FIRST® LEGO® League

TUT⚙RIALS

teach　　share　　learn

ROBOT DESIGN JUDGING

SESHAN BROTHERS

ROBOT DESIGN JUDGING OVERVIEW

- Robot Design judging focuses on **process**

- Talk to the judges about your engineering design process, and how you came up with your ideas and how you improved them

- Make sure that everyone on the team is involved

- During your 5-minute presentation, you need to cover all the components of the Robot Design rubric

BEGINNING 1	DEVELOPING 2	ACCOMPLISHED 3	EXCEEDS 4	
				How has the team exceeded?
IDENTIFY – Team had a clearly defined mission strategy and explored building and coding skills they needed.				
Unclear mission strategy	Partially clear mission strategy	Clear mission strategy	☐	
Limited evidence of building and coding skills in all team members	Inconsistent evidence of building and coding skills in all team members	Consistent evidence of building and coding skills in all team members	☐	
DESIGN – Team produced innovative designs and a clear workplan, seeking guidance as needed.				
Minimal evidence of an effective plan	Partial evidence of an effective plan	Clear evidence of an effective plan	☐	
Minimal explanation of robot and code's innovative features	Partial explanation of robot and code's innovative features	Clear explanation of robot and code's innovative features	☐	
CREATE – Team developed an effective robot and code solution matching their mission strategy.				
Limited explanation of their robot and its attachment and sensor functionality	Simple explanation of their robot and its attachment and sensor functionality	Detailed explanation of their robot and its attachment and sensor functionality	☐	
Unclear explanation of how code makes their robot act	Partially clear explanation of how code makes their robot act	Clear explanation of how code makes their robot act	☐	
ITERATE – Team repeatedly tested their robot and code to identify areas for improvement and incorporated the findings into their current solution.				
Minimal evidence of testing their robot and code	Partial evidence of testing their robot and code	Clear evidence of testing their robot and code	☐	
Minimal evidence their robot and code was improved	Partial evidence their robot and code was improved	Clear evidence their robot and code was improved	☐	
COMMUNICATE – Team's explanation of the robot design process was effective and showed how all team members have been involved.				
Unclear explanation of robot design process	Partially clear explanation of robot design process	Clear explanation of robot design process	☐	
Minimal evidence that all team members were involved	Partial evidence that all team members were involved	Clear evidence that all team members were involved	☐	

DESCRIBE YOUR ROBOT

- How did you come up with the design for the base robot? Did you start with an existing design (your last year's robot or something from the Internet/book)?

  - Experienced judges can recognize standard designs. Therefore, always cite your sources.

- Did you test your design(s) before picking it?

- What features does it have and why?

| Robot Testing | Name: |

Instructions:
1. If you design more than one robot, use this chart to compare them. At the top of each column, describe your robot
2. Come up with some basic tests to compare the robot designs. Can this robot move straight accurately? Can it turn consistently? Can it line follow? Can it detect a line? Did the robot move as intended?
3. Discuss which robot performed the best to help you pick the best design for your team.

	Robot 1: Wheels: Size: Sensors: Motors:	Robot 2: Wheels: Size: Sensors: Motors:	Robot 3: Wheels: Size: Sensors: Motors:
Move Straight 50cm			
Overall: Speed Balance			

Available at
https://flltutorials.com/en/Worksheets.html

9

©2020, FLLTutorials.com

DESCRIBE THE SENSORS & MOTORS

- How many motors and sensors do you use? Which ones? Why?

- Which missions do you use them on?

- How do you use sensors and do you use them in any novel way?
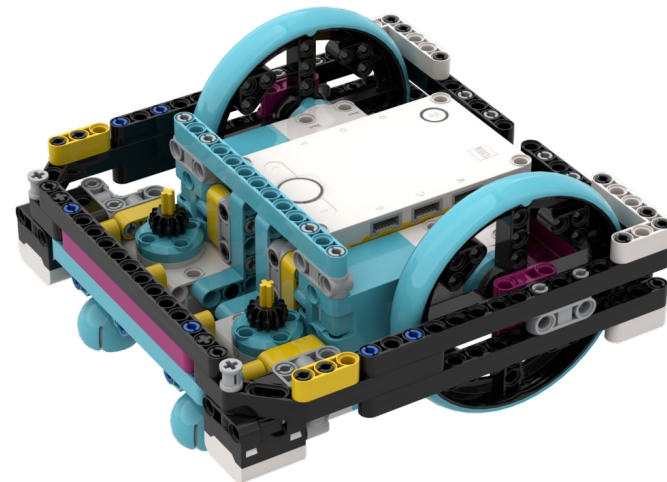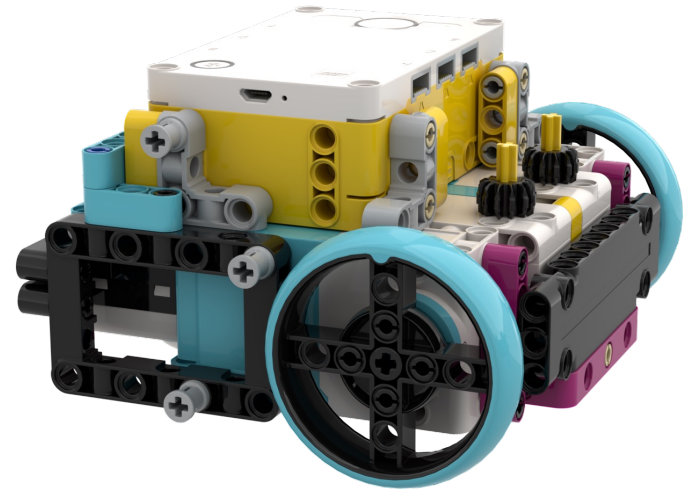
EXPLAIN YOUR TEAM'S STRATEGY

- How did you come up with your strategy?

- How did you decide on which missions to accomplish and which path to take?

Bring a picture like the one on right to explain your robot runs and strategy.
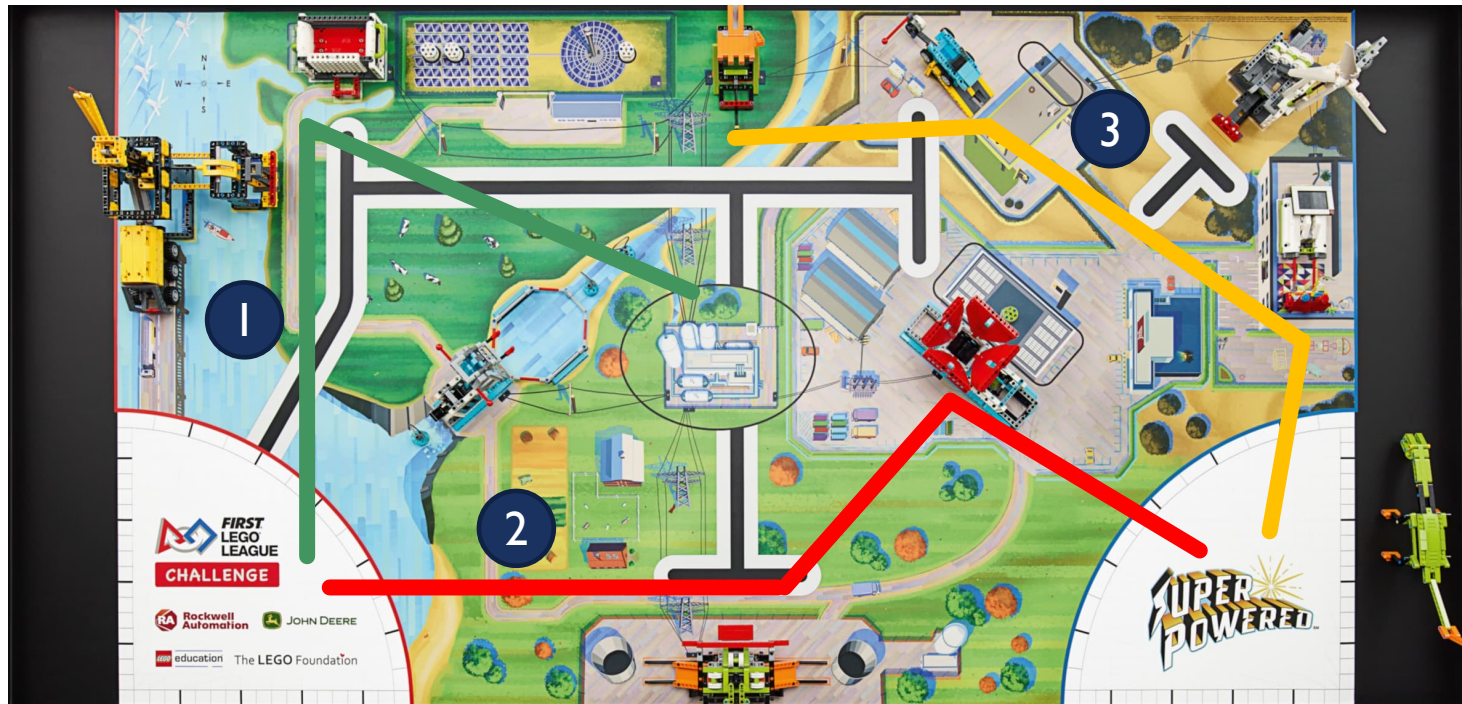
EXPLAIN YOUR ATTACHMENT DEVELOPMENT

How do you solve the missions?

How did you come up with that particular solution?

How did that solution change over time?

Do you solve a particular mission in an unusual way?

Attachment Evolution	Name:

Date:
Mission Name:

Describe Attachment Features	Image

Attachment Testing	Name:

Date:
Mission Name:

	Attachment Tested

What

	Test 1	Test 2	Test 3
What worked well?			
What did not work?			
Next steps: What will you change or modify?			

14

©2020, FLLTutorials.com

Available at
https://flltutorials.com/en/Worksheets.html

EXPLAIN YOUR PROGRAMMING

- You must explain your programming in judging.

- You will not have time to talk about all your code. Pick one program, one run, or your best code.

- No matter what programming language you used, you should be able to communicate your programming techniques to the judges

  - Make sure you have pseudocode and comments

- You can share your code on a laptop or using a printout
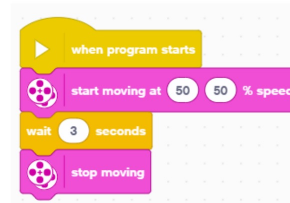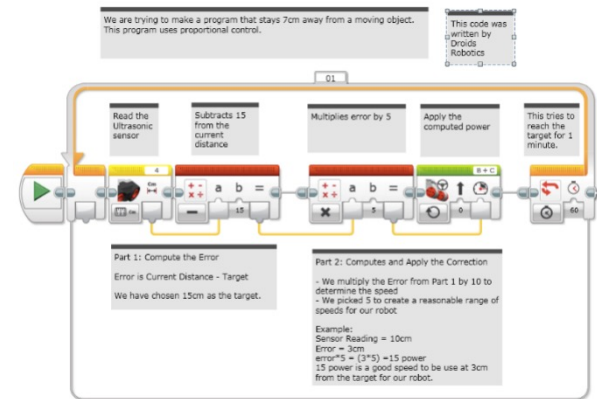
```
Import time
motor_pair = MotorPair('A', 'E')
motor_pair.set_stop_action('brake')
motor_pair.start_tank(50, 50)
time.sleep(3)
motor_pair.stop()
```

TIPS FOR EXPLAINING YOUR PROGRAMMING

- Explain how your code is organized

    - How do you know what a block is doing? Are there comments?

    - Do you use My Blocks (or equivalent Functions in another language)?

    - How do you keep track of changes to the code?

- Explain any interesting algorithms your team came up with

- Explain how your code helps your robot be more reliable. What coding techniques/sensors do you use?

- Again, experienced judges will recognize code from others

    - If you used code from some source, always remember to cite it, explain how it works, and how your team modified or used it
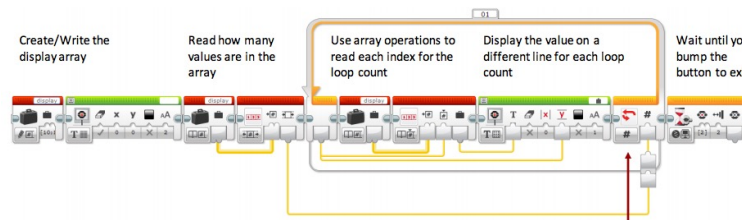
DOCUMENTATION

- Consider having a team Engineering Journal to document your engineering design process

- Share any testing your team may have done

- Print out your code as well as pictures of your development process and current robot

- If permitted, consider leaving a one-page summary of your presentation with your judges to help them remember your team (include a picture of your team, your robot and the key information you want to communicate)

Available at https://flltutorials.com/en/Worksheets.html

FINAL THOUGHTS

- Even though the Judging Flowchart refers to Robot Design as an "explanation" and not a presentation, you are strongly encouraged to prepare and practice a formal presentation

- This way you ensure that everything you want to share about your robot design process is covered

- Think of this session as a show-and-tell. You will show your robot, attachments and code and explain the process behind them

- Again, cover everything in the rubric!
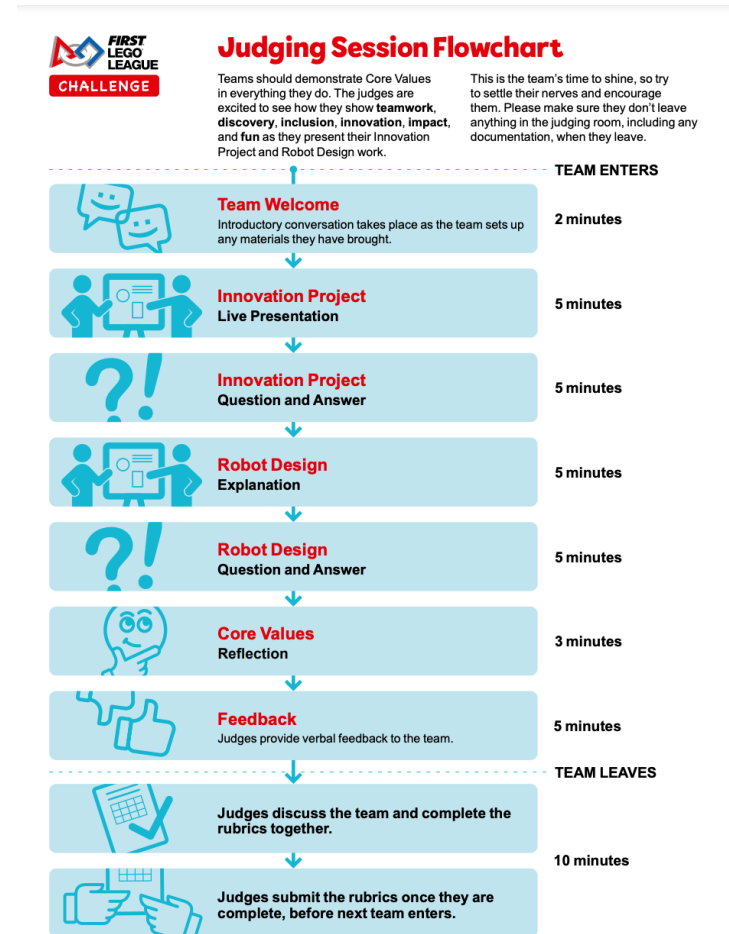
FAQS

- What should we bring into the room?

  - Your robot, your attachment and all your code (either as printouts or on your laptop).

  - Evidence of testing and improvements made (photographs, charts, engineering notebook)

- Do we have to explain code?

  - Yes. Teams who score higher are able to expain their code well and talk about it's unique features.

- What should we present in the 5 minutes?

  - Explain all aspects of the rubric (including how you designed the robot, selected a strategy, expain code, show that the entire team was involved, and show documentation of testing and improving your design)

- Does everyone need to present?

  - Ideally, yes. The rubric asks if the entire team was involved in building in programming. Therefore, everyone should be able to contribute during the scripted presentation as well as during Q&A

- There is no robot game table in the room so how can I show that my robot works?

  - Hold up your robot and attachment, come closer, and explain the mechanisms. Show testing data. Remember that Robot Design Judging is about PROCESS and not your robot game score. Explain your process well and you will score well in this category.

COMMON JUDGE QUESTIONS

- How did you select which missions to do?

- Was everyone on your team involved in building and programming?

- How did you plan the season and organize the building and programming process?

- What is the piece of code or part of the robot that you are proudest of and why?

- What would you say is your most innovative design and/or code?

- Does your robot use sensors to solve missions?

- How did you ensure your robot would reliably score points on every launch?

- Did you test different designs before picking this one?

- What improvements did you make during the season?

CREDITS

- This tutorial was created by Sanjay Seshan and Arvind Seshan

- More lessons at www.ev3lessons.com, www.primelessons.org, and www.flltutorials.com