Rules & Specifications

Revision 1, 22 January 2015

A. Competition Description

RoboWars is a sumo robot competition. The competition is carried out in a tournament format: competitors bring their robots ready to battle and are pitted against their competitors' robots in one-on-one matches where the aim is to push the opponent's robot off the arena. The robots must be fully autonomous: the only human influence allowed during the battle is press the ON switch!

Prizes consist of monetary awards to the top competitors, as well as a non-monetary prize to the top student team.

This document details all rules governing eligibility, robot design, and competition proceedings.

B. Definitions

B1. "RoboWars" and "Competition" refers to the RoboWars competition.

B2. The "Rules" refers to the present document.

B3. "We", "our", and "us" refers to IEEE Concordia and/or the RoboWars Committee within IEEE Concordia.

B4. "You", "your", and "yourself" refer to an eligible RoboWars entry, consisting of one or more individuals and one robot.

B5. "Competitor" refers to an individual entering the Competition.

B6. "Team" refers to one or more individuals jointly entering a robot to the Competition. To lighten language within these Rules, a Team may consist of only one Competitor.

B7. "Staff" and "Staff Member" refers to any on-site person under our direction during the Competition.

B8. The “Referee” is a Staff member responsible for overseeing competition proceedings, supervising Battles, adjudicating and enforcing rules.

B9. A “Battle” is one combat round between two Robots, further defined below.

B10. A “Match” is a best out of three Battles between the same two Robots.

C. Dates and Deadlines

Important competition dates are listed below. They are referred to by name in the Rules.

C1. Early-Bird Registration Deadline: Sunday, 7 February 2016 at 23:59.

C2. Registration Deadline: Sunday, 21 February 2016 at 23:59.

C3. Competition: Sunday, 6 March 2015, time/location TBD.

D. Eligibility and Registration

D1. Team composition. A team must:

- D1a. Consist of one (1) to five (5) eligible Competitors; and
- D1b. Register and bring exactly one (1) robot to compete in the Competition.

D2. **Eligibility of a Competitor.** To compete, an individual must:

- D2a. Be at least 16 years of age; and
- D2b. Be registered to at most one (1) Team; and
- D2c. Contribute to the design and construction at most one (1) robot.

D3. Prize eligibility.

- D3a. In order to be eligible to win a prize, a Team must consist solely of Competitors who:
  - (i) Are not members of the IEEE Concordia Executive Committee, RoboWars Committee, or otherwise involved in the organization of the Competition, between 1 January 2015 and the Competition Date; and
  - (ii) Are not employees or interns of IEEE or CDS Inc., or an employee of an IEEE or CDS Inc. subsidiary, between 1 January 2015 and the Competition Date; and
  - (iii) Are not an immediate family member (parent, sibling, spouse, domestic partner, child) or householder member of people falling under (i) and/or (ii).
- D3b. Any Team which does not satisfy prize eligibility criteria may compete, but will not be considered for ranking and judging leading to the award of a prize.

D4. Registration

- D4a. Every Team must register prior to the Registration Deadline. This will allow us to prepare the venue and competition brackets, as well as to ensure adequate food and event T-shirts are available.

D4b. Teams must register online. Details are available on the competition page, http://ieee.concordia.ca/portfolio/robowars-2016

D4c. The entry fee must be paid online for registration to be completed.

(i) $10 per team, until the Early Registration Deadline; or

(ii) $20 per team, otherwise.

E. Prizes and Awards

E1. Prizes are awarded to the top three (3) Teams of the single elimination tournament stage:

E1a. First Place: $1000.00 CAD

E1b. Second place: $500.00 CAD

E1c. Third place: $250.00 CAD

E2. In the case that there are less than 6 Teams competing, the rankings will be determined by number of Match wins during the Round Robin stage.

(i) Ties will be resolved with a tie-breaking Match. The winner of the Match will obtain the higher of the two rankings for which a tie occurred.

E3. Monetary prizes shall be awarded in Canadian Dollars, issued via cheque drawn on a Canadian bank. Other arrangements may be considered if needed, at our discretion.

E4. A non-monetary award shall be awarded to the top student team, to be determined later.

E4a. A student team is defined as any Team consisting solely of Competitors who are current undergraduate students (or equivalent).

E4b. The top student team is defined as:

(i) The student team that advanced highest in the single elimination stage; or, in the absence of any such team,

(ii) The team with the most Match wins during the Round-Robin matches. A two-way tie is resolved with a tie-breaking Match; a greater tie is resolved with a single elimination bracket between tied Teams.

E4c. A student team that places within the top 3 is still eligible for this award.

E5. Any prize may be substituted by a prize of equivalent value, at our discretion.

F. The Arena

F1. The arena is a circular ring 5 ft. in diameter made of medium-density fibreboard (MDF), sitting approximately two inches above ground level.

F2. The arena surface is painted gloss black, with a white 2 in. border along its periphery. The black paint is oil-based, and confirms to minor surface blemishes.

F3. The arena surface is generally smooth but may have small irregularities, which may include a line at which point two pieces of the arena join, if the arena is constructed from several pieces.

G. Competition Procedure

G1. Tournament organization

G1a. All Teams are randomly divided into as many pools as needed to ensure a maximum of 6 Teams per pool.

G1b. Each pool plays a Round Robin phase. Match wins are tallied for each Team.

G1c. The two (2) Teams with the most Match wins in each pool will advance to a single-elimination phase. The brackets will be formed by pairing the first place robot of one pool with the second place robot of another pool.

(i) If a tie prevents the selection of exactly two (2) Teams, a tie-breaker Match will occur. This tie-breaker Match only determines which Team advances, and does not award further win points to the winning Team's tally.

(ii) Byes, if necessary, will be assigned at random.

G1d. If there are less than six (6) Teams participating, the competition will consist only of a Round Robin-style tournament. Ranking is determined by each Team's total Match wins.

G2. Battles and Matches

G2a. A Match consists of a best-out-of-three (3)-Battles in which two (2) robots compete against each other.

G2b. A Battle is a single contest between two (2) robots, which ends when one robot prevails or the time limit is reached. This is governed by **Error! Reference source not found.**.

G2c. Each battle has a time limit of three (3) minutes.

G3. Pre-Match Procedure

G3a. At the beginning of a Match, the two competing Teams are announced.

G3b. Both Teams must be present and ready for the first battle within two (2) minutes of the first announcement. A Team's failure to appear within this time frame is considered a loss for that Team. Additional delay may be permitted by the Referee, at their discretion.

G4. Battles

G4a. Before each Battle, the Referee randomly determines the starting location and orientation of each robot.

(i) Position: Each robot may be placed in one of the four quadrants of the arena, at the edge of the arena.

(ii) Orientation: The front, left, back or right of the robot may face the centre of the arena. To accommodate oddly shaped robots, these orientations are defined at 90-degree angles from the front of the robot.

G4b. When both Robots are ready, and a Competitor from each Team is on standby near their robot, the Referee shall signal the start of the Match. The Competitors may then activate the robot (e.g. by physically switching an on-off switch).

G4c. The robots must not move for exactly three (3) seconds after being activated.

G4d. Competitors must move outside the range of the arena (as marked) within the three-second delay.

G4e. A robot will be declared as having Lost the Battle when any of the following conditions occur. **One or both robots can have Lost the Battle in a single Battle.**

(i) A robot moves prior to the initial three-second delay in G4c.

(ii) A robot is out of the Arena. Out of the Arena is defined as a) more than 75% of the robot is past the white border and off the Arena surface, from a top view; or b) any part of the robot has touched the floor outside the Arena. A robot whose body is hanging off the arena, but not meeting either definition, is not considered out of the Arena.

(iii) A robot is disabled. This is defined as a state in which the robot can no longer move or take various actions in the Battle, and has no chance of recovery. This Robot has Lost the Battle.

G4f. The Battle will continue until one of the following occurs.

(i) A Robot has Lost the Battle. In this case, the Battle ends and scoring is determined per G5.

(ii) Both robots are stuck in an entanglement or deadlock. In this case, the Referee may ask the competing Teams whether to end the Battle. If both agree, the Battle is nullified and restarted; if they do not, the Battle continues like normal.

(iii) The three-minute time limit elapses. In this case, the Battle is nullified and restarted.

G4g. At the end of each Battle, the competing Teams are responsible for cleaning the ring and ensuring it is ready for the next Battle to the satisfaction of the Referee.

G4h. All judgements rendered by the Referee regarding whether a robot has Lost the Battle and whether a Battle has ended are final and may not be appealed.

G5. **Scoring of Battles and Matches**

G5a. At the end of each Battle, Battle Points are awarded to each Team per the below. Battle Points are **not** accumulated throughout the tournament, but only accumulated within each Match.

(i) LOSS: If a robot is the **first** to have Lost the Battle, it is awarded zero 0 points.

(ii) WEAK WIN: If both robots have Lost the Battle, the **second** to have Lost is awarded one (1) point.

(iii) CLEAR WIN: If one robot has **not** Lost the Battle, it is awarded three (3) points.

G5b. At the end of a Match, the Battle Points from the three (3) Battles of the Match are tallied for each Team.

(i) The Team with the most Battle Points is declared the winner of the Match.

(ii) If, at the end of the second (2nd) Battle of a Match, one Team is leading by four (4) or more points, then the third (3rd) Battle may be skipped at the Referee's discretion.

H. Robot Specifications

You must build and bring one pre-constructed, fully autonomous robot whose purpose is to push, throw, flip, drag or otherwise move your opponent out of a five-foot diameter circuit ring within three minutes. The following section details all rules and specifications regarding this robot; please be sure to read them carefully and refer to them as you design your robot.

H1. **Definition of a robot:** Robots must meet a minimal definition of 'robot': they must have some mechanism of autonomous locomotion and be capable of a taking various actions (like turning, stopping, moving forward) toward the goal of the Battle. Unassembled components, a pile of bricks, or a robot that is incapable of powering on do not meet this definition.

H2. **Technical Inspection**

H2a. Robots must pass a technical inspection by the Referee and/or assigned Staff prior to being permitted to compete.

H2b. If a Team makes any physical changes to their robot, except to replace a part with an identical part, the robot must be re-inspected.

H2c. The robot belonging to the First, Second and Third place prize-winning Teams will be inspected immediately following their last match, and their ranking is conditional on passing this inspection.

H2d. Robots that fail technical inspection may not compete until the Team rectifies identified problems and passes a re-inspection. There are no limits on the number of re-inspections; however, as soon as a team fails, inspecting Staff members will move to the next robot to be inspected. This rule does not extend or invalidate any time limits during the course of the Competition.

H3. **Size constraints**

H3a. The robots must fit within a box that is 20 cm wide by 20 cm long by 30 cm high at the beginning of a Battle. There are no size constraints once the Battle has begun.

H3b. Nothing can intentionally detach from the robot. Robots will not be immediately penalised if pieces detach as a result of breakage. In the case of repeated breakage, the Referee may invalidate a Battle, request certain remedies be taken, or disqualify a Team.

H3c. The robots must weigh 3 kg or less. Extra weight (ballast) must be properly secured. Loose aggregates (sand, ball bearings, lead shot, etc.) are not permitted. Lead weights must be fully encapsulated.

H4. **Robot design**

H4a. The robot must have a "front" side. This side has no special requirements, except that it must be visually identifiable during the Competition and cannot change.

H4b. Robots may not attach or otherwise interact with any person or object outside the ring. For the purpose of this rule, any vertical face on the outside edge of the ring is considered outside and hence out of play.

H4c. The Robot must not have switches, jumpers or other field-configurable elements (for example, a switch that changes from aggressive to passive strategy).

(i) Exception: The robot may have one (1) SPST or SPDT on-off switch.

H4d. The robot must be completely autonomous. It cannot have any external source of control or of influence (e.g. wireless or otherwise, human or programmatic) except an on-off switch.

H4e. The robot must not contain any combustible, corrosive, or other materials which may pose a hazard to any person, robot or object. These are considered safety hazards.

(i) Exceptions: Batteries are permitted per H4j. However, lithium batteries have additional restrictions defined in H5.

H4f. **Weapons.** No weapons are permitted as safety hazards. Weapons are defined as any implement that may present a risk to any person handling the robot, a risk of damage to another robot during battle, or a risk of damage to the venue and the objects contained therein. This may include blades, spikes, fire, blunt hitting implements, EMPs, etc.

(i) Mechanisms intended to lift, flip or otherwise move robots are permitted provided they do not present undue risk. Forklift points, wedges and other sharp edges may receive additional scrutiny. Likewise, spring-loaded mechanisms may also receive additional scrutiny.

H4g. **Pneumatic systems.** Contestants should have clear documentation showing any part of the robot handling compressed air is rated at least 40% above peak

pressure used in the system. If this documentation is not produced on request, the pneumatic system will be considered a safety hazard.

H4h. **Hydraulic systems** of any sort are prohibited.

H4i. Robots may not intentionally or severely damage the field. Damage includes, but is not limited to, fouling (leakage of oil, glue or other fluids), gouging, galling, puncturing, denting or scuffing.

(i) Rubber cast off from robot tires is excluded from this rule.

(ii) Damage that occurs or is at undue risk of occurring may be considered a safety hazard.

H4j. **Batteries**.

(i) Batteries must be secured such that they will not fall out in the event of mechanical shock, or if the robot is placed in any orientation.

(ii) Contestants are encouraged to install a fuse, PTC or other current-limiting fail-safe set to a safe current value.

(iii) Batteries must be commercially purchased and in good condition. Leaking, bulging or otherwise damaged batteries are considered safety hazards.

H4k. **Safety hazards.**

(i) The determination of what constitutes a safety hazard, per these rules, is left to Staff discretion. Any hazards to any person or robot, or to the venue itself and its contents, not in these Rules but identified during the course of the Competition may also be addressed provided it is announced to all participants.

(ii) Staff may, at their discretion, require that any safety hazards to any person, robot, or object at the venue be addressed. This may include requiring the full removal of the components posing the hazard, disqualification of a robot if a danger cannot or will not be addressed adequately, and removal of materials or persons from the premises.

(iii) You are strongly encouraged to contact us privately via email if you have any doubts with regard to safety hazards. Staff will not divulge information provided in this way before the end of the Competition. However, we can make no guarantees about leakage of information due to e.g. hacking, electronic or physical eavesdropping, etc.

H5. Robot maintenance

H5a. Teams have approximately one (1) minute between battles. During this time, they may perform any adjustments they want to their robot, with the explicit exception of altering the software of the robot in any way.

H5b. No technical inspections are permitted during this time; teams may not add or remove mechanisms or components except to replace them with identical components.

H5c. Teams unready after this time has elapsed will receive a warning. On further violation of this time limit, the Referee may judge that the violating Team has forfeit the Match.

H5d. The only exception to both the time and technical inspection limitations are for readily correctable safety issues, as determined by Staff, for which contestants may be asked to remove or rectify hazardous or broken systems.

H5e. Changes to robot behaviour may be applied via software updates between Matches only. Software changes cannot be applied within a Match, starting from the beginning of G4a of the first Battle, until the end of the Match.

H6. **Lithium battery restrictions:** Contestants using lithium battery technology of any sort (Li-ion, LiPo, $LiFePO_4$, etc.) must, for safety reasons, meet the following additional requirements:

H6a. A fuse limiting maximum battery current must be installed and capable of interrupting all current to all batteries. While you may decide at their discretion the value of this fuse, you must likewise be prepared to justify this value. PTCs, circuit breakers, or other fail-safe mechanisms are acceptable. Multiple fail-safes of different types are encouraged.

H6b. The battery compartment must be free of sharp points and edges that risk puncturing the battery. Furthermore, the battery must be protected from any impact, crushing, piercing, slashing or other damage that may occur during a match. You must be prepared to show and explain these measures.

H6c. Lithium batteries may only be charged using a charger designed for that purpose. Charging batteries requires constant supervision. “Battery bunkers” or fireproof charging envelops are highly recommended.

H6d. Batteries must not be bulging, swollen or otherwise damaged. These are considered safety hazards (see H4k).

I. Liability and Personal Conduct

I1. Personal conduct

I1a. Competitors are expected to demonstrate respect and good sportsmanship towards fellow Competitors, Staff, their possessions and the venue itself.

I1b. Competitors are required to follow Staff instructions in regard to safety, acceptable conduct, or any other instructions to ensure smooth Competition proceedings.

I1c. Any Competitor who fails to follow such instructions faces penalties which may include verbal warnings, Match forfeiture, disqualification, or removal from the premises, depending on severity.

I2. Liabilities

I2a. We shall endeavour to ensure the personal safety of our Competitors and audience, and the safety of possessions and equipment. However, we make no guarantees in this respect and cannot accept liability for any personal or material injuries or damages to the maximum extent permitted by law.

I2b. Competitors are expected to respect the venue and venue property, and may be held liable in the event of damages to the venue or venue property.

I2c. Competitors assume all responsibility for the protection of any confidential information and confidential intellectual property to which they have access and may or may not use in the course of their participating in this Competition.

I3. **Photography/model release:** Competitors agree to grant IEEE Concordia permission to use, modify, publish, or distribute any photographs containing the Competitor's likeness and taken by IEEE Concordia, or any entity under IEEE Concordia's instruction, during the course of the Competition, in any medium. Competitors agree to assign any applicable copyrights for these photographs to IEEE Concordia.