



**Please pay attention to the updates of this rule on the website.*

**If you have any question, please feel free to contact Chao Zhang (chao515@126.com)*

Abstract

Two robots compete in a head-to-head match following the basic system of traditional human sumo matches. The sole purpose is a pushing match between the two robots to force the other from the arena.

[CH-1]: Definition of the competition

In accordance with the game rules, two robots from two teams will fight in a match on a Dohyo (sumo ring) in two different classes, **Lightweight** ($M_{\text{robot}} \leq 1\text{Kg}$) and **Heavyweight** classes ($1\text{Kg} < M_{\text{robot}} \leq 3\text{Kg}$). Every robot must be constructed by team members on-site following the specifications in Section [CH-2]. Each team consists of 1-4 participants.

[CH-2]: Requirements for Robots

[CH-2-1]: General Robot Specifications

[CH-2-1-1]: The following are specifications for all robots. The limits of LEGO and Non-LEGO robots are different in Lightweight Class, but robots compete in the same division.

Class	Robot	Height	Width	Length	Weight
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Lightweight U14, U19	LEGO	Unlimited	15cm	15cm	$M \leq 1,000g$
	Non-LEGO	Unlimited	15cm	15cm	$M \leq 500g$

Heavyweight U19	Any Robot	Unlimited	20cm	20cm	$1,000\text{g} < M \leq 3,000\text{g}$
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All robots include in Lightweight and Heavyweight class must be built on-site.

[CH-2-1-2]: Each robot must fit within a square tube of the specified dimensions for the given class.

[CH-2-1-3]: At the start of each match, the total mass of a robot must be under the specified weight for the given class.

[CH-2-1-4]: A robot may unfold itself after a match begins, but must not physically separate into pieces, and must remain a single centralized robot. Robots violating these restrictions will lose the match. Screws, nuts, and other robot parts with a total mass of less than 5 g falling off from a robot's body will not cause the loss of the match.

[CH-2-1-5]: Robots must be autonomous.

[CH-2-1-6]: After the draw session of the leader meeting, each robot gets a draw number for registration. The draw number must be visible on the robot, so spectators and officials can identify the robot. Robots without the draw number will not pass inspections.

[CH-2-2]: Requirements for LEGO robots: the robot must only be built out of LEGO® electronic parts, including controllers, motors, and sensors.

[CH-2-3]: Restrictions for all robots

[CH-2-3-1]: Jamming devices are not allowed, such as IR LEDs that saturate the opponent's IR sensors.

[CH-2-3-2]: Parts that can break or damage the Dohyo are not allowed. Do not use parts that are intended to damage the opponent's robot or its operator. Normal pushes and bangs are not considered intent to damage.

[CH-2-3-3]: Storing liquid, powder, gas, or other substances is allowed, but purposely throwing such substances is not allowed.

[CH-2-3-4]: Flaming devices are not allowed.

[CH-2-3-5]: Devices that throw things at the opponent are not allowed.

[CH-2-3-6]: Sticky substances to improve traction are not allowed. Tires and other components of the robot in contact with the ring must not be able to pick up and hold a standard A4 paper (80 g/m²) for more than two seconds.

[CH-2-3-7]: Devices to increase downforces, such as vacuum pumps and magnets are not allowed.

[CH-2-3-8]: All edges, including but not limited to the front scoop, must not be sharp enough to








scratch or damage the Dohyo, other robots, or players. Judges and competition officials may require edges that they deem too sharp to be covered with a piece of tape.







[CH-2-3-9]: In the Lightweight class, all non-electric parts must be non-metallic (for example, bolts, nuts, motor brackets, structural boards, and shovels). Electric parts include motors, sensors, batteries, and etc.

[CH-2-3-10]: In the Lightweight class, the input voltage of Non-LEGO robots should not exceed DC 9V and the total power should not exceed 5W with all motors running without load. In the Heavyweight class, the input voltage should not exceed DC 14.8V and there is no power limit.

[CH-2-3-11]: In the Lightweight class, teams are only allowed to use one pack of battery.

[CH-2-3-12]: **In the Lightweight class, a regulated power supply will be used for testing on-site. Each team must prepare a battery cable for the test: one end is a plug to the robot (same as the battery), and the other end is the normal wire terminals. The following are examples of the test.**

Cable / Connector on the Robot (Sample)	Your Battery (Sample)	<u>You Need to Prepare</u>	Power Test Equipment
			
			

			
			
The Cable you prepared for the test can not be shorter than 20 cm.			

[CH-2-3-13]: Teams must notify the referee whenever they modify the robot after passing the inspection.

[CH-3]: Competition field (Dohyo)

[CH-3-1]: Dohyo Interior

The Dohyo interior is defined as the circular playing surface surrounded by a white borderline (the borderline is part of the Dohyo interior). Anywhere outside this area is called the Dohyo exterior.

[CH-3-2]: Dohyo Specifications

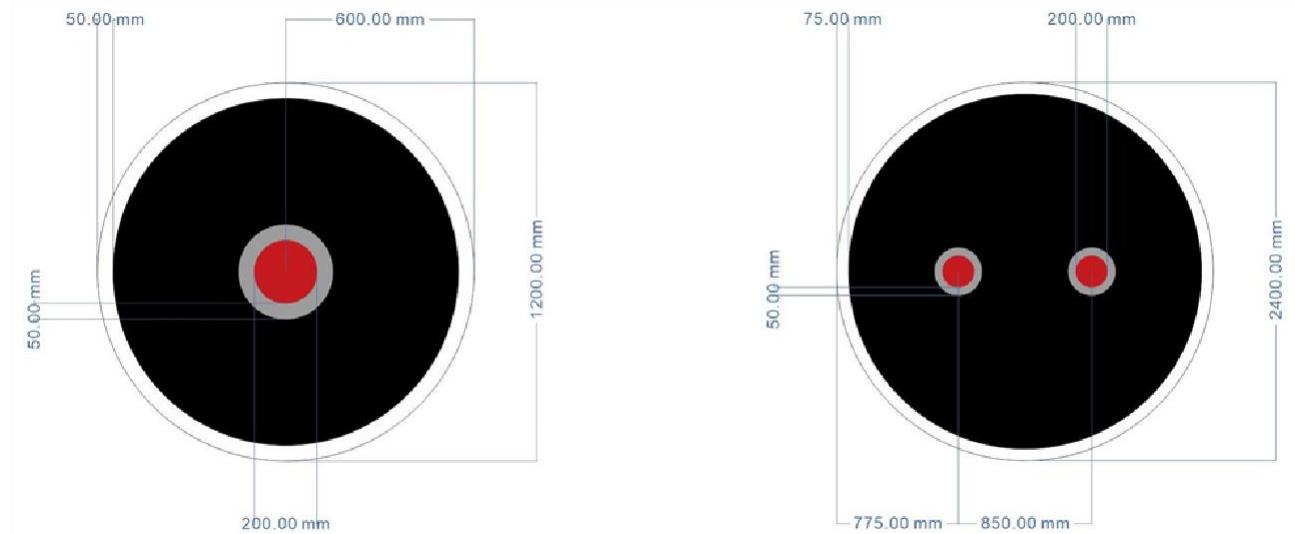
[CH-3-2-1]: The field is circular with the specified dimensions for the given class.

[CH-3-2-2]: The borderline is marked as a white circular ring of an appropriate width for each given class on the outer edge of the playing surface. All areas extending up to the outside of this circular line is considered as the field area.

[CH-3-2-3]: For all given Dohyo dimensions, a tolerance of 5% applies.

Game	Diameter	Border Width	Material	Minimal Dohyo Exterior	Obstacle
Individual	120cm	5cm	Wooden	100cm	One

United	240cm	7.5cm	Wooden	100cm	Two
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*Individual Game**United Game*

[CH-3-3]: Color

Color	C	M	Y	K
White	0	0	0	0
Black	100	100	100	100
Gray	0	0	0	50
Red	Obstacle Position			

[CH-3-4]: The obstacle

The obstacle is a cylinder fixed at the center of the Dohyo; it has a diameter of 20 cm and a height of 20 cm made of metal and colored by reflective silver. A gray ring with a width of 5 cm is painted around the obstacle.

[CH-3-5]: Dohyo Exterior

There will be a space of appropriate size for each given class outside the outer edge of the ring. This space can be of any color and can be made of any material or shape as long as the basic concepts of these rules are not violated. This area with the ring in the middle is called the "ring area". Any markings or parts outside of the central ring is also considered as part of the ring area.

[CH-4]: Mission Competition

[CH-4-1]: There will be 3-6 tasks in the mission part, each with a score of 10-20 points. All tasks will have a total score of 55 points.

[CH-4-2]: Task examples

[CH-4-2-1]: The robot starts in a random location and a random direction. Then the robot will be asked to do the following actions: Turn to an obstacle (5 points) - Go forward to a gray area (3 points) – Stop (2 points).

[CH-4-2-2]: The robot starts on the white border and faces the obstacle. There will be a bottle in the black area. Then the robot will be asked to do the following actions: Seek the bottle and stop in front of the bottle for 2 seconds (5 points) – push the bottle outside the field (5 points) – stop without touching the space outside the ring (5 points).

[CH-4-3]: Each task is given at least one hour of practice time.

[CH-4-4]: Each task allows two attempts. The better score will be the final score of the task.

[CH-4-5]: The score of the mission competition is the sum of all tasks.

[CH-5]: Individual Competition

[CH-5-1]: One match will consist of 3 rounds, within a total time of 3 minutes, unless intentionally extended by judges.

[CH-5-2]: The team who wins two rounds or receives two "Yuhkoh" points first, within the time limit, wins the match. A team receives a "Yuhkoh" point when it wins a round. If the time limit is reached before any team gets two "Yuhkoh" points, and one of the teams has received one Yuhkoh point, the team with one Yuhkoh point wins.

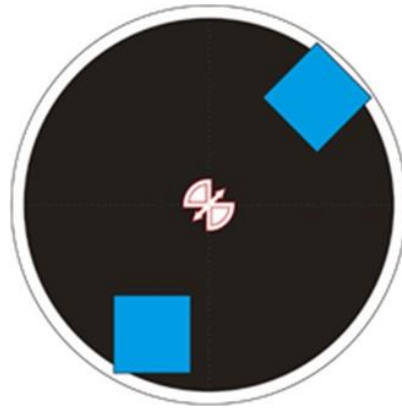
[CH-5-3]: If neither team wins within the time limit, an extended match may be fought. During the extended match, the team who receives the first Yuhkoh point will win. Alternatively, the winner/loser of the match may be decided by judges, by means of lots, or by a rematch.

[CH-5-4]: One Yuhkoh point will be given to the winner when the judges' decision is called for or lots are employed.

[CH-5-5]: Competition preparation (robot placing):

Upon the judge's instructions, the two teams approach the ring to place their robots on the ring. A cross in the middle divides the sumo ring into 4 quadrants. Robots always must be placed in 2 opposing quadrants directed by the arrows of the cross. The robots may be placed at any place

within the assigned quadrant and must touch the outer white circle. The judge will remove the cross after the robots are positioned. After positioned, the robots are not allowed to be moved by any means.



Sample of Robot Placing

[CH-5-6]: Start: The teams start their robots when the judge announces the start of the round. After a five-second pause, the robots may start moving. Within five seconds, players must clear out of the Dohyo area.

[CH-5-7]: Stop, Resume: The match stops and resumes when a judge announces so.

[CH-5-8]: End: The match ends when the judge announces so. The two teams retrieve the robots from the ring area.

[CH-5-9]: Time of the Game

[CH-5-9-1]: Duration: One Match will be fought for a total of 3 minutes, starting and ending upon the judge's command.

[CH-5-9-2]: Extension: An extended match, if called for by the judge, should last for a maximum of 3 minutes.

[CH-5-9-3]: Timekeeping: The following instances are not included in the time of the Match:

[CH-5-9-3-1]: The time elapsed after the judge announces Yuhkoh and before the match resumes. The standard delay before the match resumes is 30 seconds.

[CH-5-9-3-2]: The time elapsed after a judge announces to stop the match and before the match resumes.

[CH-5-10]: Rematch: A rematch is called under the following conditions:

[CH-5-10-1]: The robots are entangled or orbiting each other with no observable progress for 5 seconds. If it is unclear whether progress is being made or not, the judge can extend the time limit for observable progress for up to 30 seconds.

[CH-5-10-2]: Both robots move without making progress, or stop (at the exact same time) and stay stopped for 5 seconds without touching each other. However, if one robot stops its movement first, after 5 seconds it will be declared as not having the will to fight. In this case, the opponent should receive a Yuhkoh, even if the opponent also stops. If both robots are moving and it isn't clear if progress is being made or not, the judge can extend the time limit up to 30 seconds.

[CH-5-10-3]: If both robots touch the outside of the ring at about the same time, and it cannot be determined which robot touched first, a rematch is called.

[CH-5-11]: One Yuhkoh point should be given when:

[CH-5-11-1]: A team legally forces the body of the opposing robot to touch the space outside the Dohyo interior (including the side of the playing field).

[CH-5-11-2]: The opposing robot has touched the space outside the Dohyo interior on its own.

[CH-5-11-3]: Either of the above takes place at the same time that the end of the Match is announced.

[CH-5-11-4]: When a wheeled robot has fallen over on the Dohyo interior or in similar conditions, Yuhkoh will not be counted, and the match continues.

[CH-5-12]: When the judges' decision is called to decide the winner, the following points will be taken into considerations:

[CH-5-12-1]: Technical merits in movement and operation of a robot

[CH-5-12-2]: The attitude of the players during the match

[CH-5-13]: The individual competition includes a group round-robin and a knockout round. The specific competition system will be determined by the number of teams.

[CH-5-13-1]: The total score of the group round-robin is 20 points. In the round-robin, every team wins 20 points divided by the number of matches in the group. For example, if there are five teams in the group, each team needs four matches, and each winning match gets $20/4 = 5$ points.

[CH-5-13-2]: The maximum score of the knockout round is 10 points. The teams that win the group round-robin will enter the knockout round. Other unqualified teams automatically score 0 points for the knockout round. Teams entering this stage will score according to their ranking and number of total teams who enter this section.

	Team numbers			
	2 Teams	4 Teams	8 Teams	16 Teams

Ranking in Knockout	1ST	10 Points	10 Points	10 Points	10 Points
	2ND	5 Points	6 Points	6 Points	7 Points
	3RD	NA	2 Points	3 Points	4 Points
	4TH	NA	0 Point	1 Point	2 Points
	5~8TH	NA	NA	0 Point	1 Point
	9~16TH	NA	NA	NA	0 Point

[CH-6]: United Competition

[CH-6-1]: United competition is a 3 VS 3 game. Three teams will form a united team to compete with other united teams.

[CH-6-2]: The difference between united and individual competitions is the placement of robots and the winning condition.

[CH-6-3]: Robot placing:

Upon the judge's instructions, the two teams approach the ring to place their robots. A cross in the middle divides the sumo ring into 2 semicircles. Robots always have to be placed in 2 opposing semicircles. The robots may be placed at any place within the assigned semicircle. The judge will remove the cross after the robots are positioned. After positioned, the robots are not allowed to be moved by any means.

[CH-6-4]: One Yuhkoh point should be given when only one team's robots are completely inside the Dohyo interior.

[CH-6-5]: The total score of the united competition is 15 points. Every united team wins 15 points divided by the number of matches. For example, if there are four teams, each team needs three matches, and each winning match gets $15/3 = 5$ points.

[CH-7]: Ranking

[CH-7-1]: The top three certificates will be awarded for the Mission competition, Individual competition, and United competition.

[CH-7-2]: The top three certificates and trophies will be awarded in the All-Round competition.

All-Round score = Mission score + Individual score + United score.

[CH-7-3]: If there is a tie, the rank will be determined in the following order:

All-Round competition: Mission score -> Individual score -> United score.

Mission competition: Individual Ranking.

[CH-8] Violations

[CH-8-1]: Players performing any of the behavior described in Sections 8.2 or 8.3 should be declared in violation of the rules.

[CH-8-2]: Insults:

A player who utters insulting words to the opponent or to the judges or puts voice devices in a robot to utter insulting words or writes insulting words on the body of a robot, or performs any insulting action, is in violation of these rules.

[CH-8-3]: Minor Violations: A minor violation is declared if a player:

[CH-8-3-1]: Enters into the ring during the match, except when the player does so to take the robot out of the ring upon the judge's announcement of Yuhkoh or stopping the match. To enter into the ring means:

[CH-8-3-1-1]: A part of the player's body is in the ring, or

[CH-8-3-1-2]: A player puts any mechanical kits into the ring to support his/her body.

[CH-8-3-2]: Performs the following behaviors:

[CH-8-3-2-1]: Demand to stop the match without appropriate reasons.

[CH-8-3-1-2]: Take more than 30 seconds before resuming the match, unless the judge announces a time extension.

[CH-8-3-1-3]: Start operating the robot within five seconds after the chief judge announces the start of the match.

[CH-8-3-1-4]: Behaviors or sayings that disgraces the fairness of the match.

[CH-9]: Penalties

[CH-9-1]: Players who violate these rules by performing the deeds described in Sections 8.2 will lose the match. The judge will give two Yuhkoh points to the opponent and order the violator to clear out. The violator is not honored under any circumstances.

[CH-9-2]: Each occasion of the violations described in Sections 8.3 will be accumulated. Two of these violations will give one Yuhkoh to the opponent.

[CH-9-3]: The violations described in Article 8.3 accumulate throughout one match.

[CH-10]: Injuries and Accidents during the Match

[CH-10-1]: Request to Stop the Match:

A player can request to stop the game when he/she is injured or his/her robot had an accident. If the judge gives permission, the game can be stopped.

[CH-10-2]: Unable to Continue the Match:

When the game cannot continue due to the player's injury or the robot's accident, the player who is the cause of such injury or accident loses the match. When it is not clear which team is such a cause, the player who cannot continue the game, or who requests to stop the game, should be declared as the loser.

[CH-10-3]: Time Required to Handle Injury/Accident:

Whether the game should continue in case of injury or accident will be decided by the judges and the Committee members. The decision process will take no longer than five minutes.

[CH-10-4]: Yuhkoh Point Given to the Player Who Cannot Continue:

The winner decided based on Section 10.2 should gain two Yuhkoh points. The loser who already gained one Yuhkoh point is recorded as such. When the situation under Section 10.2 takes place during an extended match, the winner will gain one Yuhkoh point.

Good luck and hope to see you in Brazil~~~