

Introduction

The engineers are trying to design a vehicle that is capable of adapting itself to the rough terrain it is sent into. You are asked to design the prototype of such a bot that is capable of changing the distance between its wheels so as to cover a ground that cannot be done otherwise. There are multiple valleys that converge, diverge or are in an arc form and are to be crossed. Your challenge is to design a bot robust enough to adapt itself according to the valleys it faces. There are also certain parts of the path that you need to complete before you can cover the further ground. Use a mechanical gripper to complete this problem statement.

Problem Statement

To build a manually controlled robot, which is capable of picking and placing blocks with accuracy and changing its interaxial distance to make its way through a series of hurdles.

USP

- Changing interaxial distance.
- Gripping and lifting mechanism.
- Placing blocks and planks in their respective places.

Task

Round 1

- Start at the start zone marked red in the arena image.
- Complete its way up a slope by picking blocks from an adjacent area (This area is not shown in the arena.) and placing them appropriately in certain slots present on the arena to make a path for the robot to move ahead.
- Place two horizontal planks on pillars to make a bridge to cross a valley (dimensions are specified later). The planks are to be picked up from an adjacent space that is not mentioned in the arena.
- Cross another path by using 2 planks which will already be present over the valley.
- Cross a path which consists of two planks placed at an angle to each other such that, the distance between them changes continuously in a diverging pattern.
- Cross a path which consists of two planks placed at an angle to each other such that, the distance between them changes continuously in a converging pattern.
- Make its way down a converging slope and exit into the end zone marked green in the arena image.

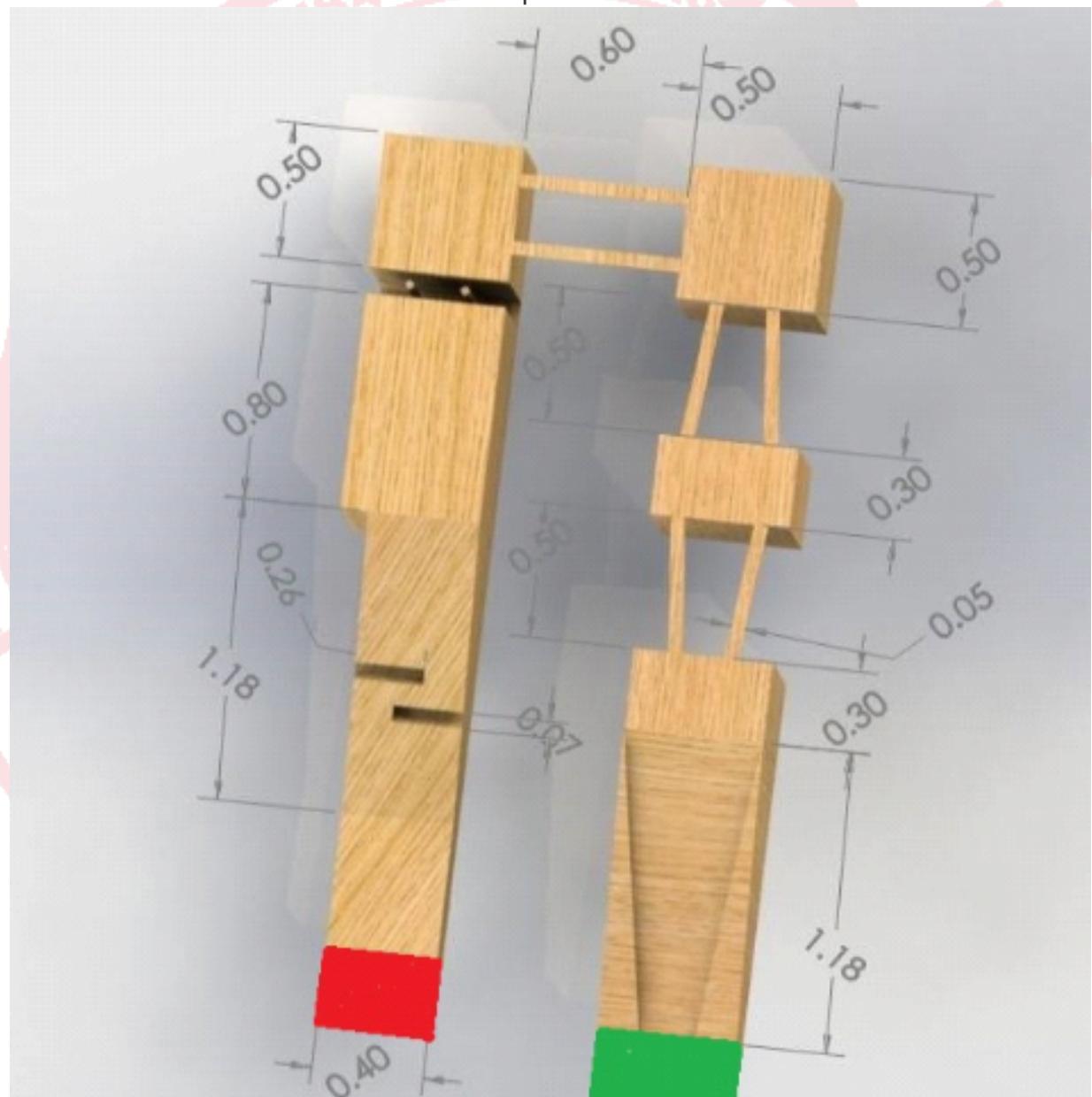
Round 2

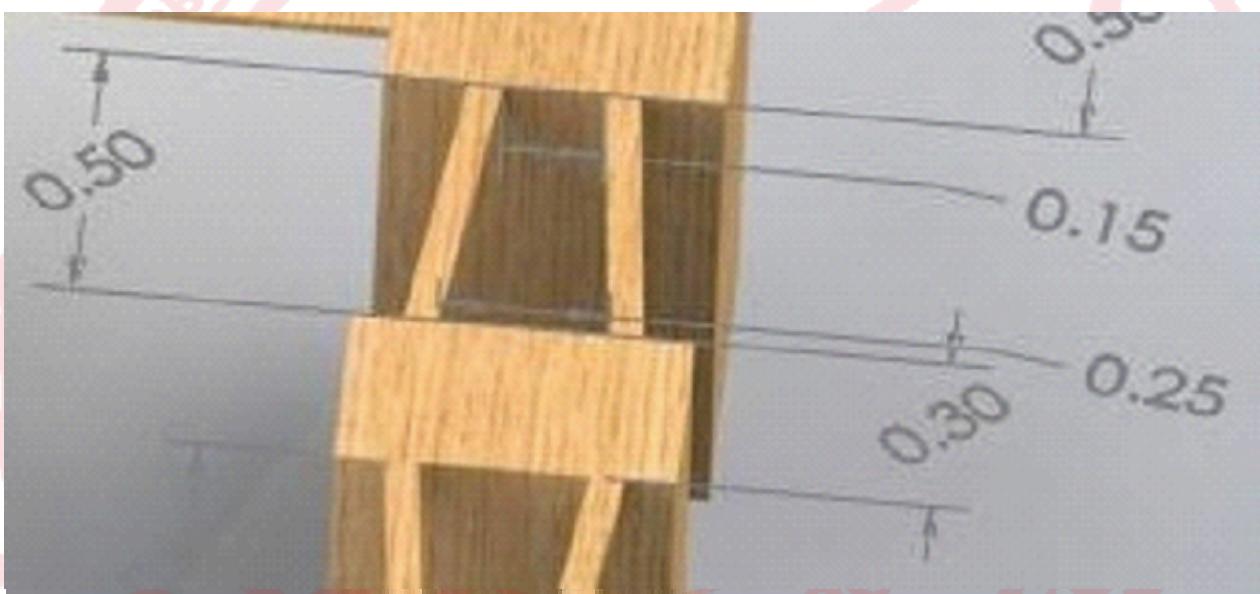
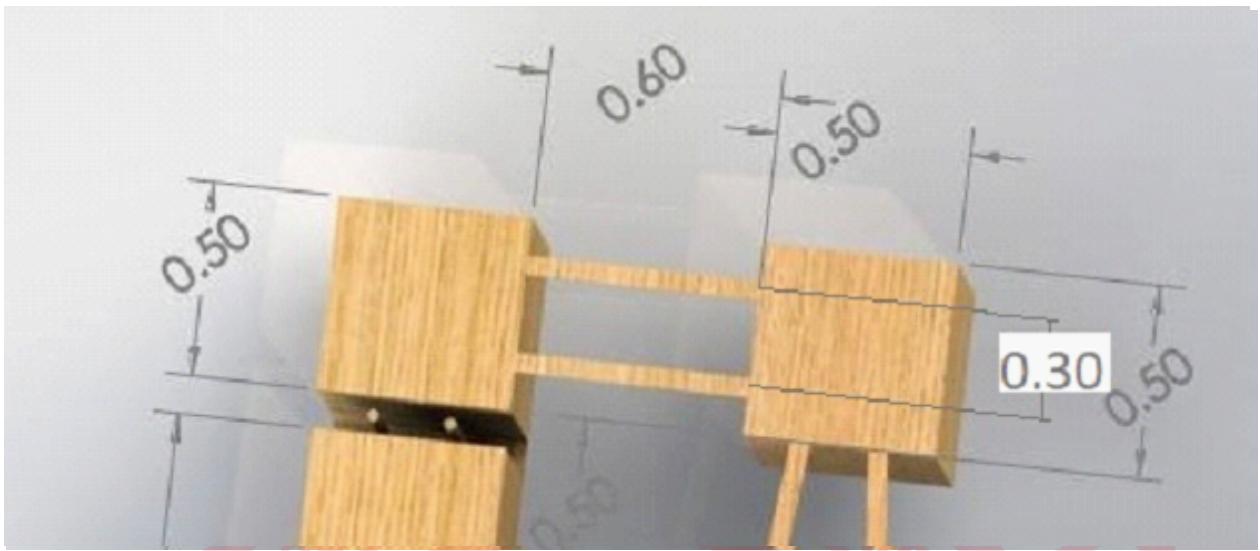
- Start at the start zone marked red in the arena image.
- Complete its way up a slope by picking blocks from a circular rotating table(which will be at the same level as the start zone and adjacent to the start zone) and placing them appropriately in certain slots present on the arena to make a path for the robot to move ahead.
- There will be points awarded for picking up a block successfully from the table. However, there will be a penalty for dropping the blocks. If unable to proceed the rotating table will be stopped at the participant's discretion with no points awarded for picking the block.
- The rotating table is placed adjacent to the starting zone, at the same level and is not mentioned in the arena.
- Place 2 horizontal planks on given pillars to make a bridge and cross a valley.

- Cross a path with two circular planks of constant radius making an arc.
 - Make its way up a slope made of two planks which will be at an angle to each other in a diverging pattern.
 - Make its way down a slope made of two planks which will be at an angle to each other in a diverging pattern.
 - Make its way down a converging slope and exit into the end zone marked green in the arena image.

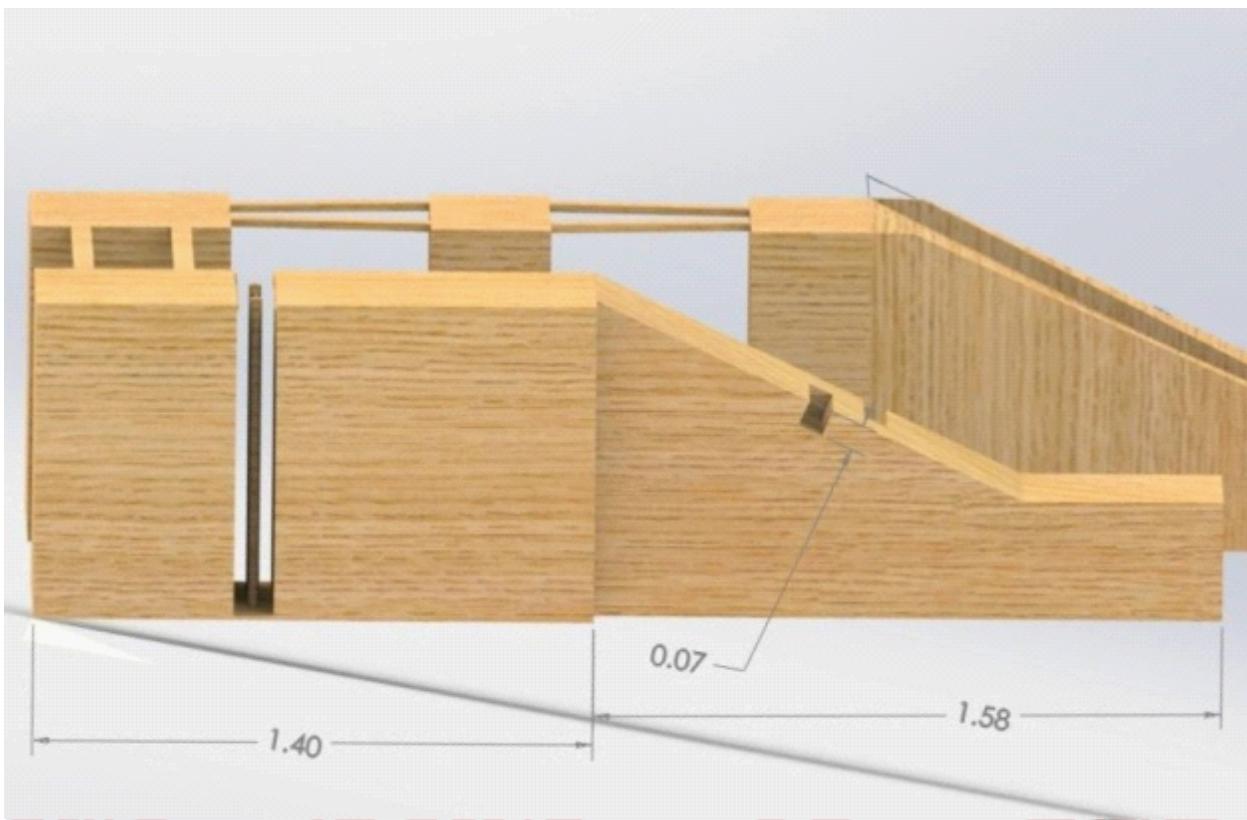
Arenas

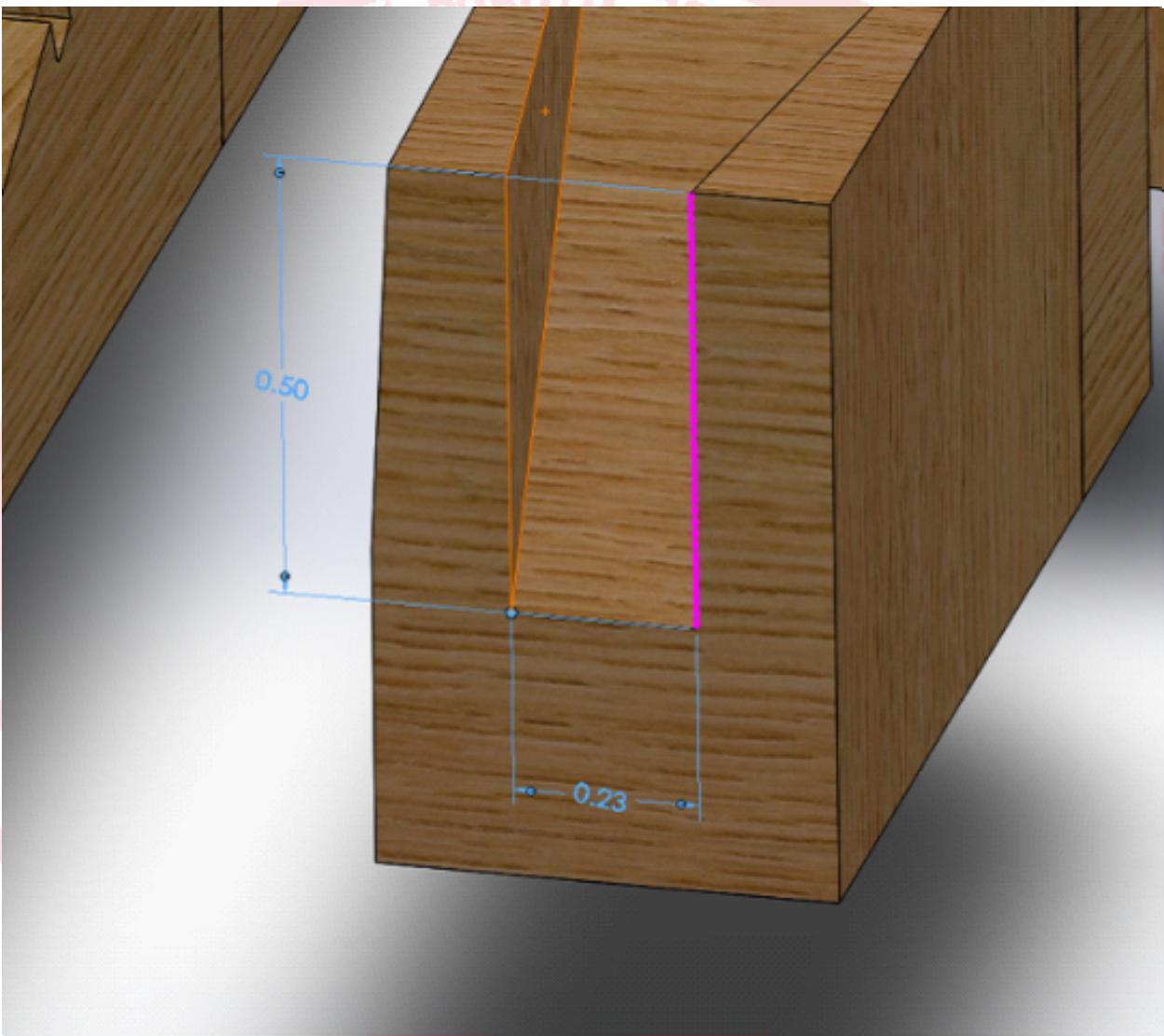
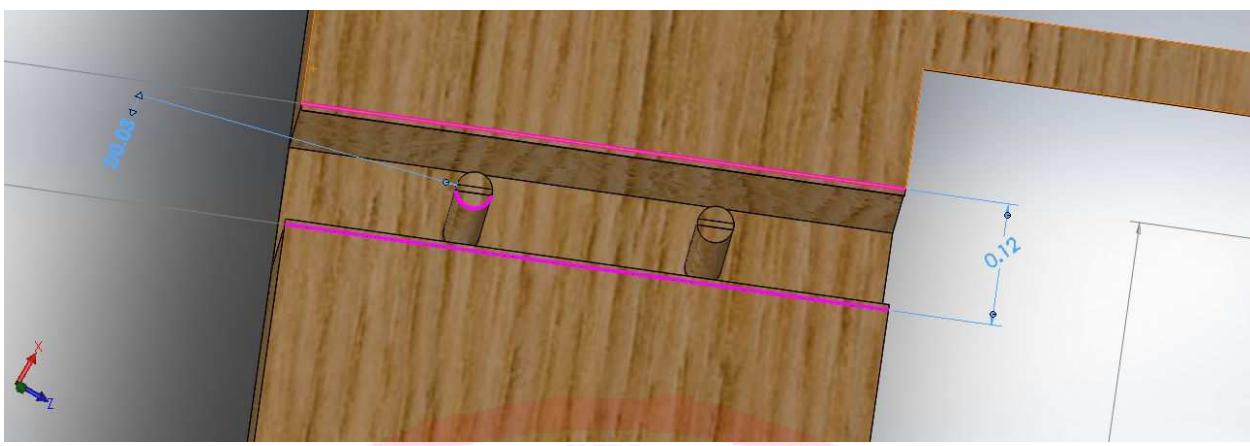
Round 1





Arena specifications:





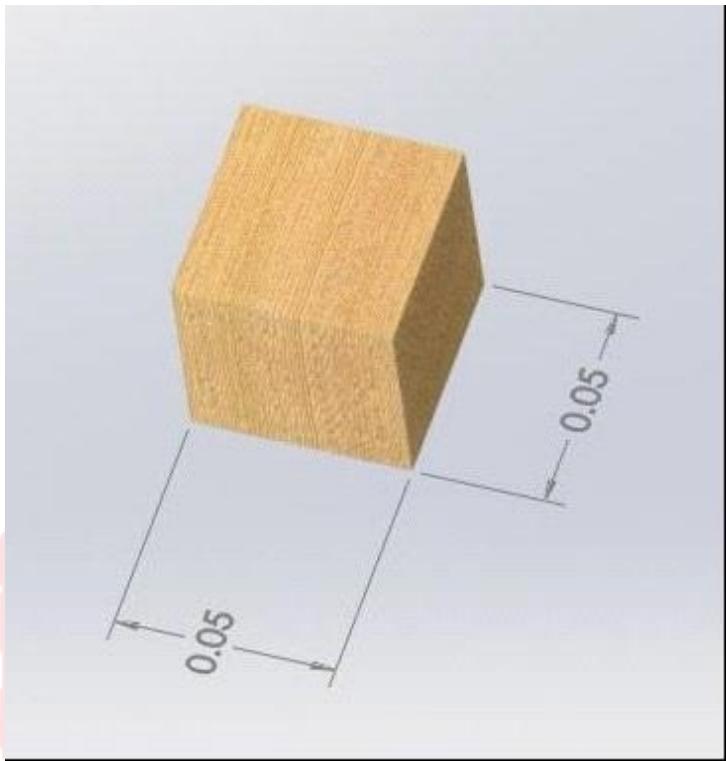
Arena Component specifications:

Block:

Dimensions: 5cm*5cm*5cm.

Bulk material: Wood.

Isometric view:



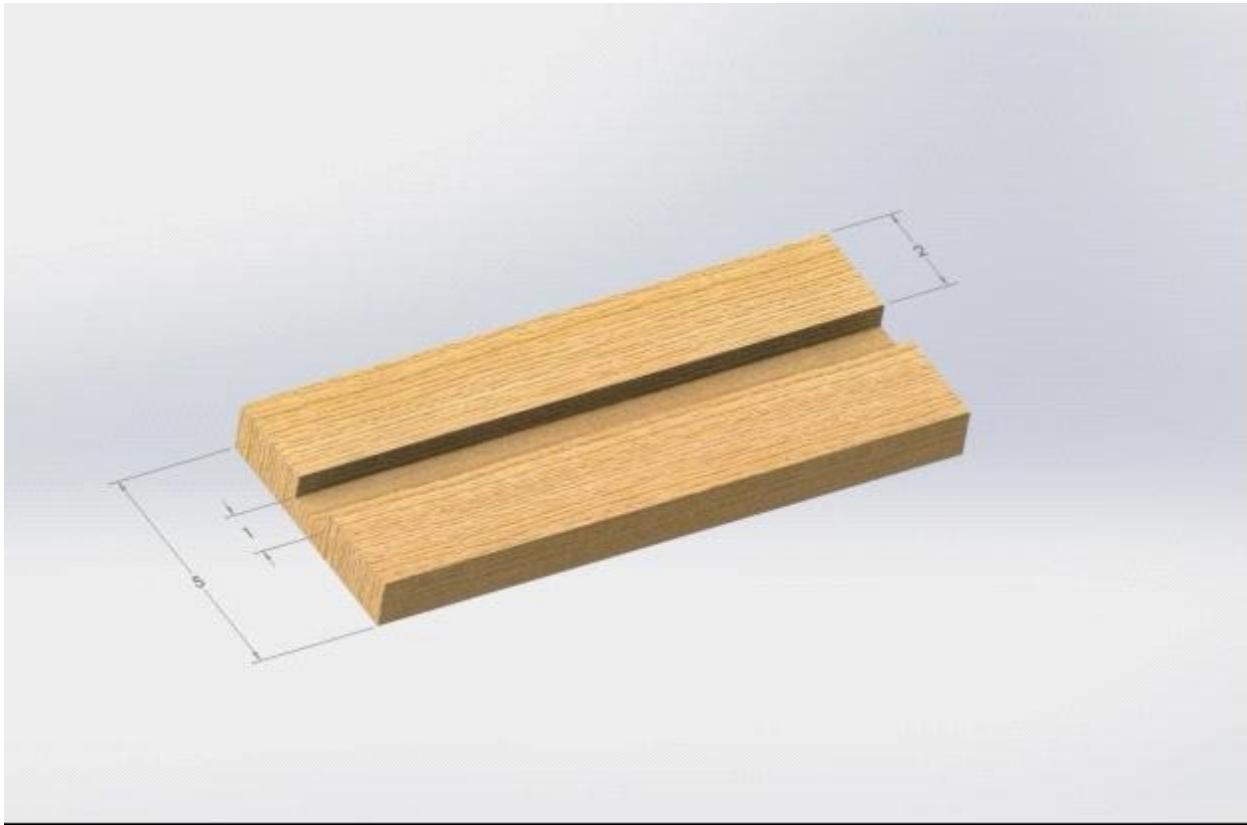
Bridge Plank:

Dimensions: 12cm*5cm*1cm.

Bulk material: Wood.

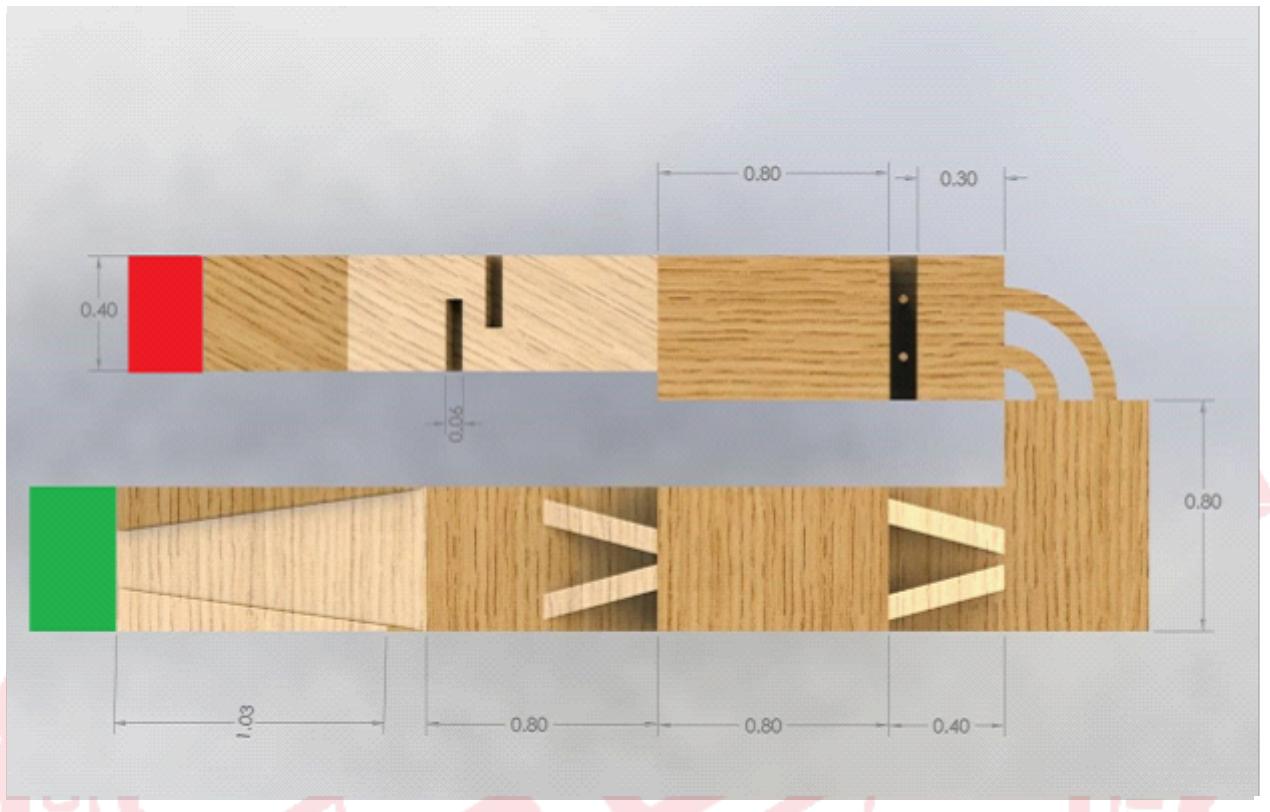
There is a groove in the plank that will fit over the given cylindrical stands perfectly.

Isometric view:

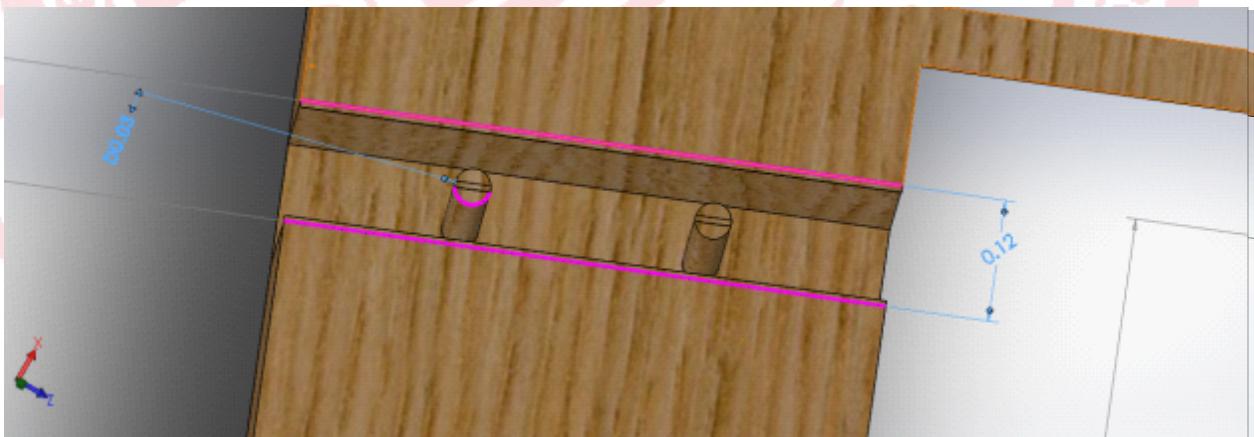


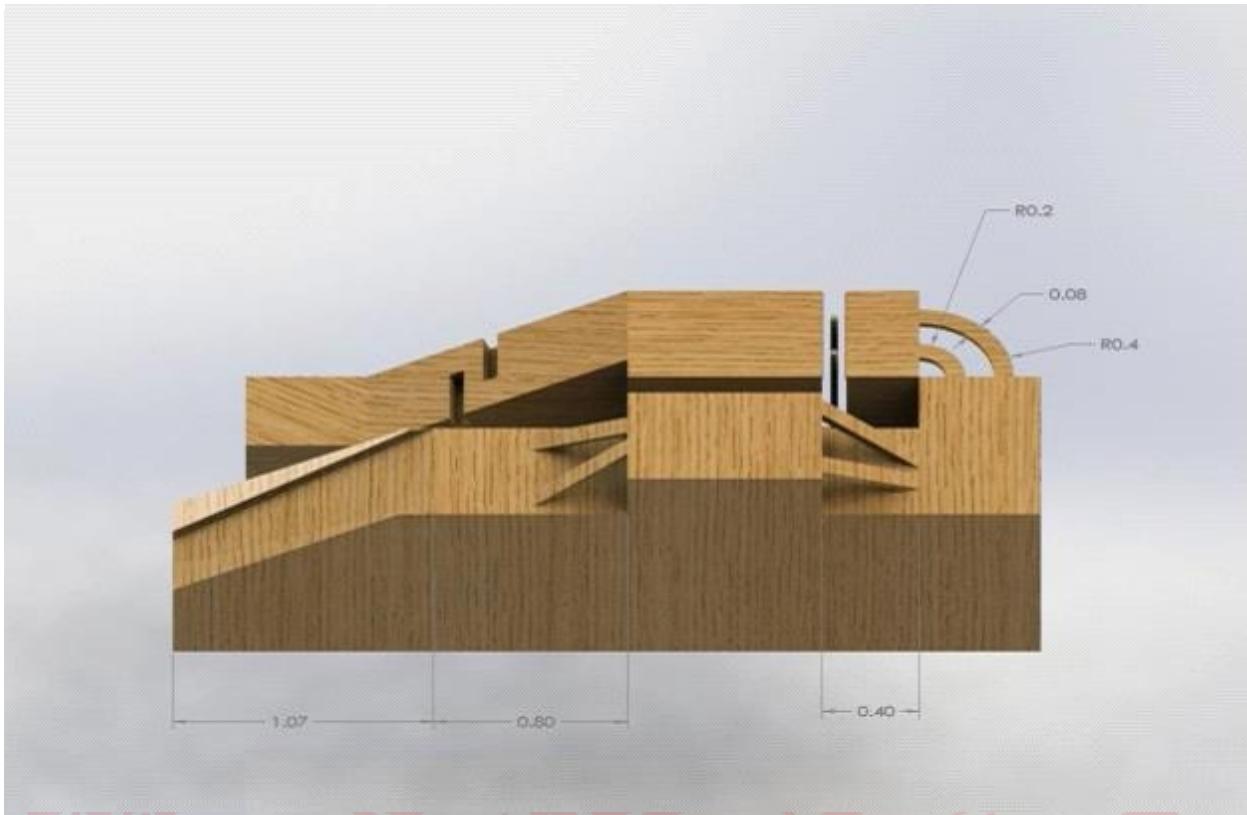
Round 2

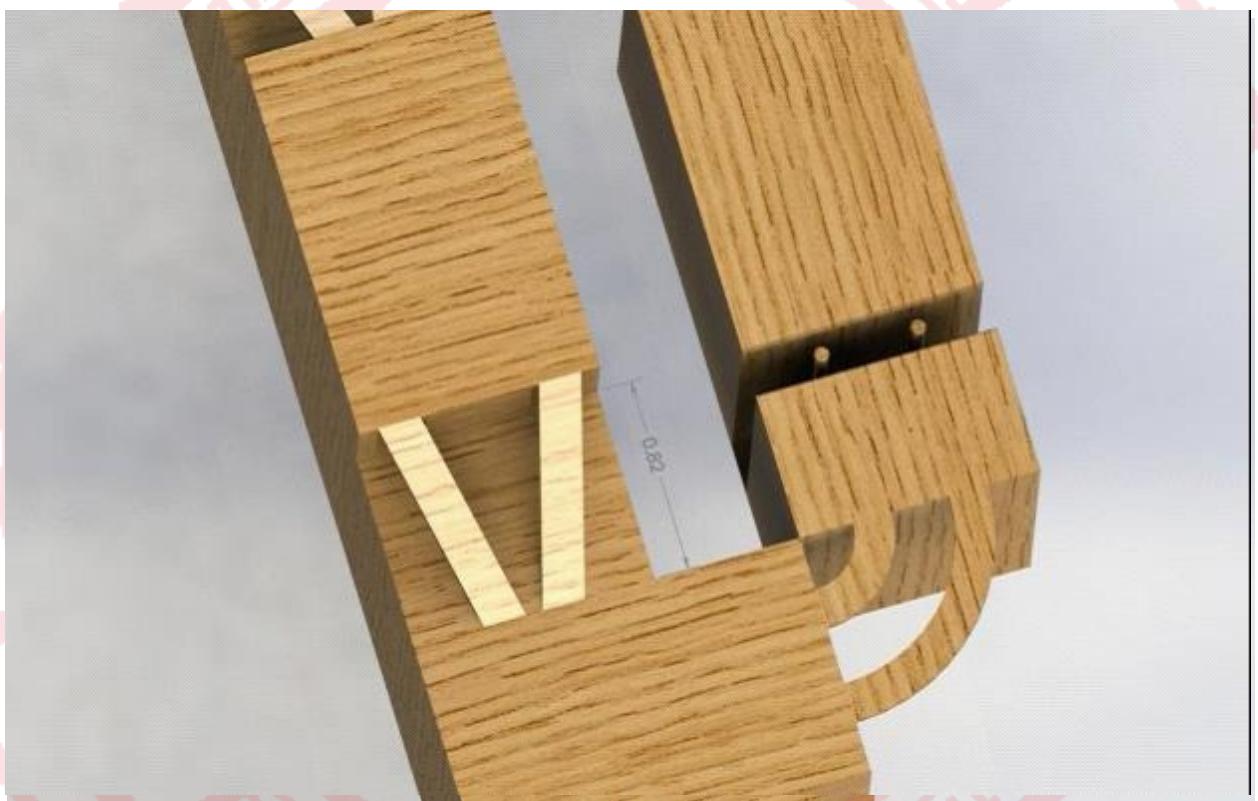
Top View:



Arena components:







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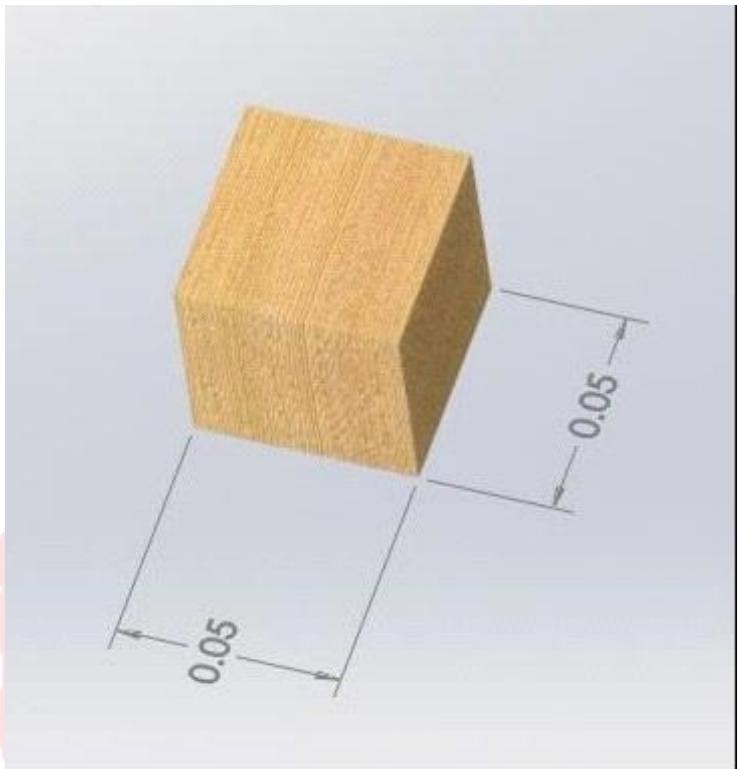
Arena Component specifications:

Block:

Dimensions: 5cm*5cm*5cm.

Bulk material: Wood.

Isometric view:



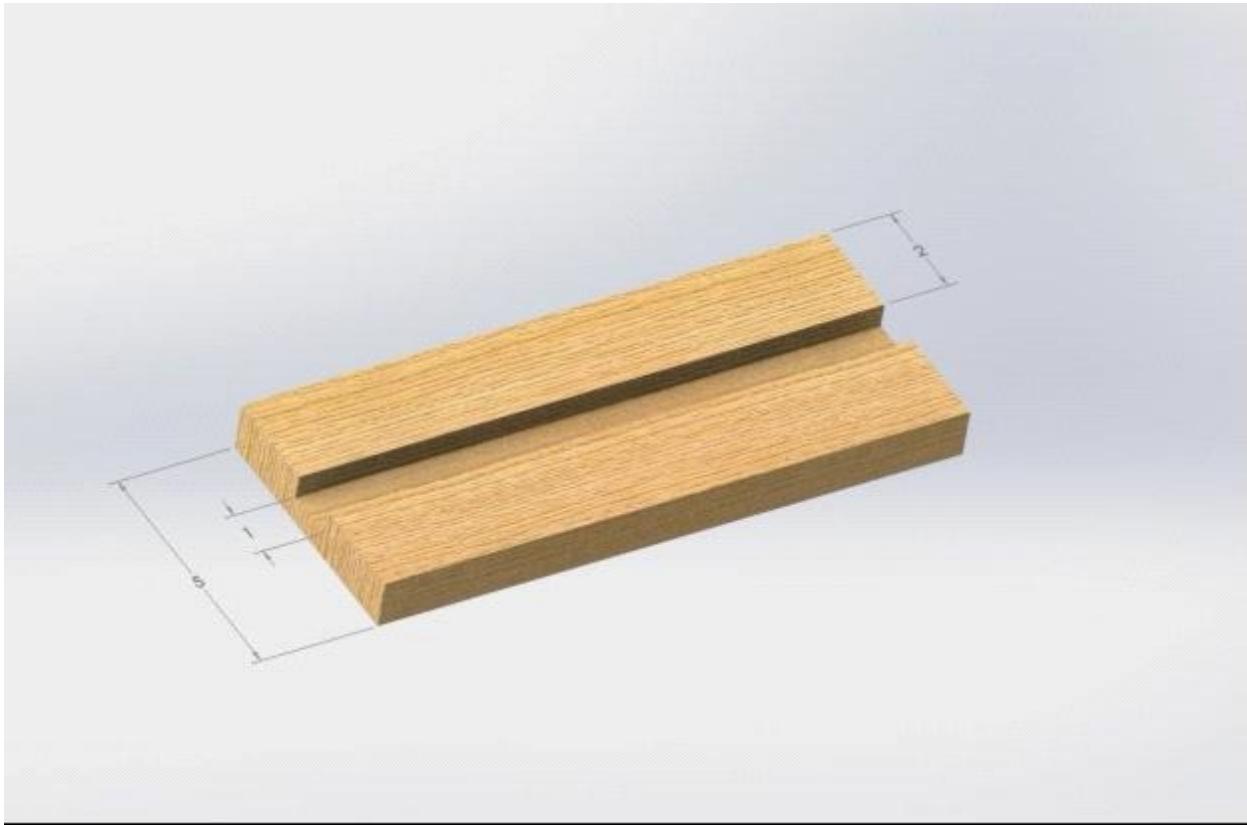
Bridge Plank:

Dimensions: 12cm*5cm*1cm.

Bulk material: Wood.

There is a groove in the plank that will fit over the given cylindrical stands perfectly.

Isometric view:



Rules and Specifications

General Rules

1. All arena dimensions may have a tolerance (error) of up to 10%.
2. Each team can consist of a maximum of 4 members.
3. Only 2 members per team will be allowed to control the robot.
4. The participants will be provided with 220 volts, 50 Hz standard AC supply. However, the participants cannot use this voltage apart from getting a 24V DC output through an adapter. This goes to say that no component on the robot may use a power supply higher than 24V DC. In case of any discrepancy, Team ROBOTIX will have the final say.
5. Two teams can have one or more members in common.
6. The team members can be from different institutes or colleges.
7. Teams qualifying the first round will go into the second round.
8. The teams cannot touch their robot during the course of the run, unless timeout is taken.
9. The best spirit of sportsmanship is expected from the participants.
10. The decision of Team ROBOTIX will be final and binding.

Arena and Locomotion

- The robot has to start from the start point, which will be marked in the arena.
- Penalty will be awarded every time the robot falls off the arena.
- The robot has to go and complete the tasks as specified above and reach the end zone which will also be marked in the arena.
- Any discrepancies will be handled by Team ROBOTIX and their decision will be final and binding.
- Time will be kept by Team ROBOTIX and their decision will be final and binding.

Initial Orientation of Robot

- Team ROBOTIX will decide the initial orientation of each robot at the start zone.

Restarts and Timeouts

- A maximum of 2 Timeouts of 1 minute each may be taken in each round. Penalty will be awarded for each timeout and robot will start from its last position on the arena.
- The participant's robots can have a maximum of 1 restart per round. A penalty will be imposed on the team for every restart that they take.
- After the restart, the participant's robot will be set to its initial position. Timer will be set to zero and the run will start afresh with the addition of the penalty for restart.
- A timeout can be taken anytime at the participant's discretion.
- A restart can only be taken if there is a genuine technical fault in the robot. Team ROBOTIX may refuse a restart if the reason is not genuine enough, and their decision will be binding and final.

Robot Specifications

- Each robot can have a maximum dimension of 30 x 30 x 30 cubic cm (L x B x H) respectively in its most concise form.
- No part/mechanism of/on the robot should exceed the given dimensions before the commencement of the event run. The robots can exceed their respective dimensions once the event commences, due to elongation of arms/gripper/forklift. However, Team ROBOTIX gets the final say in deciding whether the advantage is fair or not.
- There is no weight restriction on the robot.
- LEGO kits or its spare parts or pre-made mechanical parts are not allowed.
- Ready-made gearboxes, sensors, development boards can be used but no other part of the robot should contain any ready-made components. Simple car bases with no extra features may be used.
- The bots should not damage the event arena in any way. If it does so, a penalty will be imposed on the team. The magnitude of the penalty will be decided by Team ROBOTIX.

- The use of ready-made gripper is allowed.

Scoring

Round 1

Positives

- Base score: 500
- Picking and placing blocks
 - Block 1: 100 (B1)
 - Block 2: 100 (B2)
- Picking and placing each plank: 150 (P1, P2)
- Crossing the first path: 150 (S1)
- Crossing the diverging path: 200 (S2)
- Crossing the converging path: 200 (S3)
- Time bonus: number of seconds left(t')*2

Negatives

- Dropping a block: -25 (E1)
- Dropping a plank: -50 (E2)
- Disbalance or slipping of the robot: -50 (E3)
- Falling off the arena: -100 (E4)
- Dragging a block or plank across the arena: -25 (E5)
- Negative marks for each timeout: -100 (T)
- Negative marks for restart: -200 (R)

Scoring formula:

```
500 + (100 * B1 + 100 * B2) + 150 * (P1 + P2) + (150 * S1 + 200 * S2 + 200 * S3) - (25 * E1 + 50 * E2 + 50 * E3 + 100 * E4 + 25 * E5 + 100 * T + 200 * R) + t' * 2
```

Round 2

Positives

- Base score: 500
- Picking each block from the rotating table: 100 (M1, M2)
- Placing of the block into the correct cavity: 50 (N1, N2)
- Picking and placing of each plank: 100 (P1, P2)
- Crossing the circular path: 150 (S1)
- Crossing each sloping diverging paths: 200 (S2)
- Crossing each sloping diverging paths: 200 (S3)
- Time bonus: number of seconds left(t') * 3

Negatives

- Dropping a block: -25 (E1)
- Dropping a plank: -50 (E2)
- Disbalance or slipping of the robot: -50 (E3)
- Falling off the arena: -100 (E4)
- Dragging a block or plank across the arena: -25 (E5)
- Negative marks for each timeout: -100 (T)
- Negative marks for restart: -200 (R)

Scoring formula:

```
500 + 100 * (M1 + M2) + 50 * (N1 + N2) + 100 * (P1 + P2) + (150 * S1 + 200 * S2  
+ 200 * S3) - (25 * E1 + 50 * E2 + 50 * E3 + 100 * E4 + 25 * E5 + 100 * T + 200  
* R) + t' * 3
```

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