

# Testing Document

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GROUP 11

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## **Abstract**

This document will outline the tests in preparation for the final competition. The purpose of this document is to outline the tests done, show the recorded values for each test and present the evaluations for each test result.

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# 1 EDIT HISTORY

- Monday February 27th:
  - Ian Smith: initial set-up of document and start of Test 1 (section 2.1)
- Week of Feb 27 - 5th:
  - Ian Smith: Completion of Test 1 (section 2.1)
- Wednesday March 8th
  - Alex Lam: General formatting

## 2 Parts Testing

### 2.1 Motors

#### Test 1:

This test was done on February 27, 2017 by Ian Smith.  
8 Motors are being tested. 4 NXT Motors and 4 EV3 Motors.

Testing will be done by having each motor timed for a rotation of 360 degrees at a fixed velocity. 5 trials will be done for each motor and then the mean will be calculated. The mean will be used to determine which motors will be used.

The Mean is:  $\mu = \frac{1}{N} \sum_{i=1}^N \Delta X$  ;

Where:

- N: number of trials
- X: data sample

**Table 1:**

Trial	Motor 1	Motor2	Motor 3	Motor 4
1	2.62	2.64	2.65	2.72
2	2.54	2.62	2.65	2.76
3	2.94	2.56	2.53	2.56
4	2.48	2.68	2.64	2.74
5	2.58	2.57	2.68	2.60

- Motor 1:  $\mu = 2.63$
- Motor2:  $\mu = 2.61$
- Motor 3:  $\mu = 2.63$
- Motor 4:  $\mu = 2.68$

**Table 2:**

Trial	Motor 5	Motor 6	Motor 7	Motor 8
1	2.54	2.59	2.51	2.54
2	2.50	2.60	2.60	2.49
3	2.55	2.63	2.58	2.69
4	2.56	2.60	2.59	2.55
5	2.56	2.68	2.53	2.49

- Motor 5:  $\mu = 2.54$
- Motor 6:  $\mu = 2.62$
- Motor 7:  $\mu = 2.56$
- Motor 8:  $\mu = 2.55$

Motors 5, 7 and 8 will be used for the project based on the results. These motors will be tested again at each milestone.

Sources of Error: Incomplete definition - The measurement for the rotations are not defined. The reaction time of the person controlling the stopwatch needs to be taken into consideration.

## 2.2 Ultrasonic Sensor

## 2.3 Light Sensor

The light sensors will be tested using the Red test function found on the EV3 brick. We will be testing the accuracy of the light sensors by moving the light sensor from a white tile to a black tile and recording the number shown on the EV3 brick after 2 seconds.

# 3 Localization

## 3.1 Timing

(How long it takes on average to localize)

## 3.2 Odometer and Positioning

(Testing numbers displayed against physical measurements)

## **4 Navigation**

### **4.1 Odometer**

(Test movement on grid)

### **4.2 Square Driver**

This test is used to ensure the recorded track length corresponds to the odometer's navigation.

### **4.3 Obstacle avoidance**

(Is the robot able to avoid obstacles in different positions?)

## **5 Ball Retrieval**

### **5.1 Getting to the ball dispenser**

(Test navigation to the ball dispenser to ensure retrieval)

### **5.2 Picking up ball**

(Test possible positions for the ball to be in for retrieval)

### **5.3 Placing ball onto launcher**

(Test how successful the robot is at placing the ball in a ready to launch position)

## **6 Shooting ball**

### **6.1 Distance**

(Test the distances the robot can shot from)

## **6.2 Bounce**

(Test the amount of times the ball bounces within the green zone before going to the goal)

## **6.3 Scoring**

(Test shots from different angles and distances)

# **7 Defense**

## **7.1 Navigation**

(Gets to the defense zone)

## **7.2 Localization**

(Same as before)

## **7.3 Blocking**

(Test responsiveness of blocking arm)

# **8 GLOSSARY OF TERMS**

- Requirements document: Separate document in which the requirements of the project are outlined and discussed in detail.
- Mindstorm EV3 kit: This is the hardware kit containing the majority of the hardware components to be used in this project.
- API: The Application program interface is a set of routines, protocols, and tools for building software applications
- Java Lejos API: The firmware used in order to allow Java code to be executed on the Mindstorm EV3 device.
- Noise: unwanted data reported by devices that causes error in performance