Rules for Competition 2

Engineering Physics' Robot Competition 2023
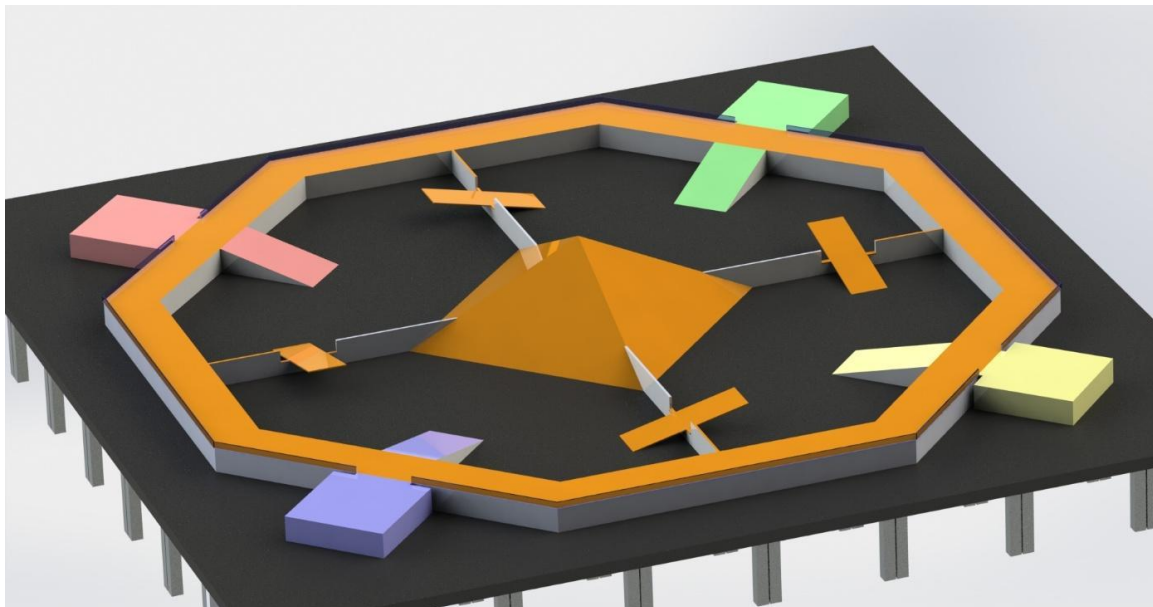
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1   Description

Competition 2 builds on the familiar qualifying competition where the teams stacked a tower of blocks. Here, the teams have **8 minutes** to both collect blocks and stack them in their nest. There are four blocks below the pyramid in each zone, and like the qualifier there is also a secret bonus block on the pyramid's plateau. The blocks on the floor all have the same shape and are cubes with a **side length of 5 cm**. Of the four blocks in a zone, two of them are the same color as that zone's nest and are therefore earmarked for that team: only green team can pick up green blocks etc. The remaining two blocks are gray and available for everyone to pick. The blocks locations are illustrated in figure 1.

During the **first four minutes** the pilots of the robots will only be able to see the race course through a video link while they maneuver the robot. This limitation applies only to the person who controls the robot via a hand control or similar. The remaining team members get to see the competition course with their own eyes and communicate freely with the pilots. The pilots can be replaced without problems and the pilots can also walk over to the course and look, provided they have relinquished control of the robot. Summarized: During the time a person can physically control a robot, this person may only navigate via the view from a camera mounted on the robot. When the first four minutes of the competition have passed, this restriction is lifted.

We will provide all the video equipment that you plug in and mount at any location on the robot. More details including dimensions will come in a separate document, but don't expect any bigger equipment than a competition block with a protruding antenna.

2   Rules

It is not allowed to intentionally move blocks that are of the wrong color. Only the team's own color and the gray blocks are meant to be moved. Accidentally driving into the wrong block is not a foul, but intentionally moving another team's block into a corner can be considered a foul.

If a block ends up outside the course, it is picked up again and placed on the course by an official. The block is placed on the floor in the same zone from which the block left the course. If the bonus block goes off the course, it will be placed back in its original place on the pyramid. For example: Blue team builds a tower in their nest and demolishes it so that two blocks go off the course. Those blocks are then placed below the pyramid in the same zone as the team's nest.

It is forbidden to enter the nests of other teams. See the document *General rules for the main competition* for additional regulations.

3 Assessment

The points are counted per tower and then the points for each tower are summed. For each tower, the height is counted in number of stacked blocks which are then squared to give points. Teams can build multiple towers in their nest and even a single brick lying in the nest counts as a tower with the height of one brick, however the brick must have one of its flat sides in full contact with the ground to be valid. **The maximum height** of a tower is five blocks. After that, the score for that tower does not increase. Table 1 shows the scoring for a single tower, and Figure 2 visualizes an example stacking in the blue team's nest.

What happens if a brick is placed on two towers? Let's say that two towers that are three blocks high are next to each other. They would then give $3^2 + 3^2 = 18$ points. If a block is placed on top of both then that block only counts towards one tower so that the total score is $4^2 + 3^2 = 25$.

The bonus block will be worth ten points and does not have to be part of a tower. It only needs to be placed in the nest, and if there is a well-defined orientation on the block, it also needs to stand upright in the nest.

Should several teams have the same score when the points from *Competition 1* and *Competition 2* are combined and it is not possible for all of them to advance to *the Final*, the final placement between them will be decided by means of *Sudden Death*. This is described in the document *General rules for the main competition*.

Table 1. Scoring for a tower, where the height of the tower is counted in number of blocks and the maximum height per tower is five blocks.

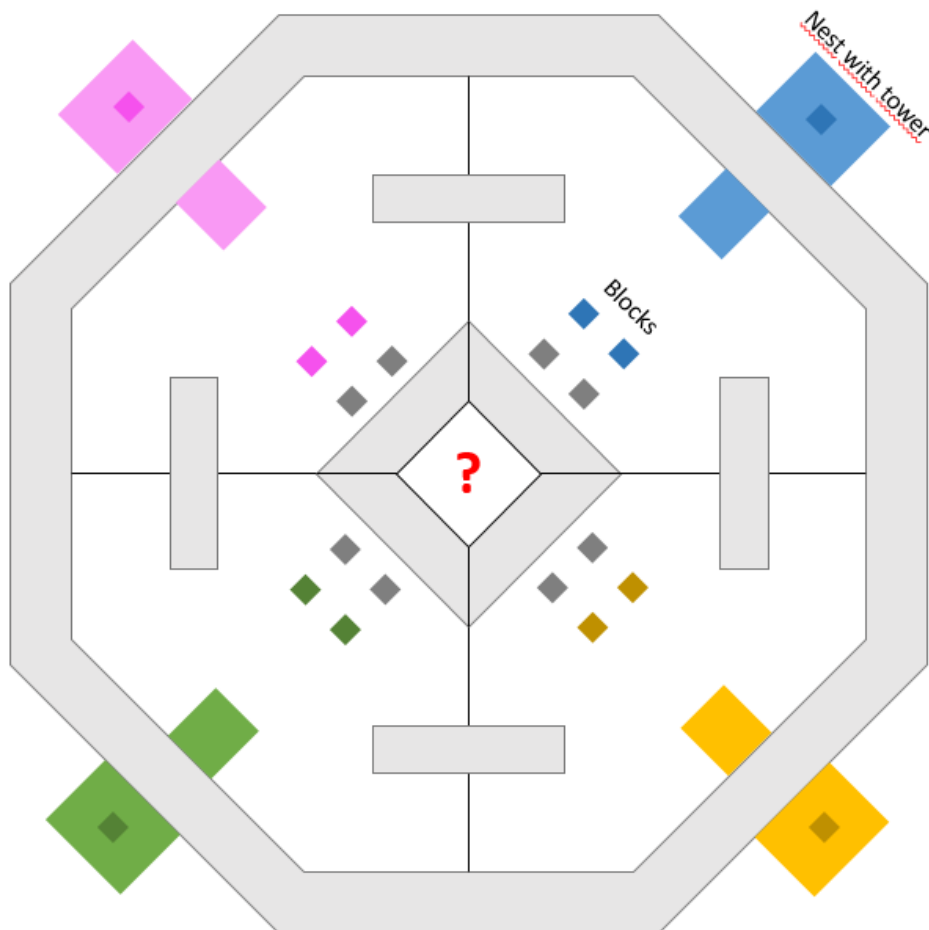| Height	Point
1	$1^2 = 1$
2	$2^2 = 4$
3	$3^2 = 9$
4	$4^2 = 16$
5	$5^2 = 25$

Figure 1. Illustration of the competition course. The position and size of the blocks in this figure is only to exemplify the amount of blocks per zone. Note that the top of the pyramid is flat as in *Competition 1*. The question mark marks where the bonus block will be placed.
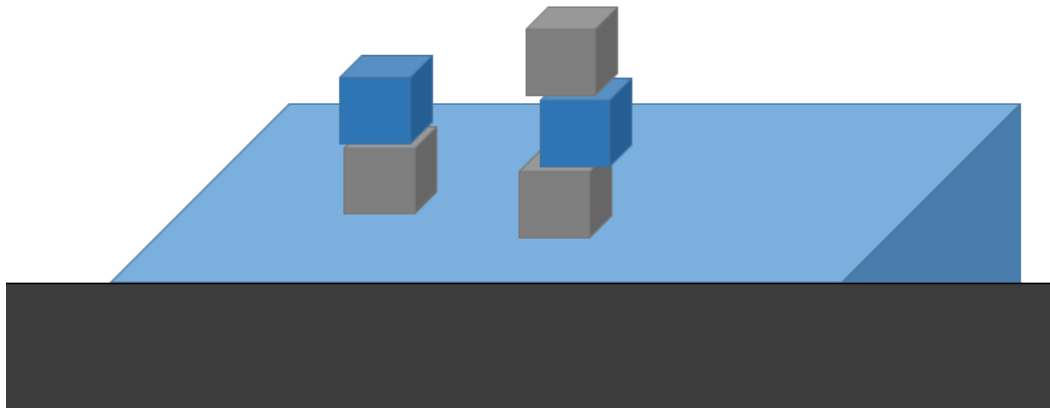
Figure 2. Example of a view of the blue nest after the competition has ended. The team has collected their two blue blocks and three gray blocks and stacked two towers. The left one with two blocks is worth $2^2 = 4$ points and the left one with three blocks is worth $3^2 = 9$. In total, the teams collected $4 + 9 = 13$ points.