

# **WRO2013**

## **Regular Category**

### **Senior High School**

Game description, rules, & scoring

## **KOMODO ISLAND**

# 1. Prelude

Komodo is one of the 17,508 islands that make up the Republic of Indonesia. The island is particularly notable as the natural habitat of the Komodo dragon, the largest lizard on earth and consequently named after the island. Komodo has a surface area of 390 km<sup>2</sup> and a permanent population of over 2,000.

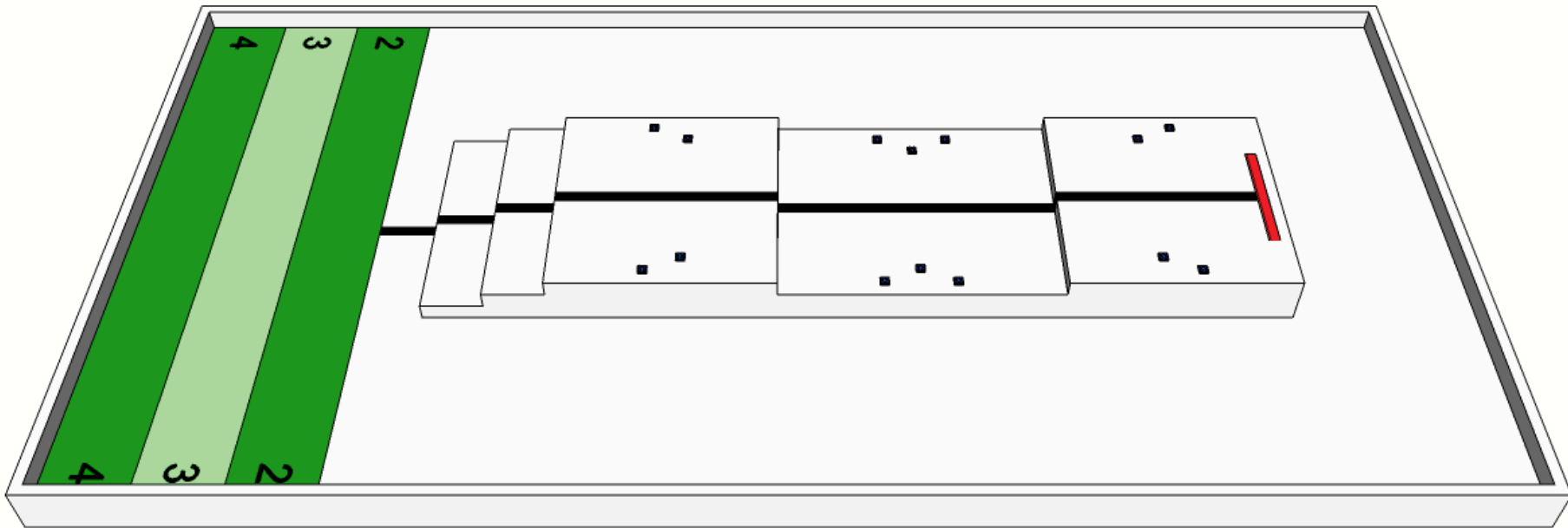
The Komodo dragon (*Varanus komodoensis*), a member of the monitor lizard family (*Varanidae*), is the largest living species of lizard, growing to a maximum length of 3 metres (9.8 ft) in rare cases and weighing up to around 70 kilograms (150 lb). Their unusual size has been attributed to island gigantism, since there are no other carnivorous animals to fill the niche on the islands where they live.

Mating begins between May and August, and the eggs are laid in September. About twenty eggs are deposited in abandoned megapode nests or in a self-dug nesting hole. The eggs are incubated for seven to eight months, hatching in April, when insects are most plentiful. Young Komodo dragons are vulnerable and therefore dwell in trees, safe from predators and cannibalistic adults. They take about eight to nine years to mature, and are estimated to live for up to 30 years.

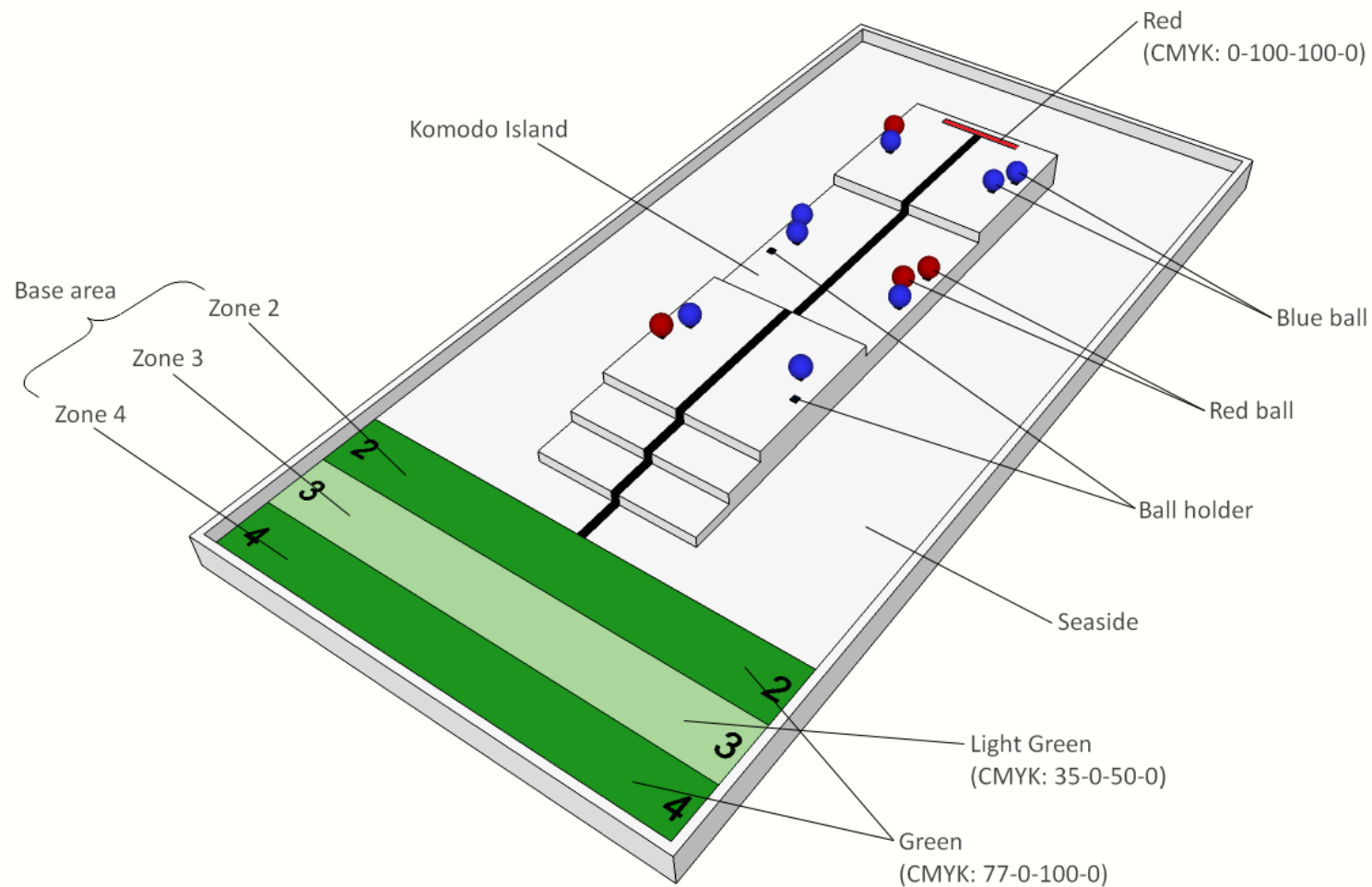
Komodo dragons were first recorded by Western scientists in 1910. Their large size and fearsome reputation make them popular zoo exhibits. In the wild their range has contracted due to human activities and they are listed as vulnerable by the IUCN. They are protected under Indonesian law, and a national park, Komodo National Park, was founded to aid protection efforts. (Wikipedia)

## 2. Challenge

### 2.1. Game Table in 3D



## 2.2. Table Definitions



- "Komodo Island" is all the elevated platform on the table.
- "Seaside" is the white area surrounding "Komodo Island"

## 2.3. Challenge Objects

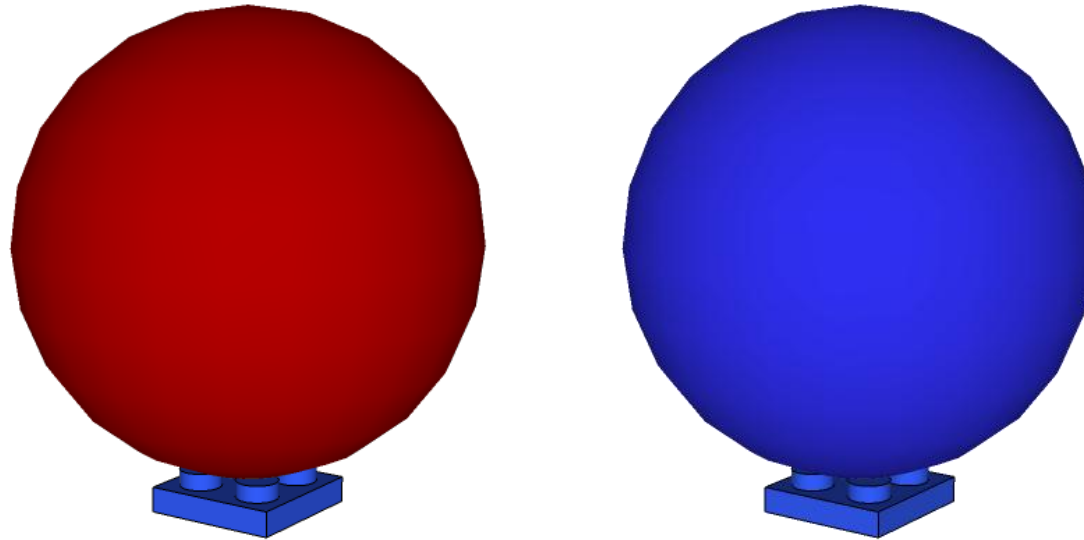


Figure 1. Red and blue ball on top of a "ball holder".  
(#9797 LEGO MINDSTORMS Education NXT Base Set ball + LEGO plate 2×2)

- Red balls represent Komodo eggs which must be preserved. Blue balls represent other species' eggs.

## 2.4. Challenge Overview

The robot's mission is to travel around the Komodo island, collect and count the number of Komodo eggs, and carry them back to the Base area. Only the Komodo eggs should be collected and carried back to the Base area. Other species eggs may not be removed from their original places.

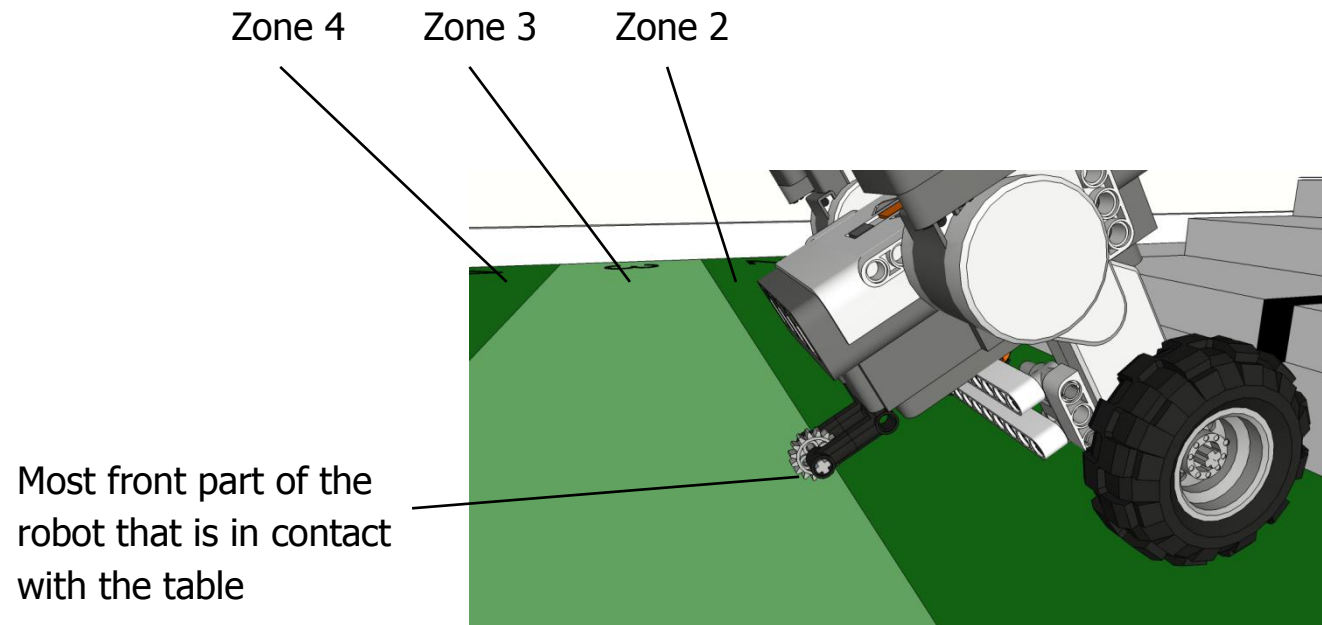
The robot can solve the challenge in different ways: either it goes on the "Komodo Island" or around the "seaside" to collect the eggs.

## **3. Match Definition**

### **3.1. Rules & Regulation**

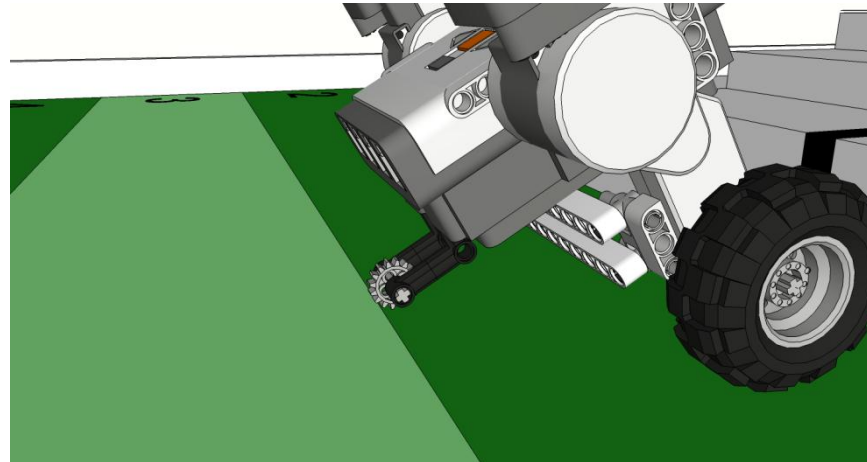
1. The maximum dimensions of the robot before it starts are 250 mm × 250 mm × 250 mm. After it starts, the dimensions of the robot are not restricted.
2. Before starting the challenge, the robot must be placed within the Base area (Zone 2, Zone 3, and Zone 4 are all defined as Base area). Once physical adjustments have been made to the satisfaction of the participants, the judge will give the signal to start. No part of the robot is allowed to exceed the Base area before it starts.
3. The robot's mission is to travel around the Komodo Island, collect and count all the red balls, and carry them back to the Base area. Only the red colored balls should be collected and carried back to the Base area. The blue colored balls must not be removed from their original places (on top of a "ball holder").
4. A red ball is considered to be "carried" only if the ball remained within contact with the robot and not having contact with the table after the end of the challenge (a ball which is in contact with the table will not be considered as "carried").
5. The number of red and blue balls, along with their positions on the table, will be randomly decided at the start of each round (post-quarantine). The total number of balls is 12. For example, if the number of red balls is 2, the number of blue balls will be 10; if the number of red balls is 4, the number of blue balls will be 8.
6. There are 14 ball holders but only 12 of them will be used (there will be 2 empty ball holder; see 2.2. Table Definition). The positions of the balls will be fixed for all participants in that particular round.
7. The number of red balls used in one particular round will determine the required "finish position". For example, if the number of red balls is 2, the robot must stop in Zone 2. If the number of red

- balls is 4, the robot must stop in Zone 4.
8. The robot is considered to have returned to the Base area and the time is stopped if any part of the robot has pass the Base area. After the robot has stopped completely, the most front part of the robot that is in contact with the table (for example, a wheel or any other part that is in contact with the table) will determine its "finish position" (whether it is in Zone 2, Zone 3, or Zone 4). See illustrations below for details.



(a) Finish position of the robot is Zone 3.





(b) Finish position of the robot is Zone 2

9. The robot is free to choose its own route for collecting the balls (for example, left, middle black line, or right).
10. Your attempt and time will end if:
  - a. Robot is touched by any team member after it starts.
  - b. Challenge time (2 minutes) has ended.
  - c. Robot has returned to the Base area.
  - d. Participant call for "Stop" of the match.
  - e. Violation of the rules and regulations herein.

## 3.2. Scoring

1. Score will only be calculated at the end of the challenge.
2. Red ball removed from their original position = 5 points per ball.
3. Blue ball untouched (remained in their original position at the end of the challenge) = 5 points per ball.
4. At least one (1) red ball "carried" back to the Base area = 10 points.
5. All red balls carried back to the Base area = 20 points.
6. Robot stopped at the correct "finish position" = 10 points.
7. Maximum score = 100 points.
8. If teams acquire the same score, ranking is decided by the fastest time.

Red ball		Blue ball		At least one red ball carried to Base	All red balls carried to Base	Finish position	
Removed from original position	Stay on original position	Removed from original position	Stay on original position			Correct zone	Incorrect zone
5 pts per ball	0 pt	0 pt	5 pts per ball	10 pts	20 pts	10 pts	0 pt

Table 1. Score allocation.

### 3.3. Scoring Example

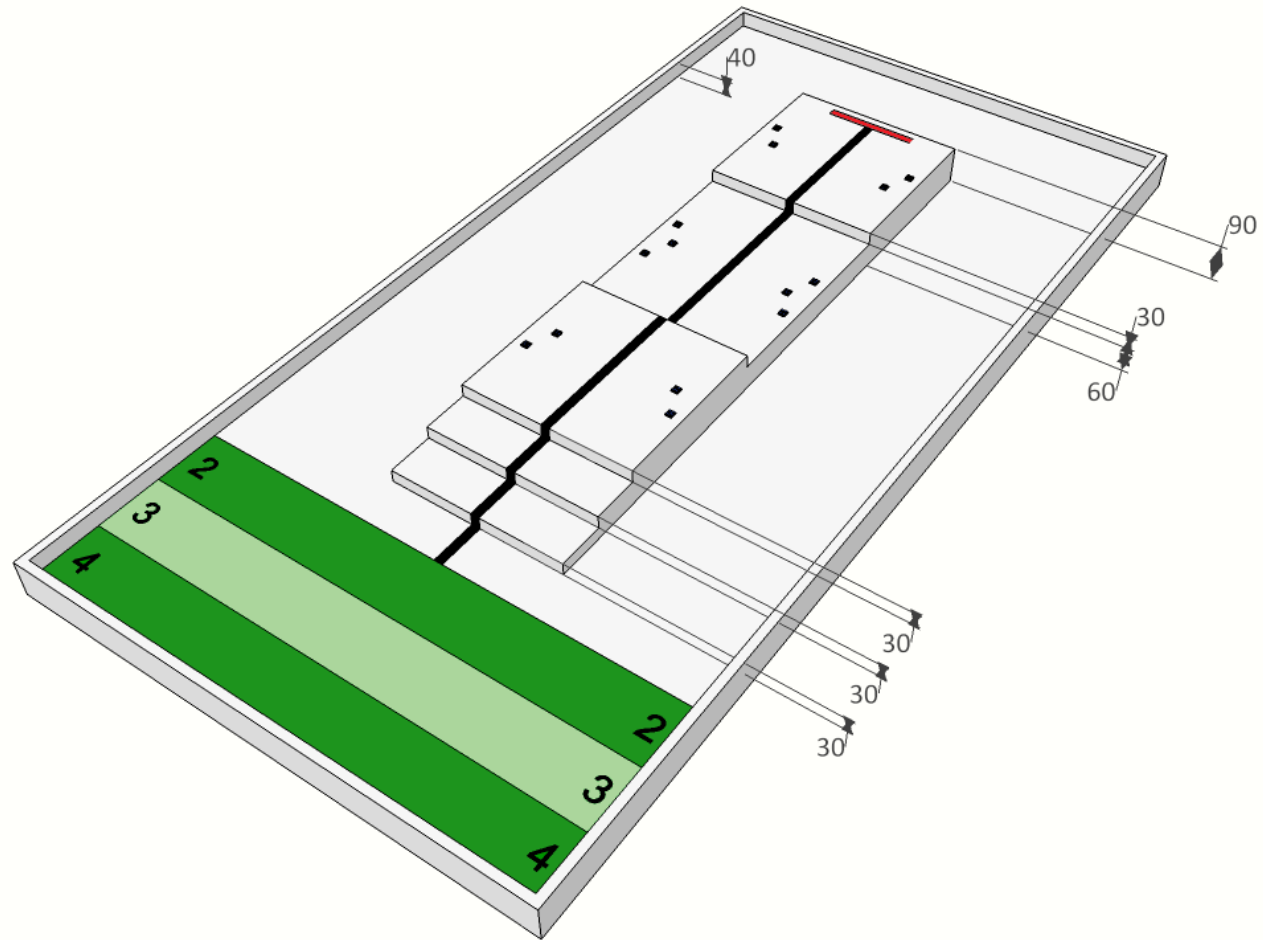
		Round 1 (2 red ball, 10 blue ball)		Round 2 (3 red ball, 9 blue ball)	
		Team A	Team B	Team A	Team B
Red ball	Removed from original position	2 balls (2×5 pts = 10 pts)	2 balls (2×5 pts = 10 pts)	2 balls (2×5 pts = 10 pts)	3 balls (3×5 pts = 15 pts)
	Stay on original position	0 ball (0×0 pts = 0 pts)	0 ball (0×0 pts = 0 pts)	1 ball (1×0 pts = 0 pts)	0 ball (0×0 pts = 0 pts)
Blue ball	Removed from original position	0 ball (0×0 pts = 0 pts)	2 ball (2×0 pts = 0 pts)	2 ball (2×0 pts = 0 pts)	1 ball (1×0 pts = 0 pts)
	Stay on original position	10 balls (10×5 pts = 50 pts)	8 balls (8×5 pts = 40 pts)	7 balls (7×5 pts = 35 pts)	8 balls (8×5 pts = 40 pts)
At least one red ball carried to Base		2 balls (10 pts)	1 balls (10 pts)	2 balls (10 pts)	3 balls (10 pts)
All red ball carried to Base		Yes (20 pts)	No (0 pts)	No (0 pts)	Yes (20 pts)
Finish position	Correct zone	Yes (Zone 2) (10 pts)	Yes (Zone 2) (10 pts)	No (Zone 4) (0 pts)	No (Zone 4) (0 pts)
	Incorrect zone	No (Zone 2) (0 pts)	No (Zone 2) (0 pts)	Yes (Zone 4) (0 pts)	Yes (Zone 4) (0 pts)
Mission time		00:45.18	00:40.20	00:55.12	01:03.20
Final score		100 pts (10+0+0+50+10+2 0+10+0)	70 pts (10+0+0+40+10+0 +10+0)	55 pts (10+0+0+35+10+0 +0+0)	85 pts (15+0+0+40+10+2 0+0+0)

Table 2. Scoring example.

Verdict: Team A win.



## 4.2. Vertical Dimensions



- All size is in mm.

## 4.3. General Information

1. The size of the game table is 2400 mm × 1180 mm.
2. Base consists of three zone: Zone 2, Zona 3, and Zone 4 (see Table Descriptions).
3. The size of Zone 1, Zone 2, and Zone 3 is 1180 mm × 150 mm. The total size of the entire Base area is 1180 mm × 450 mm.
4. Komodo Island is located at the center of the table. See 4.1 and 4.2 for detailed information of its size.
5. The height of the wall is 40 mm.
6. The width of the black lines and red line is 20 mm.
7. There are 14 ball holders which are spread in Zone A, Zone B, and Zone C (see Table Specification I and II). Ball holder is made of LEGO plate 2×2 which is attached to the top of the island.
8. There are a total of 12 balls, consists of:
  - a. Minimum two (2) and maximum four (4) red ball.
  - b. Minimum eight (8) and maximum ten (10) blue ball.
9. The balls in used came from the #9797 LEGO MINDSTORMS Education Base Set.