Introduction to Robotics
Lego Mindstorm NXT

Name (first & last) _____

Team Name _____

Table Number _____

Period number _____

NXT- Task Assignment
"Moving Straight"

As a team, work to develop the project outlined below. Each of these steps must be *demonstrated* successfully to one of the other teams. That team will then sign off indicating you were successful.

Date	**Robot Building**	Sign-off
	Robot constructed according to instructions	

Date	**Programs**	Sign -off
	Move forward 3 rotations	
	Move forward 3 rotations/backwards 3 rotations	
	Move 1m, using proportional math to determine duration needed	

Show proportional math used to move 1m below:

Click on the last step, #14, in the ***Moving Straight*** video and follow the steps to complete the

***Close Shave Challenge*:**

Use the provided layout and have another team sign off on your demonstration, before arranging with the teacher for your ***Close Shave Challenge*** presentation. On the back of this sheet, explain in detail the mathematics you used to complete ***Close Shave***, and be prepared to explain it as you demonstrate the challenge.

Date	***Close Shave Challenge***	Sign-off
	Math for Close Shave shown	
	Successful Close Shave	
	Successful completion of the challenge (on back)	**(Teacher)**

Task Assignment
"Arm Control"

As a team, work to develop the programs outlined below. Each of these completed programs must be *demonstrated* to one of the other teams. That team will then sign off indicating your program was successful.

Date	**Program**	**Sign-off**
	Gripper Close Program	
	Direction Challenge	

Fruit Picker

When you have completed this challenge, have another team sign it off before arranging with the teacher for your demonstrations. Be prepared to discuss your Flow Chart, NXT-G program details and how you overcame any difficulties that arose.

Date	**Challenge**	**Sign-off**
	Fruit Picker	
	Successful Fruit Picker Completion!!!	**(Teacher)**

Task Assignment

"Line Following"

As a team, work to develop the programs outlined below. Each of these completed programs must be *demonstrated* to one of the other teams. That team will then sign off indicating your program was successful.

Date	Program	Sign-off
	Follow Straight Line for 15s (step #8)	
	Follow Straight Line Optimized for 10s (step #9)	
	Optimized to follow "S" Curve (step #10) _____(best time)	

Click on the last step, #11, and complete the **RoboSlalom Challenge**. When you have completed this challenge, have another team check it off before arranging with the teacher for your demonstration. Be prepared to discuss your Flow Chart, NXT-G program details and how you overcame any difficulties that arose.

Date	Challenge	Sign-off
	RoboSlalom Challenge	
	Successful RoboSlalom Challenge Completion!!! **Best time:_____**	**(Teacher)**

NXT- Task Assignment

"Move Until Dark"

VIEW video in Connect 1: "Boss, Urban Navigator."

VIEW Construct 3, "Lesson Overview," and answer questions 3.1 - 3.3

3.1_____

_____

3.2_____

_____

3.3_____

_____

VIEW Construct 4, "Move Until Dark," *Finding a Threshold*," answer questions 4.1- 4.3 and compute your robot's threshold.

4.1_____

_____

4.2_____

_____

4.3_____

_____

COMPUTE in the space below to find <u>your</u> threshold. Be sure it is **neat, well labeled** and **easy to read**.

VIEW Construct 3, "Move Until Dark," *Forward Until Dark*, and answer questions 5.1 - 5.3

5.1_____

_____

5.2_____

_____

5.3_____

_____

DEMONSTRATE "Move Until Dark," *Forward Until Dark*, first to a classmate and then to a teacher.

READ, **REVIEW AND STUDY** Construct 6, "Program Review," *Forward Until Dark Program.*

CHALLENGES: In order to reach 10/10, you must successfully complete both challenges below. Once you feel you have completed a challenge, demonstrate for another team first. Once they have signed off on it, then demonstrate for the teacher.

CHALLENGE 1: Complete 10.1, "The Intersections Challenge." Your "city block" must be a minimum of 12" x 16". The "stop lines should be 8" in length. Use blue tape for this challenge. (Will the blue tape change your threshold?) Display the dimensions of your "city block," next to the lines, measuring from the outside of the tape. Measurements must be accurate within ¼", and tape ends must be square.

Second group sign	Teacher sign

_____ 10 pts

Engineering Challenge #1
Light-Activated Robo-Dragster

Design, build & program a Dragster-Bot that:

5 pts- Begins racing at the removal of the starting "flag"

5 pts- Stops as a result of reaching the finish line (race is over when dragster comes to a stop)

5 pts- Stays within its racing lane

5 pts- Covers the track in the shortest time possible

5 pts- The Light Sensor must be at the back of the robot

Points _____ /30

+5 Fastest Dragster in Class

Criteria	Points Possible	Points Earned
Research: Use the Internet to research the appearance and behaviors of your animal. **Record at least 3 characteristics (appearance or behaviors) and describe how you will use your NXT or EV3 kit and/or program to simulate each characteristic.**	6 (1 pt per characteristic, 1 pt per description)	
Design: Use **only the parts from your NXT or EV3 kit**. **Your design must be your own** (do not use building tutorials found online). **Make a sketch of your robot before you build it, then make a sketch of the final product and list what you changed and what remained the same**. You must include **at least TWO sensors.**	6 (1 pt each for before/ after sketch, 1 pt each for changes/ same, 1 pt per sensor)	
Build: Robot is **completely built by the day of the Zoo Tour.**	3	
Program: Create a program that causes your robot to behave like the animal. You must **use the two sensors** that you included in your design. Your program should **be ready by the day of the Zoo Tour.**	4 (1 pt per sensor used, 2 pts ready on time)	
***Peer Evaluation:** Does your robot look like your animal?	3	
***Peer Evaluation:** Does your robot behave like your animal?	3	
TOTAL POINTS	25	

Design Challenge: Robo-Zoo

For this project, you will research, design, build, and program a robot that looks and behaves like an animal of your choice. Two groups cannot choose the same animal.

Use the criteria in the table below to help you complete your project by the deadline.

*On the day of the Zoo Tour, your classmates will evaluate your design and program for the "Peer Evaluation" Criteria. For each question, Yes = 3, Sort Of = 2, No = 1. Class scores will be averaged to determine your grade for these portions.

Draw your DESIGN BELOW:

Introduction to Programming
Lego Mindstorm NXT

<u>Behaviors: Turning 1-12</u> *(found online in NXT Video Trainer 2.0)*

VIEW video in Connect 1: "Nomad: Ice Sheet Explorer"

USE Connect 2 to construct your robot according to the directions in VT.

READ Construct 3, "Lesson Overview," and answer question 3.1

3.1_____
_____
___

READ Construct 4, "Point Turns," *Program Point Turn Behavior,* and answer question 4.1

4.1_____
_____
___

DEMONSTRATE "Point Turn," first to a fellow classmate and then to a teacher. **TEACHER INITIALS _____**

READ Construct 5, "Swing Turns," *Program Swing Turn Behavior*, and answer questions 5.1 and 5.2

5.1
_____
_____

5.2
_____
_____

DEMONSTRATE "Swing Turns," first to a fellow classmate and then to a teacher. **TEACHER INITIALS _____**

READ Construct 6, "Program Review," *Left Point Turn Program*

READ Construct 7, "Program Review," *Left Swing Turn Program*

READ Contemplate 8, "Adjusting Turning," *Adjust duration to perform a desired rotation,* and answer questions 8.1 and 8.2.

8.1

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_____

8.2

_____

_____

8.2

_____

_____

DEMONSTRATE "Step 8 Challenge," first to a fellow classmate and then to a teacher. **TEACHER INITIALS _____**

READ Contemplate 9, and answer questions 9.1and 9.2.

9.1

_____

_____

9.2

_____

_____

USE proportional math to find the degrees necessary to rotate 360º. Show your neat, orderly math below:

Engineering Challenge #3 – Sumo-Bots

- Use the Engineering Process to develop your Sumo-Bot.
- The Commercialization step will be the Sumo-Bot competition.
- For each of the other steps of the Engineering Process, document your progress by completing the associated Deliverables and your Engineering Process Log.
- Have another team sign off on your deliverables before submitting them for grading (including all the elements for your Design Review).
- Present your Design Review for your classmates and teacher

Date	Deliverables	Sign-off
	Requirements	
	Research Report	
	Design Concept	
	Project Plan	
	Design Review Elements	
	SUCCESSFUL SUMO-BOT DESIGN REVIEW!!	**(Teacher)**

Task Assignment

Engineering Challenge #3 – Sumo-Bots

Sumo-Bot Match Procedures

This will be a double-elimination competition.

Each match will begin with a one minute "call to start" warning. Additional 30s, 15s, and 5s warning will also be given. Teams unprepared to start on time will forfeit that match.

This event will take place on a ~4'x4' whiteboard with a black border. The arena will be a white square 36" on a side.

Sumo-bot wrestling will begin with opponents in opposite corners and will continue until either one opponent is completely out of the arena, or one Sumo-bot is disabled.

If, after two minutes, there is no clear winner the competition will be halted. After a second one minute "call to start", an additional one minute re-match will begin. If there is no clear winner after the second match, both Sumo-bots move to the loser's bracket.

The winning robot must either push its opponent completely out of the arena, or disable its opponent (render opponent unable to maneuver, while victor Sumo-bot still can). If a robot is not pushed off the mat, but is flipped, the flipped Sumo-bot is considered disabled and loses the match.

Sumo-Bot Specifications

Components: All robots will be constructed only from a single 9797 kit (items as listed on the 9797 placards) and the following additional allowed items:

Large Wheel (2)

Angled Snap Beam (8)

Claw (2)

DEMONSTRATE "Step 9 Challenge" first to a fellow classmate and then to a teacher.

READ Contemplate 10 and answer question 10.1

10.1

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DEMONSTRATE your "Point Turn to the Right," first to a fellow classmate and then to a teacher. **TEACHER INITIALS** _____

READ Contemplate 11, and answer question 11.1

11.1

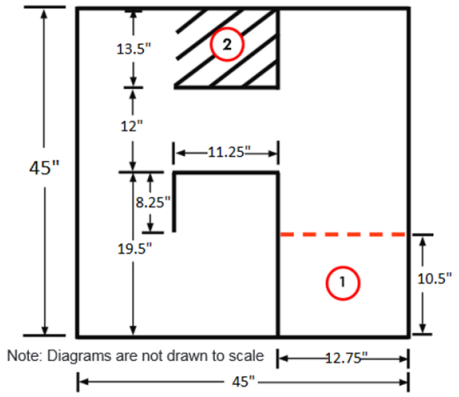
_____

_____

Task Assignment
Engineering Challenge #2
Walled Maze Challenge

READ Continue 12, and follow the diagram below to set up and complete the *Maze Challenge* to receive your final points.

- Program your robot to travel from box 1 to box 2 and BACK to box 1 in the least amount of time. You may NOT use any sensors, however, other any other parts from your kit may be used.



Total: _____ / 25

Task Assignment
Move Until Touch– Touch Sensor

USE Connect 2 to construct your robot according to the directions in VT. ***(Student Sign) (Teacher Sign)***

READ Construct 3, "Lesson Overview," and answer questions 3.1 and 3.2

3.1_____
_____

3.2_____

_____

READ Construct 4, "Move Until Touch," *Program Forward Until Touch*, and answer question 4.1and 4.2

4.1_____
_____

4.2_____
_____

DEMONSTRATE "Move Until Touch," first to a fellow classmate and then to a teacher. **TEACHER INITIALS _____**

READ, **REVIEW AND STUDY** Construct 5, "Program Review," *Forward Until Touch Program*

READ Contemplate 6, "Move Until Release," *Forward Until Release,* and answer question 6.1

6.1

_____
_____

DEMONSTRATE "Move Until Release," first to a fellow classmate and then to a teacher. **TEACHER INITIALS _____**

READ, **REVIEW AND STUDY** Contemplate 7, "Touch Sensors,"

READ Continue 8, "Vacuum Challenge." (Your "room" will be half of one of the large tables.)

DEMONSTRATE "Vacuum Challenge," first to a fellow classmate and then to a teacher. **TEACHER INITIALS _____**

_____**32 Points**

Task Assignment
Repeating Behaviors– Loops

As a team, work to develop the programs outlined below. Each of these completed programs must be *demonstrated* to one of the other teams and have that team sign off below.

Date	Program	Sign-
	Looped Square	
	Count Controlled Loop	

Complete step #7, **Sensor Controlled Loop**, and when you have completed this program, have another team check it off before arranging with the teacher for your demonstration. Review the animation in Step #8 carefully, and be prepared to discuss your program and why the robot fails to detect the obstacle in some circumstances.

Date	Program/Challenge	Sign-off
	Successful Sensor Controlled Loop	
	SUCCESSFUL SENSOR CONTROLLED LOOP DEMONSTRATION	**(Teacher)**
	Successful Automated Sentry Challenge	
	SUCCESSFUL AUTOMATED SENTRY CHALLENGE	**(Teacher)**

After this first teacher sign off, complete Step #9. When you have completed the **Automated Sentry Challenge**, have another team check it off before arranging with the teacher for your demonstration. Be prepared to discuss your program details (including comments) and how you overcame any difficulties that arose.

Task Assignment
Move Until Near– Ultrasonic Sensor

VIEW video in Connect 1: "Tractor: Farm Utility Vehicle"

USE Connect 2 to construct your robot according to the directions in VT. The attachment instructions will need to be adjusted. Your sensor must be at the same level as the wall you are approaching. Our walls are 3 ½" high. The attachment will not work as outlined in the instructions. ***(Student Sign) (Teacher Sign)***

READ Construct 3, "Lesson Overview," and answer questions 3.1 and 3.2

3.1_____

_____

3.2_____

_____

READ Construct 4, "Move Until Near," *Forward until Near behavior*, and answer questions 4.1- 4.3

4.1_____

_____

4.2_____

_____

4.3_____

_____

DEMONSTRATE "Move Until Near" (25 cm), first to a fellow classmate and then to a teacher. **TEACHER INITIALS _____**

READ, **REVIEW AND STUDY** Construct 5, "Program Review," *Forward Until Near Program*

READ Contemplate 6, "Move Until Near," *Backward until Far Behavior,* and answer question 6.1

6.1

_____

_____

DEMONSTRATE "Move Until Near," *Backward until Far*, first to a classmate and then to a teacher. **TEACHER INITIALS _____**

READ, **REVIEW AND STUDY** Contemplate 7, "Ultrasonic Sensors." **In your own words,** briefly describe how the ultrasonic sensor works.

7.0

_____

_____

_____

_____

READ Contemplate 8, "Thresholds," and answer questions 8.1 and 8.2

8.1_____

_____

_____

8.2_____

_____

_____

FINAL CHALLENGE

Follow the directions to complete the ***MAZE CHALLENGE.*** Your program must use the ultrasonic sensor for navigation. When you have completed this challenge, have another team check it off before arranging with the teacher for your demonstration. Be prepared to discuss your pseudocode, your program details (including comments) and how you overcame any difficulties that arose.

Date	Challenge	Sign-off
	Successful Walled Maze Challenge	
	SUCCESSFUL WALLED MAZE CHALLENGE DEMONSTRATION	**(Teacher)**