30 lbs.
- Robot must be built. Not purchased as one unit.
 - May purchase a kit, but it has to be built by the students.
 - Judges may disqualify your robot.
- **You may be required to show your code.**

42.2 Maze Programming Scoring/Timing/Rules of Play

- Each team will be given a "Layout Map" and a roll of painter's tape.
- Each team will be given 3 attempts on the track
 - Each will be timed (max time allowed is 5 minutes.)
 - The clock starts when you pass the green tape
 - The clock stops when you pass the red tape
 - There will be intermediate black lines to indicate progress through the maze in case 5 teams do not complete the entire maze.
 - A team may call time and the progress through the maze will be recorded for that run along with the time. For instance, if a robot has made it to the third intermediate line but is not making progress towards the next line, the team calls time.
- Every robot will be scored on distance and then time.
- Fastest single run that completes the entire maze will win. Followed by all of the robots that completed the maze, based on time. These are followed in order by the robots that made it to the last intermediate line, etc.

42.3 Maze Programming Board Layout

- Maze will always be 16 inches wide



no

- Turns can be of any angle (1 degree to 180 degrees)
- Maze walls will be built out of foam board 6 inches high
 - ¼ inch wood dowel is glued to foam board to hold foam board walls up by being placed in peg holes in the pegboard.
- The floor will be pegboard
- The entire track will be 8' by 8'

43 Awards

- 1st Place and 2nd Place trophies for each event will be awarded to individual teams.
 - A school that has entered more than one team in an event could possibly win 1st and 2nd place for that event.
- Points for Grand Champion will be awarded by school.
 - So if a school takes 1st and 2nd place, they will only be awarded 10 points for winning 1st.
 - The school that won 3rd place in the event will earn 8 points since they are the second school to place in the event.
 - Each event will award points to the school as follows:
 - 1st Place - 10 points
 - 2nd Place - 8 points
 - 3rd Place - 6 points
 - 4th Place - 4 points
 - 5th Place - 2 points
 - One event will be scored on the odd scale as follows:
 - 1st Place - 11 points
 - 2nd Place - 9 points
 - 3rd Place - 7 points
 - 4th Place - 5 points
 - 5th Place - 3 points
- On the day of the competition an event will be drawn from a hat at random.
 - This event will be the one scored on the odd scale.
 - The odd scale is to try and prevent a tie between schools for the overall Grand Champion School.

If there is a tie between schools for the Grand Champion then the tie will be broken by following these steps:

1. Highest Single Point Total in Large Swept Away Challenge
 - a. If still a tie between schools then add step 2
2. Fastest Line Follow Time
 - a. If still a tie between schools then add step 3
3. Fastest Maze Time
 - a. If still a tie between schools then add step 4
4. Fastest Forklift Time
 - a. If still a tie between schools then add step 5
5. Most Points awarded in Autonomous
 - a. If for some unlikely reason there is still a tie between schools at this point, then NO grand champion will be awarded.

If you have any questions or comments please contact Robert Lofthouse:

Robert Lofthouse

Associate Professor/Chair, Engineering Science/Physics

SUNY Broome Community College

lofthouserw@sunybroome.edu

Office: (607)778-5214

FAX: (607)778-5334

Cell/Text: (607)592-1338

44 Robotic Competition Committee Members

Name	School	Email	Work Phone	Cell Phone
Ethan Leet	Whitney Point	eleet@wpcsd.org		607-624-2279
Diana Simpson	Seton Catholic Central	dsimpson@syrdiocese.org	607-723-5307 ext 156	607-743-9528
Robert Lofthouse	SUNY Broome	lofthouserw@sunybroome.edu	607-778-5214	607-592-1338
Susan B. Schwing	SUNY Broome	schwings@sunybroome.edu	607-778-5365	
Sean Keenan	Maine-Endwell High School	skeenan@me.stier.org	607-748-8070 x 2004	
Brian Tolan	Broome Tioga BOCES	btolan@btboces.org	607-763-3341	607-206-4968
Ron Oakley	Broome Tioga BOCES	roakley@btboces.org	607-763-3341	