



# JOINT INSTITUTE

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## 交大密西根学院

UNIVERSITY OF MICHIGAN - SHANGHAI  
JIAOTONG UNIVERISTY JOINT INSTITUTE

VG100 INTRODUCTION TO ENGINEERING

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## Project One - Rule and Grading Rubrics

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## 1 Introduction

In project one, students will design and construct their own robot to participate in a competitive game. The game gives students opportunities to understand how a basic robot works. This includes sensing, control, and logics.

The project one is called the "Naval Battle". In a naval battle, the battleships shoot each other by their cannons. In this game, we use Ping Pong balls and Wooden balls to represent the cannon balls. Students need to design a robot that can move the cannon balls to the enemy's territory. Within a limited time, the player who gets the highest points wins.

## 2 Field Setup

The field is shown in the figure below. All units are millimeters. The **2000mm\*1500mm rectangular area** is divided into two symmetrical parts. The wall in the middle does not touch the ground. It leaves a **gap of 50mm** between the bottom part of the wall and the ground. The wall itself has a **height of 70mm** and **width of 18mm**.

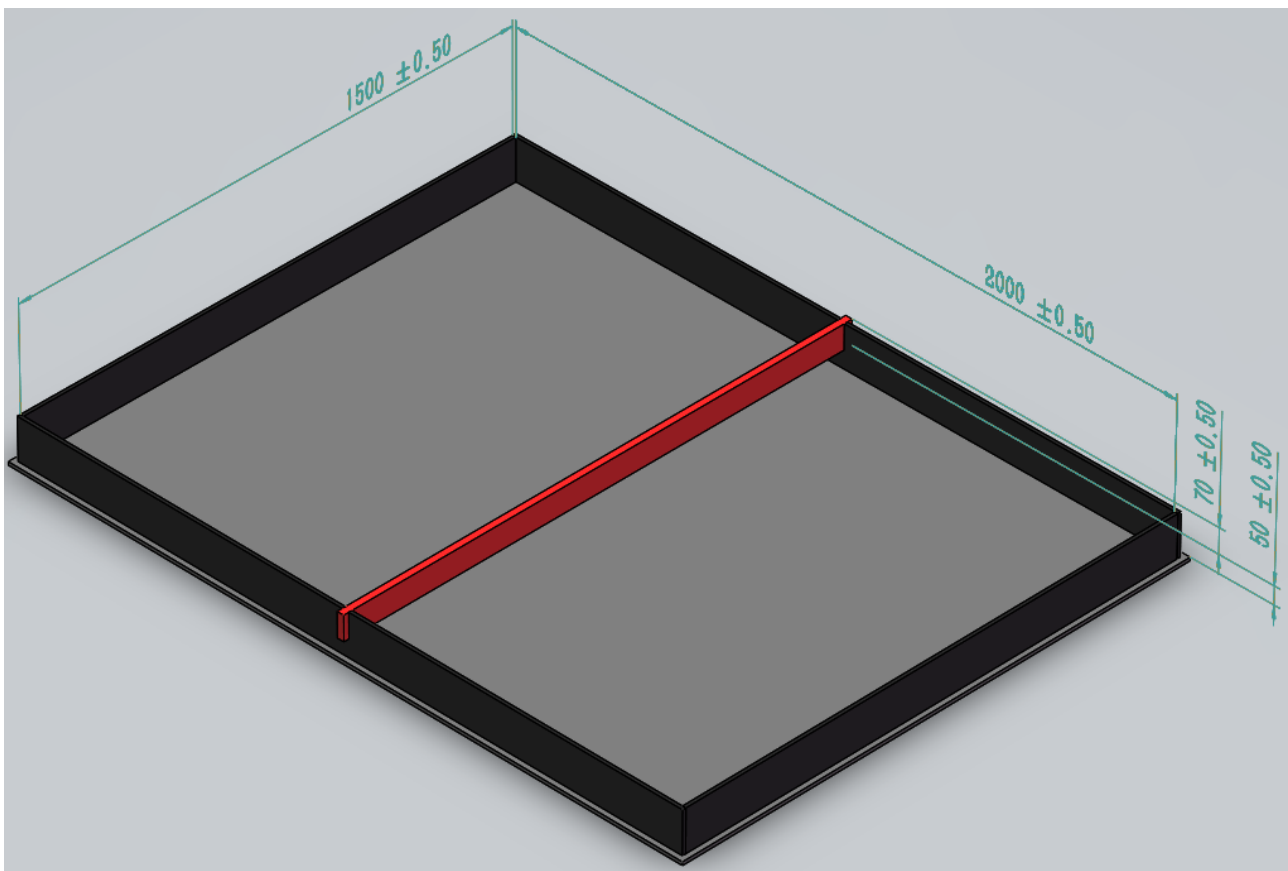


Figure 1: Field for the Naval Battle

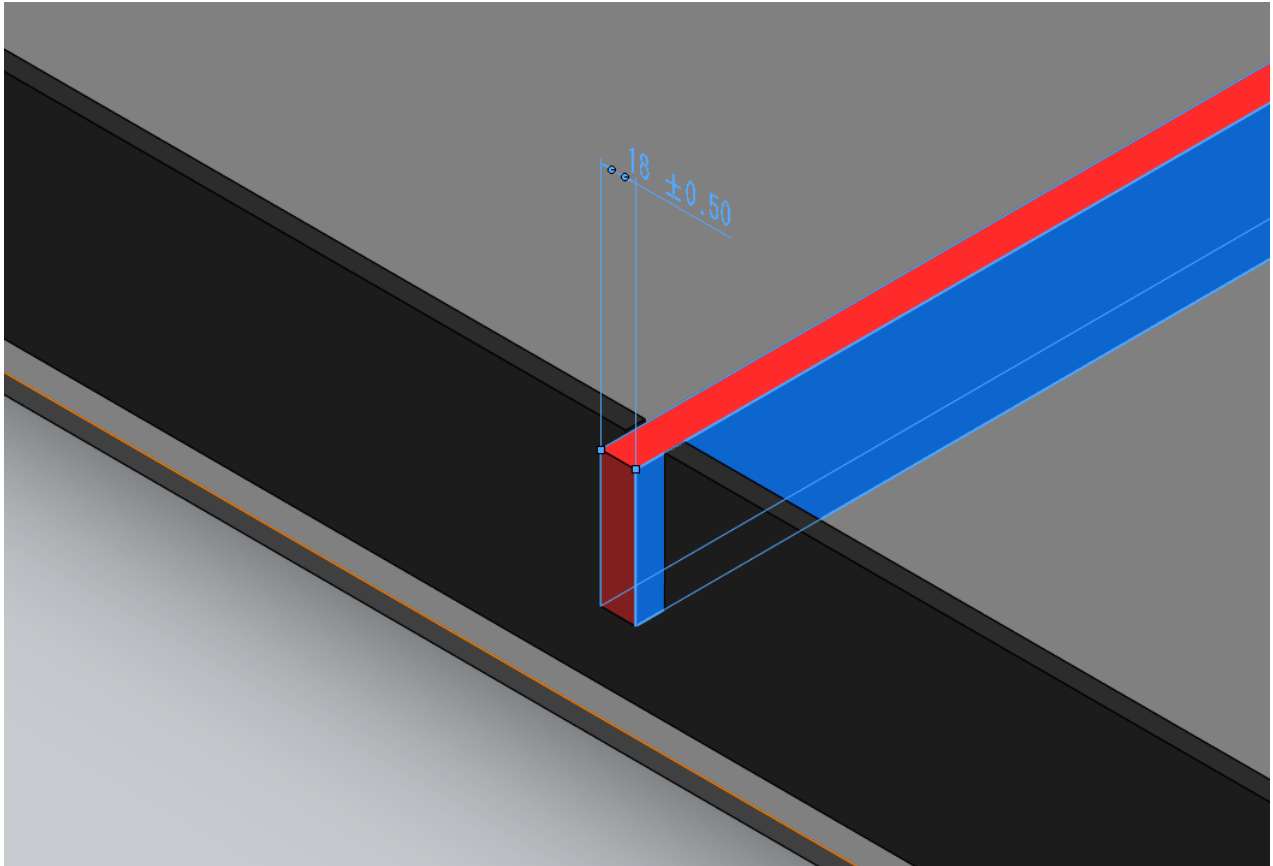


Figure 2: Detailed Picture of the Wall

There are two types of balls on the field. The first one is the Ping Pong ball with a **diameter of 40mm**. The larger ball is the wooden ball with a **diameter of 70mm**. This means the larger ball cannot go through the gap directly. The students need to find their own methods to get the larger ball into the opponent's territory. We will use **8 small balls and 4 large balls** in the competition.

### 3 Procedure

Before the game starts. All 24 balls of two different colors, 12 aside, will be placed by the teaching assistants in the designed positions. For example, the figure below shows the positions of the balls. The small balls lie in the small circle and vice versa.

Please note that this figure is only for reference. The arrangement of the balls during the game day **may not be** the same as the one shown in the figure. However, the numbers of the balls will always be **8 small balls and 4 large balls**.

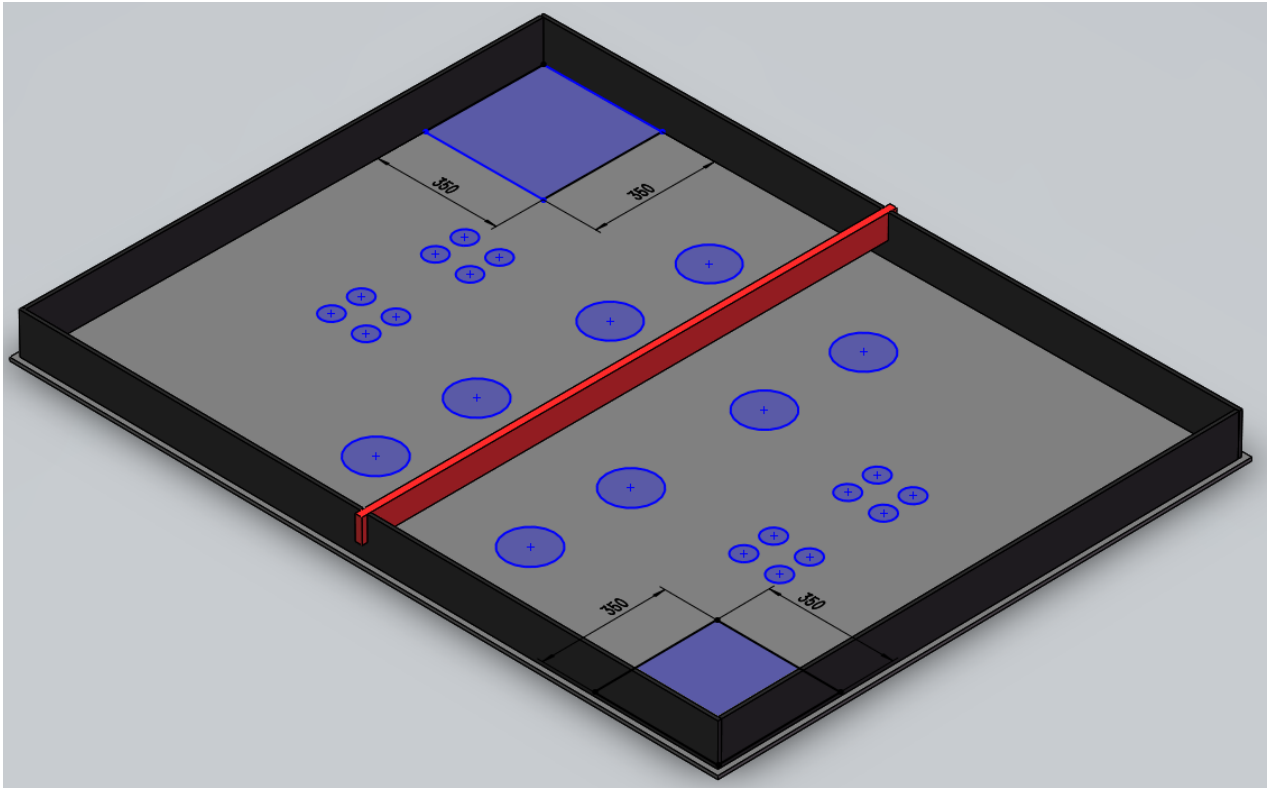


Figure 3: Setup before the Game

Two teams will start in the rectangular areas in both corners. The area is of 350mm\*350mm in dimension. The time limit for the game will be **3 minutes**.

## 4 Rule

All robots must be fit into the starting rectangular areas of 350mm\*350mm. The highest part of the robots must not exceed **the limit of 200mm**. Students may design their robots to be transformable, which means the robots only need to satisfy the above conditions at the beginning of the competition.

Motors other than the ones we provide are banned. However, we do not have any limitation on servo motors.

Each group will first complete the match without an opponent. The eight groups with the highest scores will play against each other.

To sum up,

- Time limit: 3 minutes
- Dimension limit for robots: 350mm\*350mm\*200mm
- Only the motors we provide are eligible
- Players are allowed to move opponent's ball back to the opponent's territory
- The score will be counted at the end of the game

- The ranking will be determined by the following order
  1. Total score
  2. The number of the large balls on the opposite side
- If two teams are of the same ranking, an additional **1-minute** match between these two teams will be held.

The competitive part will be held like a tournament. See the figure below.

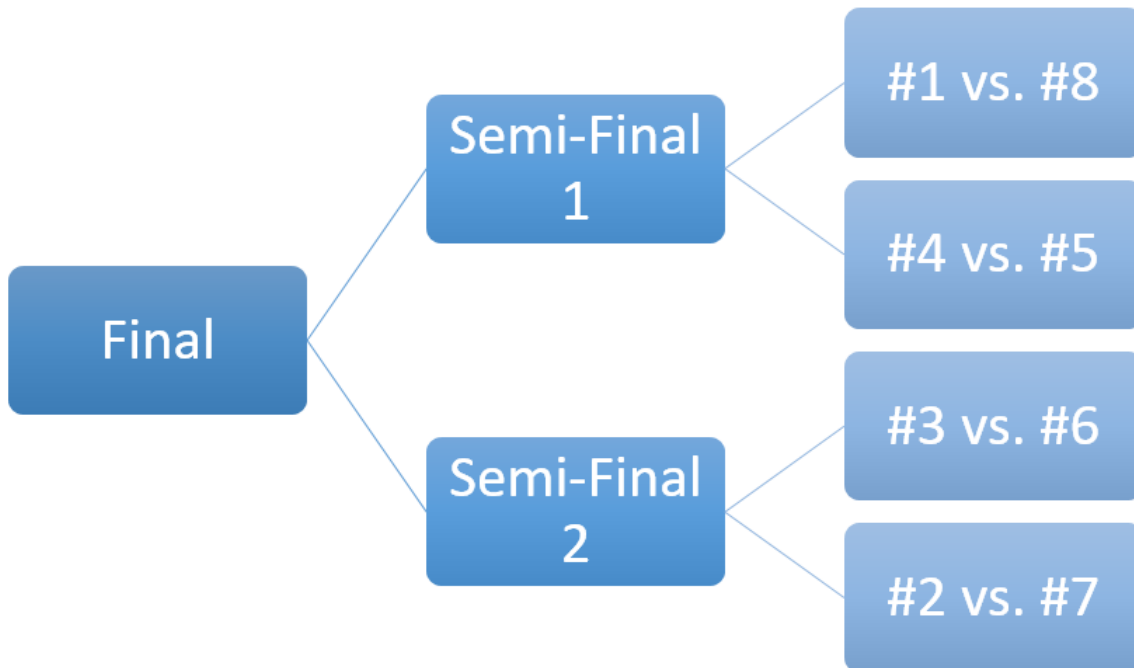


Figure 4: Competitive Part

## 5 Grading Rubrics

At the end of the game,

- if the balls fall on the opponent's territory,
  - The small ball counts as **1 points**
  - The large ball counts as **4 points**
- If the balls fall on their own territory,
  - The small ball counts as **0 point**
  - The large ball counts as **0 point**
- For any ball under the wall in the middle, which means the vertical projection of the wall is on the balls,
  - The small ball counts as **0 point**
  - The large ball counts as **0 point**

- If the ball is knocked out of the field by one of the team,
  - Deduction of **2 points** will be made on the team's total score for each small ball
  - Deduction of **5 points** will be made on the team's total score for each large ball

For groups that uses laser to guide their robots, or any other innovative ways to control their robots, extra credit will be given in the design part.

Project One Group Score =  $90\% * (\text{Ball Score}/24) + 5\% * (\text{Design Score}/5) + 5\% * (\text{Competition Score}/5)$

The right of final interpretation belongs to Prof. Shane.