Unified Robotics

Updated Nov 7, 2024



2024 SEASON

Wacky Robot Races Game Rules

Inspired by the 1968 Hanna-Barbera Productions series Wacky Races

Competing for the title of the world's Wackiest Robot Racer!

Working in your teams, design your livery, put on your racing suits, and build a Wacky Racer with your LEGO® robotics kit! Your Racer will drive three laps around the playing field, fighting to reach the finish line before your opponent. To help you finish first, maybe you will apply some Wacky tricks to slow down your opponents!

A Special Thank You to Project Bucephalus

Unified Robotics partnered with Project Bucephalus to deliver Wacky Robot Races as the game for the 2024 season. Wacky Robot Races was developed by Project Bucephalus as part of their Introduction to Robotics after-school camps and programs, including programs for special education units. The game rules were modified from its original for the purposes of this season's game.

Team 5985 Project Bucephalus is a *FIRST*® Robotics Competition team based in Wollongong, NSW, Australia. You can learn more about the team and their outreach programs by visiting projectb.net.au.

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GAME PHILOSOPHY

The primary goal is for participants to be engaged, challenged, and to have fun.

While we want to create an even and equitable playing field and experience, we need to understand that many of the students have varying levels of intellectual, physical and social disabilities. As such, we need to be flexible and accommodating with the rules. When in doubt, err on the side of accommodation and grace.

GAME GOALS

1. Design a your own “Wacky” Racing Car that can drive laps of the playing FIELD—and maybe even apply some “dastardly” tricks to slow down your opponents!
2. Program your RACER to race exactly three laps of the course in the fastest time possible, while finishing before the race limit of 2 minutes. Participants should work together to start the race, and signal for pit stops when needed.

GAME DEFINITIONS

Terms that follow the following definitions will be denoted with ALL CAPS throughout this Game Rules manual.

COMPLETE LAP When a RACER has completed one (1) counterclockwise revolution of the track.

DEACTIVATE To terminate a RACER'S program so that the RACER is not moving for the remainder of a match.

FIELD *See Section 2.2 "Play Areas"*

FINISH ZONE *See Section 2.2 "Play Areas"*

HINDER To negatively affect a RACER'S performance to the extent of jeopardizing chances of scoring points.

INTERFERE To briefly affect a RACER'S performance to gain a small advantage.

LAP CONTAINERS *See Section 2.2 "Play Areas"*

LAP COUNTER A standard 2×2 LEGO brick of any color.

PAYLOAD Material dropped on the track to potentially INTERFERE other RACERS.

PLAYER ZONE *See Section 2.2 "Play Areas"*

RACE MODE *See Section 1.3 "Robot Programming"*

RACER Your robot and anything combined with it.

RESCUE An action where a Team requests the referee to appropriately correct a RACER in the FIELD during a match if the RACER is incapacitated.

RESCUE TOKEN An indicator that represents one (1) RESCUE during a match. A RESCUE TOKEN can be a standard 2×2 LEGO brick of any color but is not required to have a physical representation during a match.

START MODE *See Section 1.3 "Robot Programming"*

STARTING LINE *See Section 2.2 "Play Areas"*

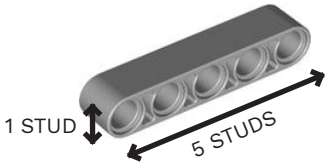
STUD A unit of measurement for LEGO pieces, determined by the bumps or holes on the piece.

WEAPONRY A tool used to potentially INTERFERE other RACERS.

A LEGO STUD

A STUD is the distance from the center of one hole/bump to the center of the next hole/bump on a LEGO piece. It is equivalent to 4.8mm or 0.19in.

For example, a 5×1 beam is 5 STUDS long and 1 STUD wide.



1 Robot Rules

The following robot rules are in place to offer a fun and fair competition among all teams, and attempt to best create equity among teams with different numbers of members, budgets, etc. At the competition, robots will be visually inspected to meet the basic motor and size restrictions. Our goal is to make sure all teams can play, with fairness in mind.

1.1 ROBOT MATERIALS

Teams are allowed to create robots using LEGO parts, as long as the robot meets all other listed rules:

R1. All robots must be built completely out of official LEGO pieces.

R2. Each robot is limited to the electronic components found in a single LEGO robotics kit:

- SPIKE™ Prime kit: one (1) Hub, one (1) Color Sensor, one (1) Force Sensor, one (1) Distance Sensor, one (1) Large Motor, and two (2) Medium Motors
- MINDSTORMS™ EV3 Core Set: one (1) MINDSTORMS brick, one (1) Color Sensor, one (1) Touch Sensor, one (1) Ultrasonic Sensor, one (1) Gyro Sensor, two (2) Large Motors, and one (1) Medium Motor. **The EV3 Infrared sensor is not allowed.**

R3. Teams are encouraged to design creatively and make the robot their own. All decorations and modifications must adhere to Section 1.2 “Robot Design” Rules.

R4. Pull back motors or pneumatics are not allowed.

R5. Robots can only have up to three motors, regardless of whether they are powered or not.

Allowed Distance Sensors

SPIKE Prime Distance Sensor

MINDSTORMS EV3 Ultrasonic Sensor

The MINDSTORMS EV3 Infrared Sensor is not allowed.

1.2 ROBOT DESIGN

D1. Design and build a robot RACER to play Wacky Robot Races. A RACER should reflect the creativity of the designers and should have a specific name.

D2. In its starting position, the RACER must fit completely within the boundaries of a standard SPIKE Prime or MINDSTORMS EV3 crate lid (24 x 34.5 cm). RACERS must be at least ten (10) STUDS tall.

D3. During a race, no RACER can ever extend more than ten (10) STUDS from its starting configuration.

D4. In the Spirit of “Wacky Robot Races,” RACERS are allowed to “cheat.” This process can involve building a WEAPON of some kind. See Section 6 “Driving Wacky” before you build a WEAPON!

D5. RACER WEAPONRY may include dropping a PAYLOAD (or multiple PAYLOADS) designed to INTERFERE other RACERS. Total PAYLOADS must consist of no more than 10 LEGO pieces, and each individual PAYLOAD can be no more than 5 STUDS across in any dimension.

D6. RACERS should include defenses against opponent WEAPONRY.

D7. With the exception of WEAPONRY, RACERS must stay intact the entire game and cannot leave parts of themselves behind.

D8. The screen on the Brick/Hub must be visible.

D9. Buttons on the Brick/Hub must be accessible.

1.3 ROBOT PROGRAMMING

Robots can be programmed in any language and must include the following functions:

P1. START MODE

- P1.1. The RACER’S program is active but waiting for user input to start movement.
- P1.2. Display image on screen to indicate waiting status to the referee.
- P1.3. Upon activating the program to enter RACE MODE, a three (3) second countdown must be initiated.

P2. RACE MODE

- P2.1. The RACER is actively racing around the FIELD.
- P2.2. Display image on screen to indicate status to the referee.

P3. Signals

- P3.1. To indicate the RACER’S status, use either the center light on an EV3 Brick or the Status Light on a SPIKE Prime Hub.
- P3.2. Use Green for START MODE and Red for RACE MODE.

If you choose to use the SPIKE Prime or EV3 Classroom Apps, you can use Icon Blocks, Word Blocks, or Python to program their RACER.

However, Icon Blocks may be limiting to teams in order to program for the requirements for Wacky Robot Races.

2 Field Rules

2.1 FIELD CONSTRUCTION

The Wacky Robot Races FIELD is constructed as follows:

F1. The game is played on a DARK-colored, low-pile carpeted surface.

F2. The Lines are made of WHITE cloth tape (such as Duct or Gaffer's tape) approximately 50mm or 1.88in wide.

F3. All Walls are pieces of timber (see dimensions in diagram). The center dividing wall is stabilized with two (2) brackets screwed to the timber and then taped to the ground.

F4. A plastic cup/container (the LAP CONTAINER) is to be placed outside the FIELD on the “short” side of the track against each RACER’S start position.

F5. A flag should be placed on each side of the PLAYER ZONE for Teams to indicate that they would like a RESCUE.

F6. Optionally, three (3) RESCUE TOKENS may be included to each side of the PLAYER ZONE to indicate the number of RESCUES teams may perform per match.

F7. FIELD dimensions are as outlined on the next page.
Note: *Volunteers will do their best, but some variance is expected and accepted between individual fields.*

Choosing Timber/Lumber

Due to different standards for dimensions, we advise using the following to build the frame and dividing wall:

For regions located in the United States and Canada:

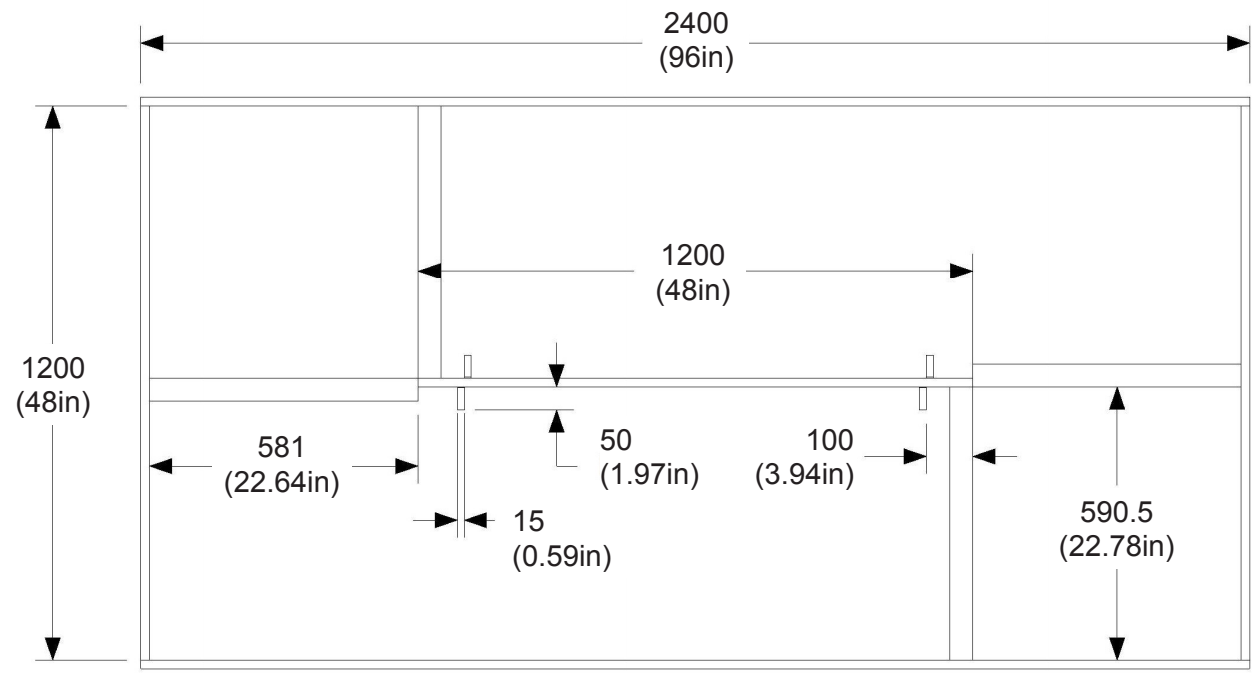
- Use 1in wide x 3in high x 96in long lumber for the long edges of the frame.
- Use 1in wide x 3in high x 48in long lumber for the short edges of the frame and dividing wall.

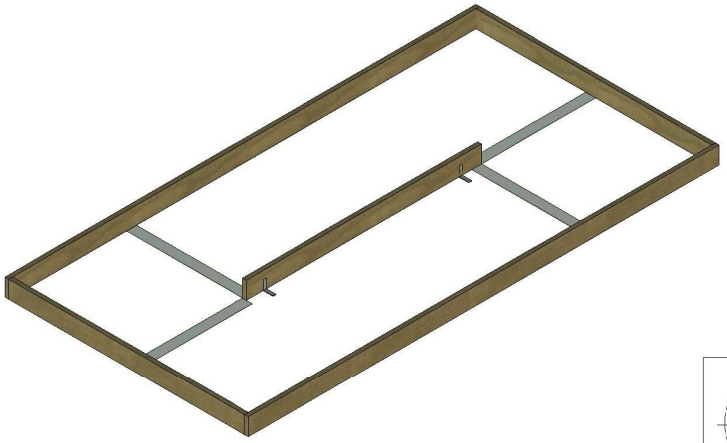
For all other regions, use the dimensions as instructed in the drawing.

Choosing Carpets

To ensure consistency during tournaments, regions that require purchasing carpet for the FIELD should use the following:

- Ensure that it is a Loop carpet with a low Pile Height (0in to 0.3in)
- Material is polypropylene or olefin
- Color should be a solid charcoal color or black





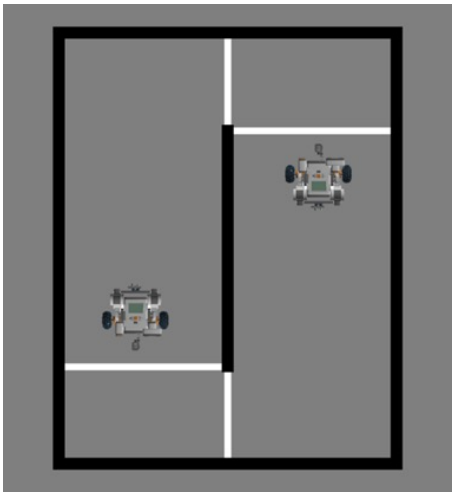
ALL WALLS 19mm THICK x 88mm HIGH
IN THE U.S. AND CANADA, ALL WALLS 1in THICK x 3in HIGH
ALL TAPE 50mm (1.88in) WIDE

FIELD HAS 180° ROTATIONAL SYMMETRY

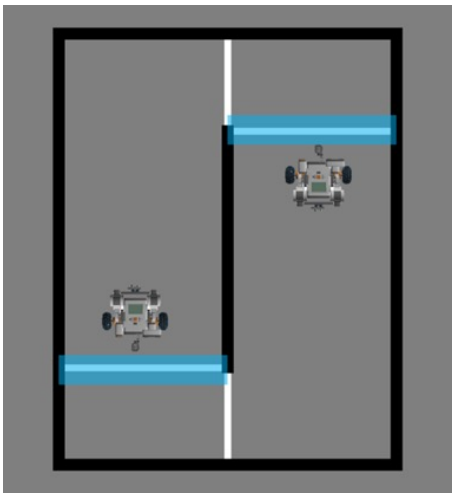
	I.CLARK	16/09/2024	UR Wacky Robot Races Field
	UNITS: mm / in	1:25, 1:15	***Project Bucephalus***

2.2 PLAY AREAS

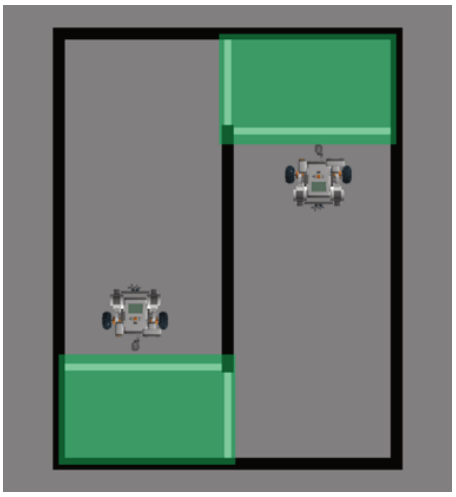
F8. The **FIELD** is a rectangular race track, surrounded by walls and with a central dividing wall. White tape marks off starting areas. Each RACER travels counterclockwise around their play area.



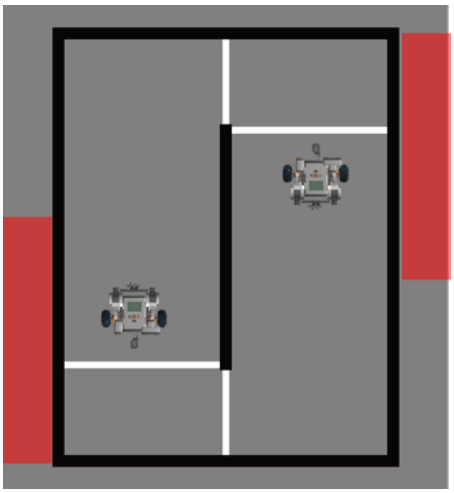
F9. The **STARTING LINE** is the White Tape line on the “long” side of the track. All RACERS must start behind these lines.



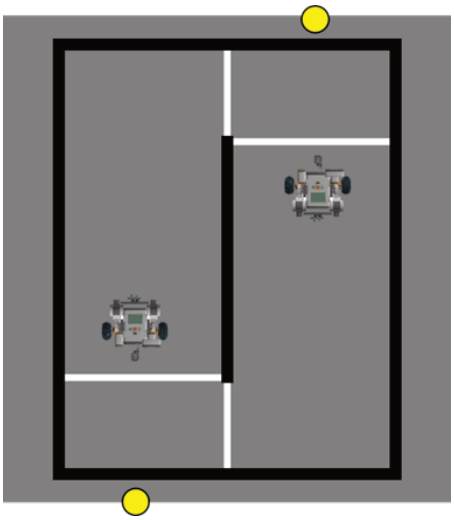
F10. The **FINISH ZONE** is the area bounded by the white tape and the outside walls. RACERS have a goal of finishing in this Zone on the third (3rd) lap.



F11. The **PLAYER ZONE** is the area indicated in red. Players should not leave this area during a Match.



F12. The **LAP CONTAINERS** are storage containers in which LAP COUNTERS are placed each time a RACER completes a lap of the track. It can be moved to other places as required.



3 Match Setup and Start

S1. Wacky Robot Races is played by teams consisting of at least two (2) members with a single RACER.

S2. Each Wacky Robot Races match consists of two (2) teams with RACERS competing on the same track.

S3. Teams are given about one (1) minute after being called to the FIELD to arrive and begin setting up their RACERS. If a team does not report to the FIELD within a reasonable amount of time, they forfeit the match.

S4. Teams are given sufficient time to select the program to run and get their RACERS into START MODE (See Rule P1).

S5. Before each match, RACERS are preloaded with any PAYLOAD and placed in front of their Start Lines, facing counterclockwise and having their programs activated, waiting for start signal.

S6. The FIELD should be clear of any debris or unintended objects or markings. Students and spectators should be outside the FIELD perimeter to not obstruct the RACER sensors.

S7. The teams indicate readiness to start the match by giving the Referee a thumbs-up signal.

S8. The Referee starts the match by counting down “3-2-1-GO!” When the Referee says “GO,” teams start their RACERS. Teams stay near their start area during the Race.

4 Game Rules

G0. It is not unusual for a student to have difficulty setting up, starting, or interacting with their RACER. The Referee may need to assist If the team member is having a difficult time interacting with their RACER.

G1. Each game lasts no more than two (2) minutes.

G2. Laps are scored counterclockwise.

G3. Scoring is determined by the position of powered wheels.

G4. Scoring is based on three (3) laps of the track.

G5. RACERS will be stopped by Referees if they travel more than one line past their designated FINISH ZONE.

G6. Teams start each race with three (3) RESCUE TOKENS.

G7. Referees will perform a RESCUE only if a Team requests one. Teams can signal referees to RESCUE their robot by waving flags.

G8. RACERS can be RESCUED for any valid reason, including:

a. If the robot is incapacitated, stuck, or leaves the Track.

b. If the robot is unable to make any forward progress.

G9. The referee uses best judgment on how to RESCUE a RACER. Typically, the RACER is lifted from the Track, turned such that the robot is inline with the direction of that section of the track and then placed down again once the Track is clear. Programs should not be stopped or restarted.

G10. A team loses a RESCUE TOKEN each time the referee RESCUES their RACER.

G11. Teams without RESCUE TOKENS can no longer be RESCUED.

G12. The referee may choose to DEACTIVATE the RACER:

a. If a Team exhausts all RESCUE TOKENS and the RACER is unintentionally HINDERING the opponent RACER.

b. If the RACER is egregiously HINDERING the opponent RACER.

G13. RACERS can carry PAYLOADS or use other WEAPONS to INTERFERE with other RACERS. See “Driving Wacky” for specific guidance.

G14. PAYLOADS or WEAPONS cannot be reset, reloaded, or otherwise interfered with during a Race.

G15. Any parts leaving the Track are collected by designated volunteers and kept until the end of the game.

Special Note for G9

A RACER cannot be RESCUED just because it has turned at the wrong time and will eventually correct itself—if it is clear the RACER will not recover, a RESCUE is allowed.

Special Note for G12

Referees will use their best judgment to decide if a RACER is HINDERING its opponent. Generally, a Deactivation is warranted if:

a. The RACER is clearly jeopardizing the chances for the opponent to gain any points during the remainder of the match, and

b. Terminating the Racer’s program will relieve any disadvantage.

G16. Players cannot enter the Track for any reason.

G17. RACERS earn points for achieving a COMPLETE LAP of the FIELD. Each time a RACER passes its Start/Finish Line, the referee adds a LAP COUNTER to the collection cup. Points are given for each Counter received at the end of the Race.

G18. RACERS earn two (2) points for stopping in their FINISH ZONE on their third lap as long as some part of the RACER is in the FINISH ZONE.

G19. RACERS earn points for any unused RESCUE TOKENS (maximum 3) at the end of the match.

G20. Points are tallied at the end of the game when two (2) minutes have passed or when all RACERS are DEACTIVATED. The team with the highest score wins the match, even if the RACER has been DEACTIVATED.

G21. The following information will be recorded by a scorekeeper to determine Team ranking and can be used as tiebreakers as needed at the end of qualification play:

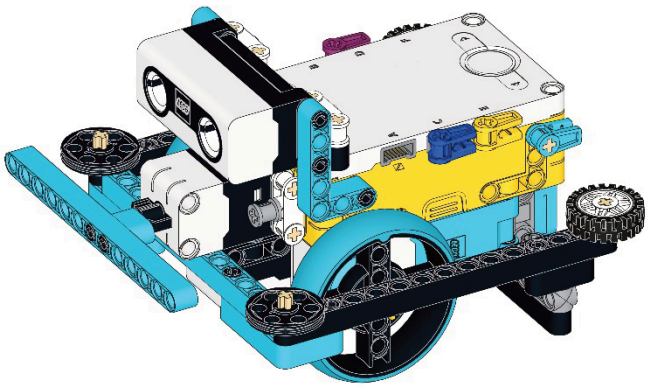
- Whether the RACER reasonably resembles a racing car.
- Number of LAP COUNTERS
- Number of Finishes
- Number of Finishing First
- Number of unused RESCUE TOKENS
- Whether the RACER has been DEACTIVATED

4.1 SCORING TABLE

All points listed below are cumulative.

Task	Points	Description
Lap	1	Awarded for each LAP COUNTER in the LAP CONTAINER at the end of the match
Finish	2	Awarded if the RACER Finishes on the third (3rd) lap
Win	1	Awarded if the RACER Finishes before the other RACER
Skill	1	Awarded for each unused RESCUE TOKEN
Wacky	3	Awarded if the RACER resembles a race car—Wacky or otherwise (at the referee's discretion)

5 Example of a Racer



5.1 RECOMMENDED RACER FEATURES

Driving: Your RACER will need to travel along a straight track. How will you achieve this?

- Normal Driving: Build your robot to travel in as close to a straight line as possible?
- Wall Runners: Use the Walls to straighten you up?
- Sensors: Use The Gyro Sensor to keep track of your direction? Use the Distance Sensor to watch a wall?
- Combination: All of the above?

Navigating: Your RACER will need to know when to turn. How will you achieve this?

- Dead Reckoning: Turn after a preset number rotations?
- Sensor/Run into Wall: Use a Force Sensor to detect a Wall Hit?
- Sensor/See Wall: Use Distance Sensor to see the Wall?
- Sensor/See Divider: Use a Distance Sensor to see the central Divider?

Counting Laps: Your RACER will need to know when to finish the Race. How will you achieve this?

- Code: Hardcode entire race?
- Code: Loop through Drive/Turn tasks?
- Sensor/Wall: Use Force Sensor detect and count Wall hits?
- Sensor/Lines: Use the Color Sensor to detect and count lines?

5.2 RECOMMENDED CONFIGURATION

- Use a Color Sensor to count lines
- Use a Force Sensor to touch RACERS or Walls to know when to turn
- Use a Distance Sensor to see RACERS or Walls and slow down (but not stop) if they get too close
- Use Wall Runners to straighten up on walls

5.3 TIPS

- Make your charging port accessible!
- Make sure your Racer’s Screen and Buttons are accessible!
- Make your RACER balanced and stable.
- Don’t forget to defend from WEAPONRY!
- Test the RACER Drive and Turn performance at different speeds.
- Test reaction time and obstacle detection.
- Make sure your RACER is tested on a carpet surface.

6 Driving Wacky

In “Wacky Robot Races,” trying to get an edge on your opponents is not only allowed—it’s encouraged! However, there are some very important things to consider first.

Hitting, flipping, or ramming another RACER is bad (for you)

This isn’t Sumo Bots—you win by finishing the race. If you hit another RACER, you will get tangled up or knocked off-course yourself. No one finishes first.

If you successfully knock over or flip another RACER, then it just becomes an obstacle that prevents you from winning. No one finishes first.

If you see a RACER in front of you, you’re winning!

RACERS start on opposite sides of the track. If you catch up to the other RACER, you’re in the lead! You don’t need to overtake. Slow down and keep driving.

Trigger a wrong turn?

If you can trigger another robot to make an “false” turn, you can gain a few seconds, and the other robot should be able to recover.

Dropping PAYLOADS?

It can be very effective to drop something to jam another RACER’S wheels or trigger a false turn. **However, if you drop it too early, it will affect your RACER as well.**

It is a smart move to protect your robot from your own PAYLOADS—or anything dropped by other RACERS.

7 Tournament Rules

The tournament is played in two parts. Part one is the Qualification rounds. These are random matches among all the RACERS (or all the RACERS in a given Division). Part two is the Elimination Rounds. This uses a bracket-based, winner-advances model for the matches, until one Team remains, and is the tournament champion!

7.1 QUALIFYING ROUNDS

Depending on the total numbers of Teams in the event, Divisions may be used to ensure all Teams have the most matches possible, in a reasonable amount of time. Here are some examples of tournament structure depending on the number of Teams participating:

Total Number of Teams	Number of Divisions	Number of Teams per Division	Number of Matches a Team will Play	Number of Teams Advancing
7-12	1	7-12	6-11	4 or 8
14-22	2 or 3	7-11	6-10	4 or 5 (plus wildcard)
24-36	3 or 4	8-12	7-11	4 or 5 (plus wildcard)

A match schedule will be created that randomly assigns Teams to play one another. Each Team will play against each other Team (or each other Team in their Division) at least once. Depending on the event timing, the schedule may be repeated for more matches. Teams will earn Tournament Ranking Points—three (3) for a win, two (2) for a tie, one (1) for a loss—for each match played.

7.2 RANKING TEAMS AND TIEBREAKERS

After the qualifying rounds, Teams will be ranked based on their Tournament Ranking Points and any necessary tiebreakers. For events with multiple Divisions, each Division will be ranked individually.

If teams have the same number of Tournament Ranking Points, the following tie-breaker rules will determine the other. (This is true if two or more teams have the same number of Tournament Ranking Points.)

1. The first tiebreaker compares the cumulative point total during all their matches. The team with the higher number of points obtained will be ranked higher.

2. The second tiebreaker compares the number of times each team has Finished First during all their matches. The team with the higher count will be ranked higher.

3. The third tiebreaker compares the cumulative number of unused RESCUE TOKENS during all their matches. The team with the higher number of unused RESCUE TOKENS will be ranked higher.

4. The final tiebreaker is a coin flip, witnessed by members of both teams. The Head Referee will assign heads to one team, tails to the other, and flip a coin. The team that matches the visible coin face will be ranked higher.

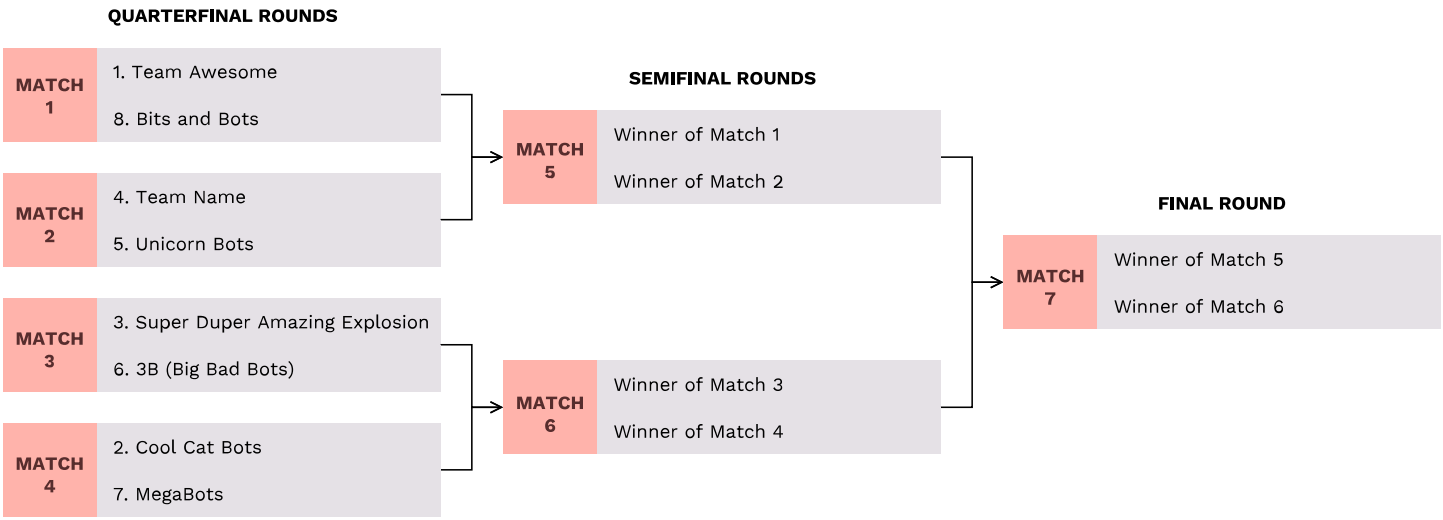
After ranking, a number of Teams (or Teams from each Division) will be placed into a bracket for the Elimination Rounds. The number of advancing Teams must be a multiple of 2 (4, 8, 16, or 32) for a complete bracket.

7.3 BUILDING THE BRACKET

The Eliminations bracket is built in such a manner that the highest ranked teams play the lowest ranked teams in the first level of the bracket. For events with multiple Divisions, the bracket should be built such that teams compete against teams from other Divisions.

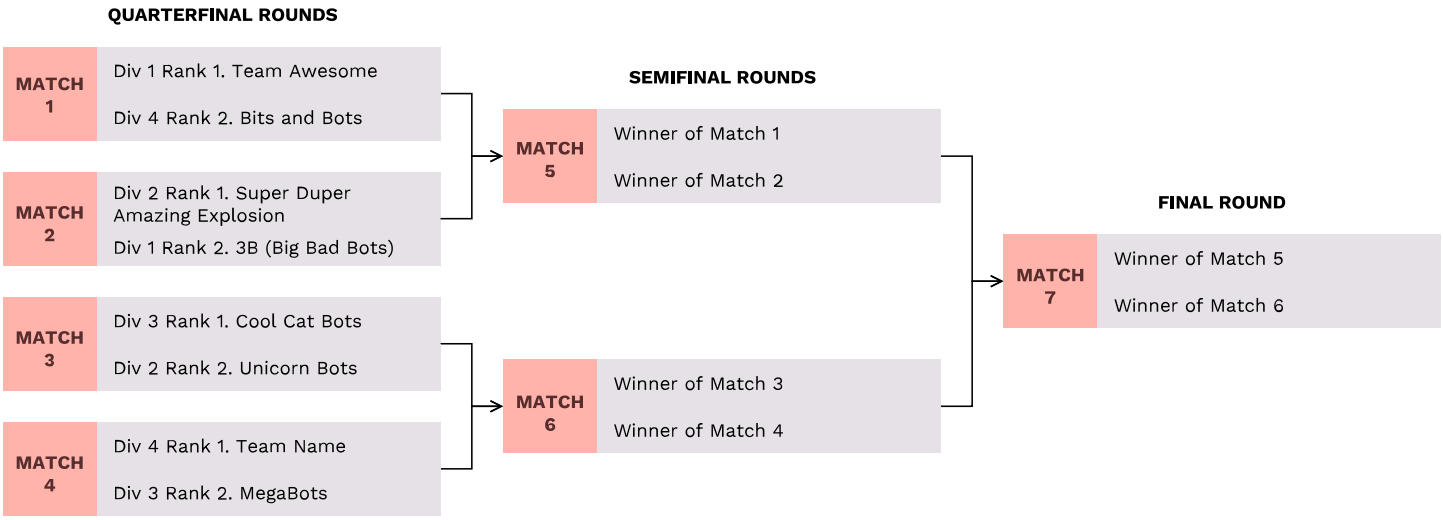
SINGLE DIVISION EXAMPLE

Ranking	
1. Team Awesome	5. Unicorn Bots
2. Cool Cat Bots	6. 3B (Big Bad Bots)
3. Super Duper Amazing Explosion	7. MegaBots
4. Team Name	8. Bits and Bots



MULTI-DIVISION EXAMPLE

Ranking			
1. Team Awesome	1. Super Duper Amazing Explosion	1. Cool Cat Bots	1. Team Name
2. 3B (Big Bad Bots)	2. Unicorn Bots	2. MegaBots	2. Bits and Bots
3. Purple Mayhem	3. Frank and Frank	3. Gear Robotics	3. Schoolyard Bots



7.4 PLAYOFF ROUNDS

Playoff rounds are played where Teams need to win two (2) out of three (3) plays, and the winner will advance to the next round. All rounds at the same level in the bracket are played before continuing onto the next level. (e.g. all quarterfinal matches are complete before starting semifinals.) The bracket will conclude with a finals match between the last two Teams, and the winner of this will be the Tournament Champions!