



General rules for the main competition

Engineering Physics' Robot competition 2023

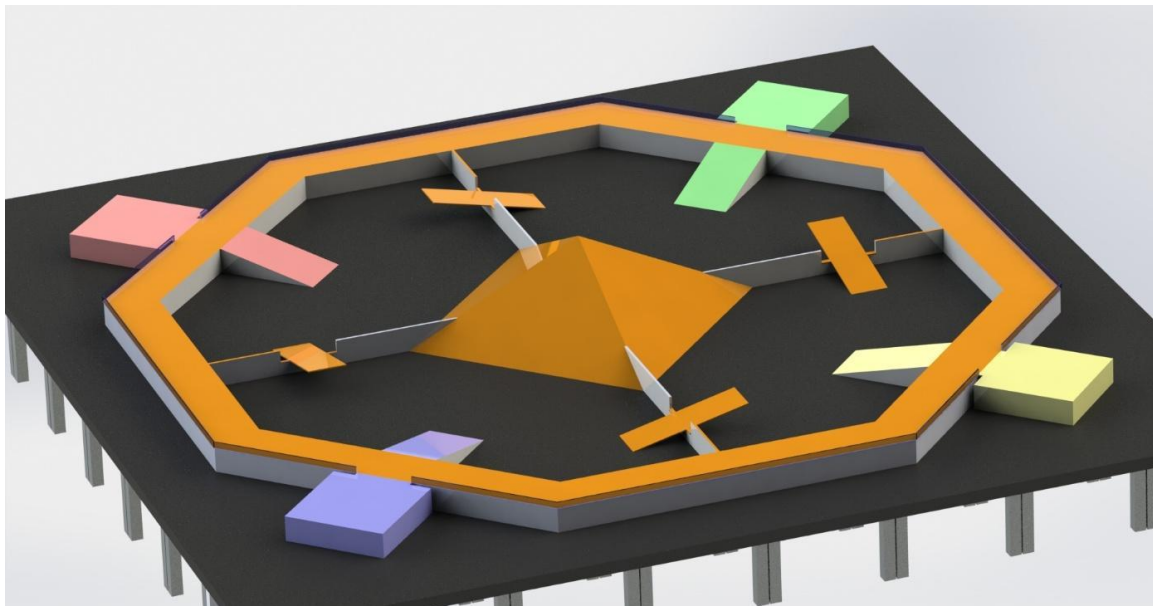




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1 Competition layout

The competition will be divided into three stages, *Competition 1*, *Competition 2* and *the Final*. The specific rules for each part are found on the competition website (robot.tekniskfysik.se) when they are published. In both *Competition 1* and *Competition 2*, teams compete to collect points. The points are accumulated and will determine which four teams advance to *the Final*. Figure 1 is an example of the competition structure.

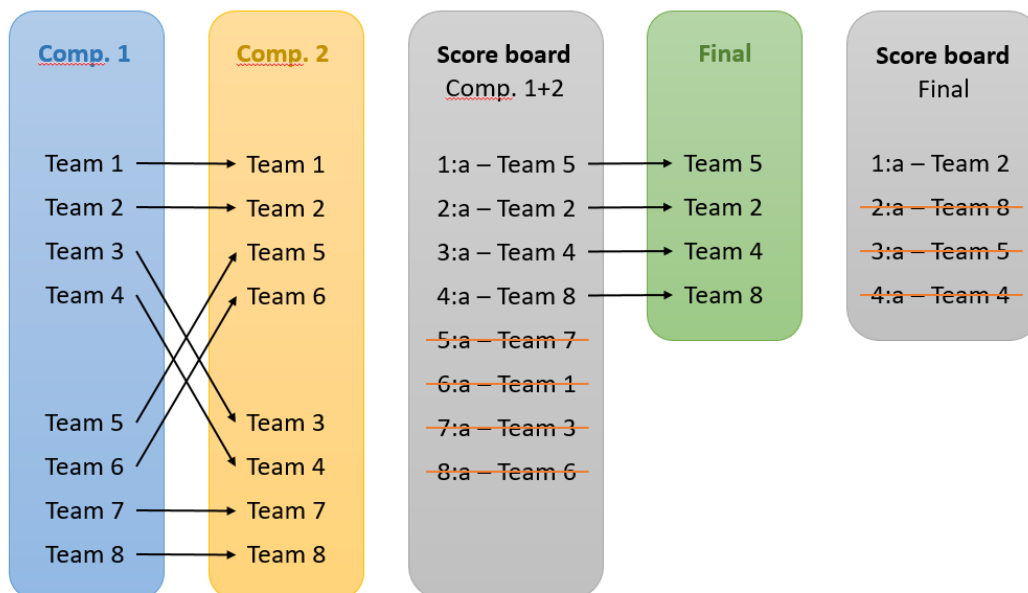


Figure 1. Example of the competition structure.

1.1 Competition 1

During eight minutes, the teams must place spheres on the competition track using any means. Based on where the spheres are placed, they yield different amounts of points. The points are tallied for the balls that are correctly placed when the time is up. Ball size and weight as well as their locations and points are detailed in the specific rules document for *Competition 1* when published.

1.2 Competition 2

The teams must build a tower in their own starting zone for eight minutes, similar to the qualifying competition. The building material will have different shapes and be scattered on the competition course. Points are based on the height of the tower, not the amount of material used. When half the time has passed, the pilot(s) will no longer be able to see the competition course except through a camera mounted on the robot. Size and weight of the building material, its location and scoring for height are given in detail in the specific rules document for *Competition 2* when it is published.





1.3 Final

The final consists of the classical competition *Capture the Flag*, where the teams must capture flags in ten minutes. The flags will be scattered around the course, where the value of the flags are based on how difficult they are to access. There will also be a gold flag worth the most points. The dimensions and value of the flags are detailed in the specific rules document for *the Final* when published.

2 Components provided by the competition management

In addition to the parts used during the competition, the teams will have access to:

- A battery pack, 11.1V lithium (Chargers will be available in the 3D lab)
- Battery alarm (must be connected while using the battery)
- A DC-to-DC buck converter (Converts higher voltage to 5V)
- RF transmitter + receiver (approx. 433 MHz)
- Analog video transmitter + receiver (approx. 5.8 GHz)

Components provided by the competition management may not be modified or rebuilt.

3 Ordering components

The team will be able to order components from RS (se.rs-online.com) and (dfrobot.com) to a value of SEK 1,500. From RS you use the prices excluding VAT and from DFRobot you convert EUR to SEK.

On Monday **March 6th**, a first order of a maximum of SEK 1,000 will be sent. Later on **Thursday April 6th**, another order for the remaining budget will be sent. The team may distribute the sum of the orders as needed, as long as the first order does not exceed SEK 1,000 and the total sum does not exceed SEK 1,500. The teams compile which parts they want to order via a Google Sheets. Personal link is sent out by the competition management in each team's Discord channel.

Some DFRobot products are also available from RS. If RS is missing some DFRobot products, these need to be ordered directly from DFRobot. To decrease the chance of late deliveries, make sure to order from DFRobot in the first order.

If additional stores appear as alternatives, the competition management will announce this followed by the publication of a revised version of this document.





3.1 Use of personal electronics

It is also possible to use your own electronics, with some conditions. Electronics whose sole purpose is purely cosmetic are free to use, for example LEDs. If you are unsure, contact the competition management. If the electronics the team has at home can be bought from RS or DFRobot, we simply deduct the purchase price from the team's budget, just as if the team had actually bought the electronics. If the electronics the team has at home are not available for purchase from RS or DFRobot, the competition management may decide if an exception needs to be made in the individual case. To clarify, some examples are given:

- A team has two servos at home that they want to use. Equivalent servos can be purchased from DFRobot for SEK 100/piece. Then SEK 200 is simply deducted from the budget. In practice, it will be as if the team has "purchased" two servos. The purpose of this solution is that all teams should have the same conditions and not be able to circumvent the budget.
- A team has a battery-powered disco ball they want to mount on their robot for fun without bringing any strategic advantage in any of the three different competitions. In that case, it is counted as building material, which is not included in the budget, and therefore no deductions need to be made.
- A team needs an H-bridge to control a DC motor and cannot find any within a reasonable price range from either RS or DFRobot. The competition management then considers that an H-bridge is such a vital part for robot construction that they make an exception and buy one for the team from another supplier. The price of the component from the new supplier is therefore used by the team in their budget calculation.

4 Communication

Teams must communicate with their robot via the RF transmitter provided by the competition management. Any exceptions or additions must be approved by the competition management. For example, Bluetooth has usually been disrupted by the large amount of spectators and is not a reliable method of communication.





5 Building regulations and restrictions

Apart from the restrictions below, the construction of the robot is completely free.

- At the start of the competition, the robot must not exceed the following dimensions:
 - a. Height: 40 cm
 - b. Width: 40 cm
 - c. Length: 40 cm

It is perfectly fine to exceed those measurements once the competition has started, for example unfolding an arm.

- The robot's weight must not exceed 3500 g (with the battery mounted).
- No weapons that could harm the audience or other robots are allowed.

Failure of any team to comply with the above points may result in disqualification from the competition or penalties.

6 Battery protection

The battery must be protected so that there is no risk of it being damaged or short-circuited. An approved example of protection is to place the battery in a plastic box. The battery alarm must be connected to the battery while it is being used. This is to minimize the risk of damage to the battery due to discharging too much. Figure 1 shows how to connect the alarm to the battery.

NOTE: If the battery is swollen, do not use the battery and notify the competition management immediately. If the battery catches fire, you must evacuate the premises as toxic fumes are formed and lithium fires cannot be extinguished.



Figure 1. This is how to connect the alarm to the battery. (Tips: The alarm beeps loudly when connected, so block the speaker with a finger when connecting it and it will not beep as loud.)



7 Contact rules

The competition presupposes that there will be some friction between the teams. You may not intentionally (for an extended period of time) block or lock in opponents. No intentional offensive weapons to damage the function or mechanics of opponents will be permitted and the competition management reserves the right to correct questionable actions and that penalties may be awarded.

8 Competition track

The competition will take place in an octagon with a diameter of **6m**, which is divided into four sectors. In the middle of the octagon there will be a tilted pyramid, which will have a removable top. With the top on it will be difficult (but not impossible) to drive between the sectors. The alternative will be to get between the sectors by driving over seesaws or along the wall. With the top removed from the pyramid, it will be easy to drive between the sectors. The slope of the pyramid's walls will be **no more than 30 degrees** and will be covered with friction tape. The width of the tilting boards will be **30cm** but the opening **45cm**. The width of the wall and the ramp up to the edge will be **45cm** wide. Around the wall on the outside, there will be a fringe of plexiglass with a height of about **15-20 cm**. The slope of both the seesaws and the ramp up to the wall will be **less than 15 degrees**. The starting zone will be **80x80cm**. Figure 2 illustrates the course that will be used in the Main Competition. (NOTE: the figure is not to scale)

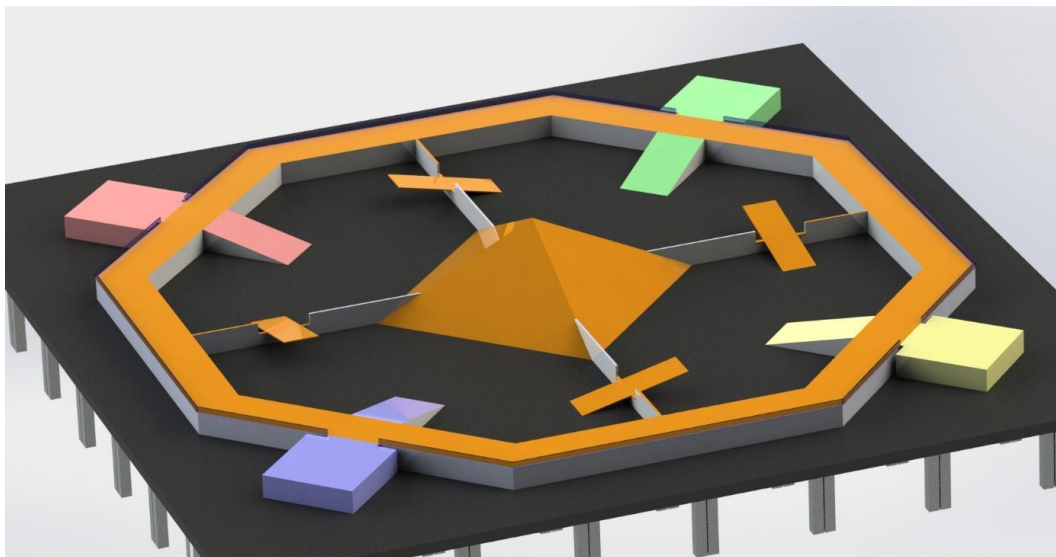


Figure 2. Illustration of the competition course.





9 Officials

During each competition stage, each team will have its own official who supervises and assists them.

10 Milestones

10.1 Test run of robots and RF

Two weeks before the competition (**Friday April 28th**), the teams must show that the robots are capable of driving. The robot does not need to be completely finished, but the robot must be able to drive forward, turn and get over a seesaw. The communication with the robot must not take place with a cable but must be wireless, e.g. with the RF modules that the competition management has provided you. The robot must also have a battery protection, see the point above about battery protection. If the robot is not operational two weeks before, a penalty of 10 seconds will be awarded. The penalty is served at the start of *Competition 1* of the main competition.

10.2 Test of arm/claw

One week before the competition (**Friday May 5th**), the teams, in addition to the robot being able to drive, must demonstrate that the robot's arm/claw works by grabbing and lifting a block or flag. If the robot cannot do this, a penalty of 10 seconds will be given. The penalty is served at the start of *Competition 1* of the main competition.

11 Sudden death

In the event that two or more teams have the same position when a competition stage is over and the position is decisive for who advances to/wins *the final*, the position will be decided using *Sudden Death*. The teams start in the respective starting zone and must collect their game piece in the opposite sector. When the team has collected its game piece, it must press the button in the starting zone. The game piece must be inside the team's starting zone when they press the button. The fastest team or teams win a place in *the final*, depending on which moment is being decided. Depending on which moment is decided by *Sudden Death*, either a block or a flag will be used as a game piece.

12 Between heats

The team may modify the robot between each heat. The time to modify the robot is guaranteed to be at least 5 minutes. Each robot version must meet the restrictions for dimensions and weight, but the components of the robot versions together must not exceed the restriction for the value of the total robot, see chapter 5.





13 During heats

The robot will always be placed in the starting zone (nest) at the beginning of each phase. When the head referee gives the start signal, the robot is allowed to start running. When the final signal goes, the robots are not allowed to move anymore. If a robot breaks down during one of the competitions, the official gets to pick the robot off and the team gets a chance to fix it. When the robot is repaired, the official places it back on the track. No team members may enter the competition course during the game, only the officials deploy the robot and retrieve it from the competition course. Teams may not intentionally leave items on the court to sabotage or make it difficult for other teams.

14 Team picture, and picture of the robot

The teams must take a group photo of everyone in the team and a photo of the robot. The robot must be in the same (as similar as possible) design as it must be on the day of the competition. The photos must be sent to the competition management by **Wednesday 29th April** at the latest.

