

# **ENGLYMPICS CONCORDIA 2021**

## **Senior Design Competition**

**Date: Saturday, November 13th**

**Erman Akman, Vice-President of Competitions of the ECA (Editor)**

**Gloria Anastasopoulos, Director of Competitions of the ECA (Editor)**

**David Gervais - Jean-Simon Dick Boisvert - Nicolas Toupin, Leaders of Senior  
Design Competition of CQI (Original Authors)**

# Table of Contents

<b>Table of Contents</b>	<b>1</b>
<b>Context</b>	<b>2</b>
Presentation	2
Task Description	2
<b>Rules and Restrictions</b>	<b>3</b>
Team Composition	3
Time	3
Trial Procedure	3
Remote Control	3
Reparation	3
Course Dimensions	3
Engine Dimensions	4
Internet Access	4
Course Description	4
<b>Contest</b>	<b>5</b>
Concept	5
<b>Conception Phase</b>	<b>6</b>
Material	6
Electrical Supplies	6
Mechanical Supplies	7
Tools	8
<b>Evaluation Criteria</b>	<b>9</b>
<b>Score</b>	<b>10</b>



# Context

## Presentation

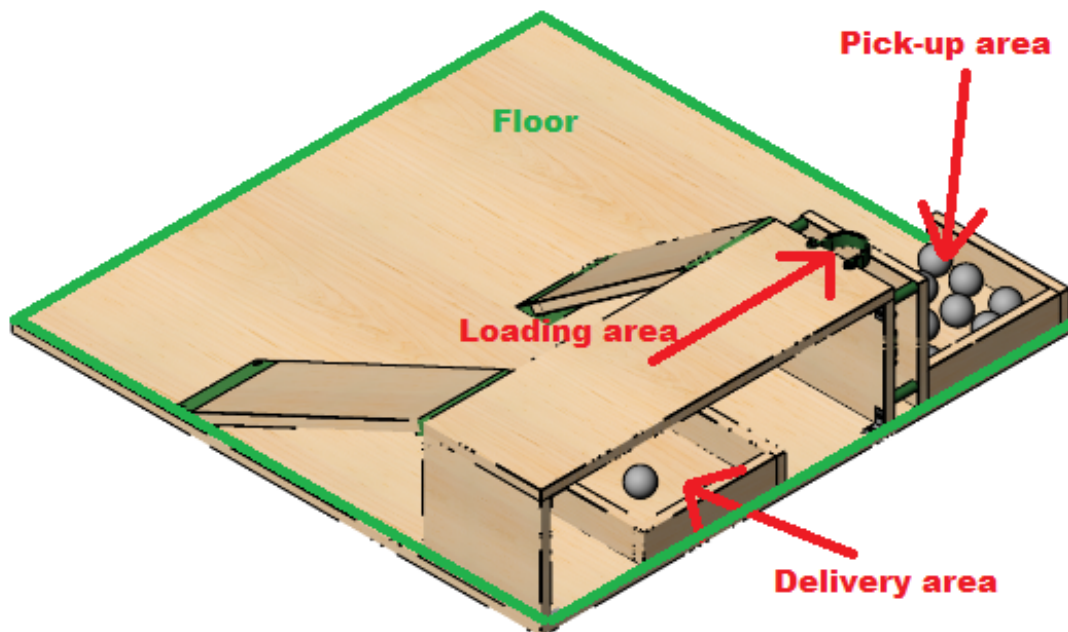
The 4.0 Industry has been around for a while. It is time to make the best of this technology and with this preparatory challenge, you must use your knowledge to perform at the senior conception. During this challenge, you will have to build an engine that will help you to perform tasks in a limited time. Be strategic!

## Task Description

Build a robot that will be able to transport ping pong balls around the course.

Steps to follow:

- Retrieve the balls from the supplier (pick-up area)
- Transport balls to the factory's loading area
- Retrieve the balls from the factory's unloading area
- Transport balls to the client (delivery area)



# Rules and Restrictions

## Team Composition

Teams of 4 students in engineering.

## Time

Teams have:

- 8 hours for the conception and construction of a robot. This includes the time needed to prepare the presentation.
- 10 minutes to do the trials. Time calculation begins when the engine is on the course. Any manipulation or repair must be performed during the time reserved for the trials.
- 8 minutes for the presentation and 5 minutes for the question period.

## Trial Procedure

Each team has 10 minutes to do an unlimited number of trials.

## Remote Control

Robots can only be controlled using a computer connected with a USB cable to their robot. Teams have different options, like a direct transfer of the keyboard buttons to the Arduino IDE terminal.

## Reparation

During the final trials, repairs must be from pieces that were on the engine since the first trial, before starting it up. No piece should be added after the conception phase.

## Course Dimensions

The course dimensions must be measured directly by the teams during the conception and construction phase.



## Engine Dimensions

The robot must measure a maximum of 20 cm wide by 20 cm long by 20 cm high during the beginning of the first trial. After the start of the first trial, the robot does not have to follow the prescribed dimensions.

## Internet Access

Internet access is allowed throughout the competition; however, it is forbidden to communicate or have contact with anyone who is not part of the team.

## Course Description

The course has a base floor and two slopes directing to an elevated floor. The entire surface is made of plywood, except for the joints between the 3D plastic slopes and floors.

The base floor includes:

- The pick-up area
- The delivery area

The slopes have different corners. The steepest slope is the closest to the loading area, which is at the end of the elevated floor.

The competitors will receive a .STEP file of the course. However, the dimensions may vary. Therefore, it is highly recommended to verify all dimensions with the real-life course.



# Contest

## Concept

When a ball falls into the loading area, it automatically goes to the unloading area in approximately **15 seconds**. There will be a total of **25 ping pong balls** available at the pick-up area.

There will be 3 different options for scoring:

- If a ball is taken from the pick-up area and directly dropped to the delivery area (without going through the loading area), it counts for **1 point**.
- If a ball is taken from the pick-up area and dropped to the loading area, it counts for **3 points**.
- If a ball is taken from the pick-up area, dropped to the loading area, caught before it touches the floor and dropped to the delivery area, it counts for **5 points**.

To clarify:

- If a ball touches the ground or goes outside the course's limits after going through the loading area, it cannot be picked up again and counts for 3 points.
- If a ball touches the ground or goes outside the course's limits while it is being carried by the engine, it counts as 0 points.
- If a ball dropped to the loading area does not go to the unloading area for a reason unrelated to the participants, it will be manually dropped into the loading area again.
- If a ball falls outside the course's limits for any other reason (unrelated to the participants), it goes back to the pick-up area.

The goal is to score as many points as possible. Scores will be calculated by normal distribution, taking in consideration the gap between the average and the standard deviation.

The team with the highest score will get an increased mark to 100%. Teams will receive Excel documents on which the scores will be calculated so they can have an idea of how the final scores will be compiled.



## Conception Phase

During the first 2 hours of the contest, each team will be able to access the course to take pictures, measurements or get informed about any useful information. After, teams will have to register to a waiting list if they desire to test their vehicle for a 10-minute period. Following the trials, teams will get the chance to register again to the waiting list. For everyone to have access to the same information, the responsible for the contest will share every question asked, with the response, to each team.

## Material

The environmental footprint will be calculated every time a piece is used, in totality or partially, for the robot's conception. That way, there will be no difference when a team uses one piece or a set of pieces from the same type. Only the materials on the robot during the official trials will be counted.

## Electrical Supplies

Item	Quantity	Environmental Footprint
Arduino Uno with USB micro cable	1	10
AA Battery	12	15
Cradle for 4 AA batteries	1	5
9V Battery with connector	2	10
DC Motor	2	5
Motor Controller(Arduino)	1	7
Small Servomotor	2	5
Switch	1	3
Limit Switch	2	1
Black Electrical Wire (meters)	1.5	2
Red Electrical Wire (meters)	1.5	2
Soldering Wire	1	1



## Mechanical Supplies

Item	Quantity	Environmental Footprint
Popsicle Sticks	50	1
Cut Plywood Pieces	6	3
Wooden Dowel $\frac{1}{4}$ in Dia (12 inches)	5	1
Styrofoam (12" by 12")	1	5
Rubber Band	20	2
String (meters)	2	1
Hot Glue Stick	10	2
Metal String (meters)	4	2
Wheel	2	5
Wooden Skewer	10	1
Clothespin	5	1
Straws	10	3
Electric Tape Roll	1	1
Duct Tape Roll	1	2
Ping Pong Balls (Testing)	2	0



## Tools

### By Team

- Hot glue gun
- Measuring Tape
- Scissors
- Exacto Knife

### In Common

- Soldering Iron
- Wire Cutter
- Wire Stripper
- Cutting Pliers
- Stripping Pliers
- Needle-Nose Pliers
- Multimeter



## Evaluation Criteria

Teams will have to do an oral presentation of their conception before the trials. During the presentation, the designers shall do an estimate of the points they would win during the contest. The weighting associated with this prediction is in the Trial Criteria grid. The weighting associated with the presentation is in the Presentation Criteria grid. Each team has a maximum of 8 minutes for the oral presentation and 5 minutes to respond to the judge's questions, if applicable.

Presentation Criteria	Weighting
Presentation of alternative solutions	5
Presentation of conception process	5
Presentation of chosen solution	10
Presentation quality	5

Trial Criteria	Weighting
Contest (Note calculated with Z rate (Normal Law))	50
Prediction $R1 = P1(1 - ABS(Best\ trial - Prediction)/Prediction)$ $P1 = \text{Maximum weighting in the left column}$ $R1 = \text{Prediction result}$	10
Environmental footprint <i>*The team with the lesser environmental footprint has the rank 1</i> $R2 = [A - (R - 1)/A] * P2$ $A = \text{Number of teams}$ $R = \text{Environmental rank}$ $P2 = \text{Ponderation}$ $R2 = \text{Environmental print results}$	15



## Score

### **Presentation Criteria**

Presentation of alternative solutions	/5
Presentation of conception process	/5
Presentation of chosen solution	/10
Presentation quality	/5
<b>Section Total</b>	<b>/25</b>

### **Trial Criteria**

Contest	/50
Prediction	/10
Environmental footprint	/15
<b>Section Total</b>	<b>/75</b>

