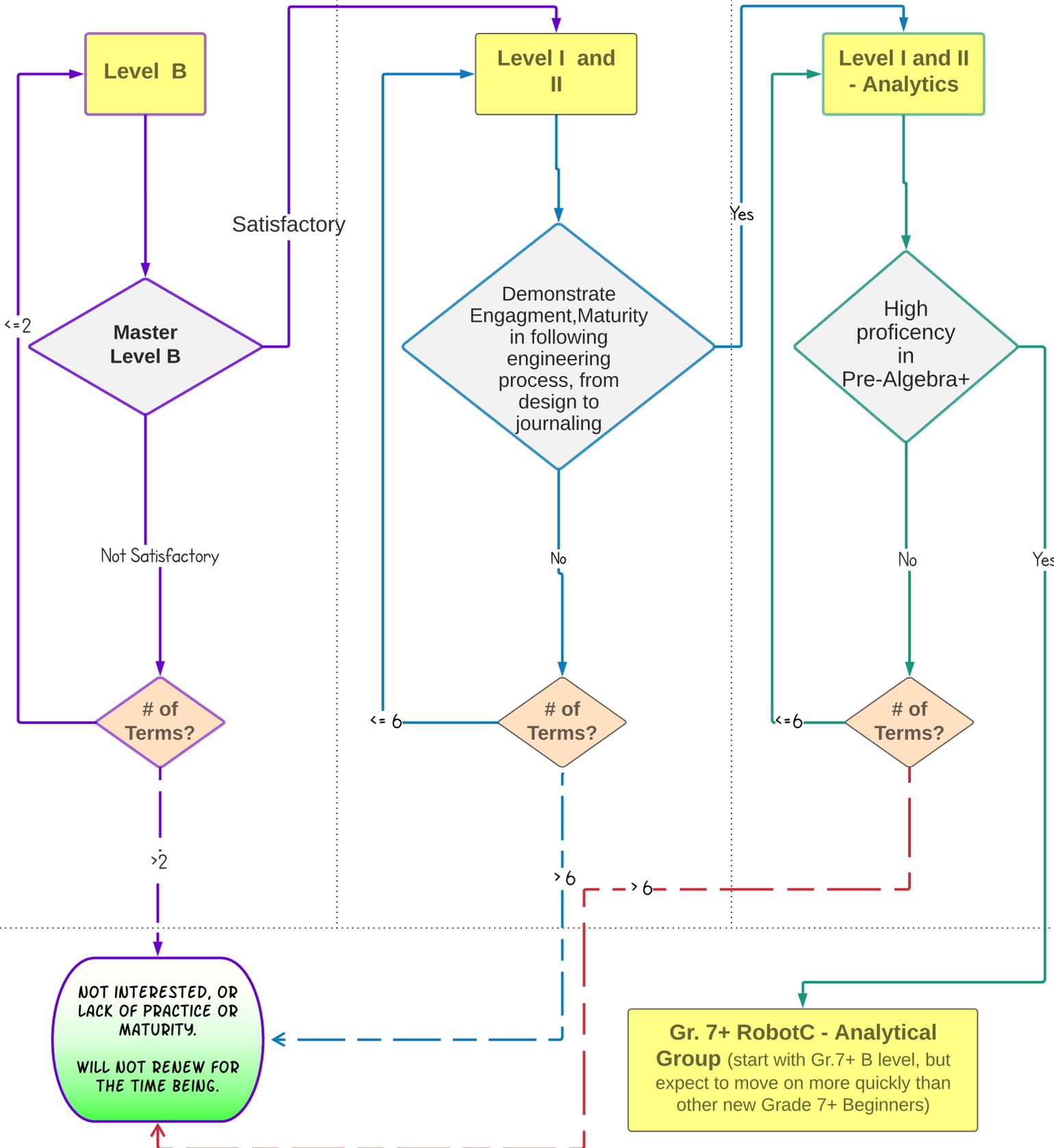


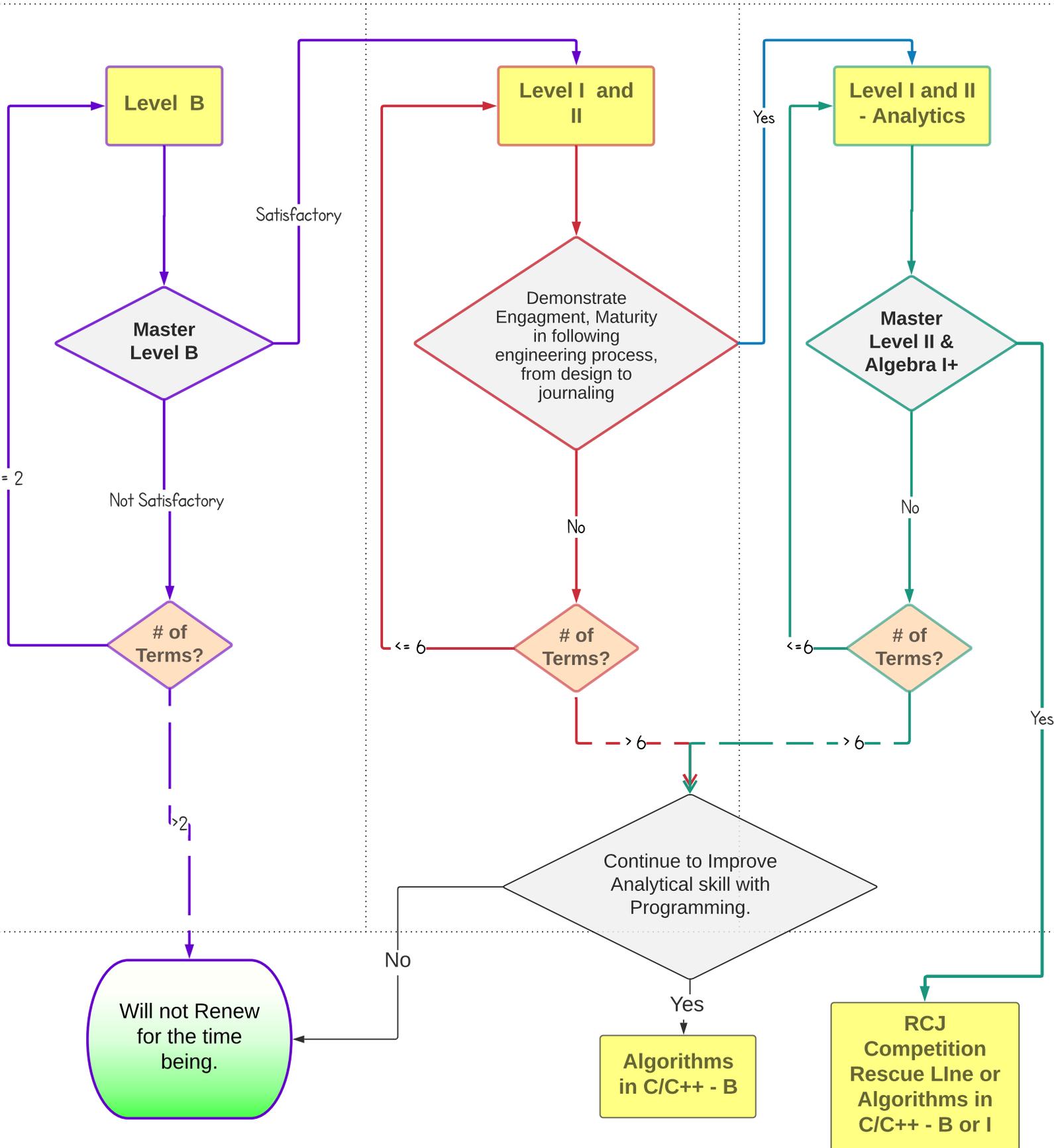
# Learning Roadmap

Gr. 4 to 6 : Robotics Projects Track



# Learning Roadmap

Gr. 7 to 9 : Robotics Projects Track

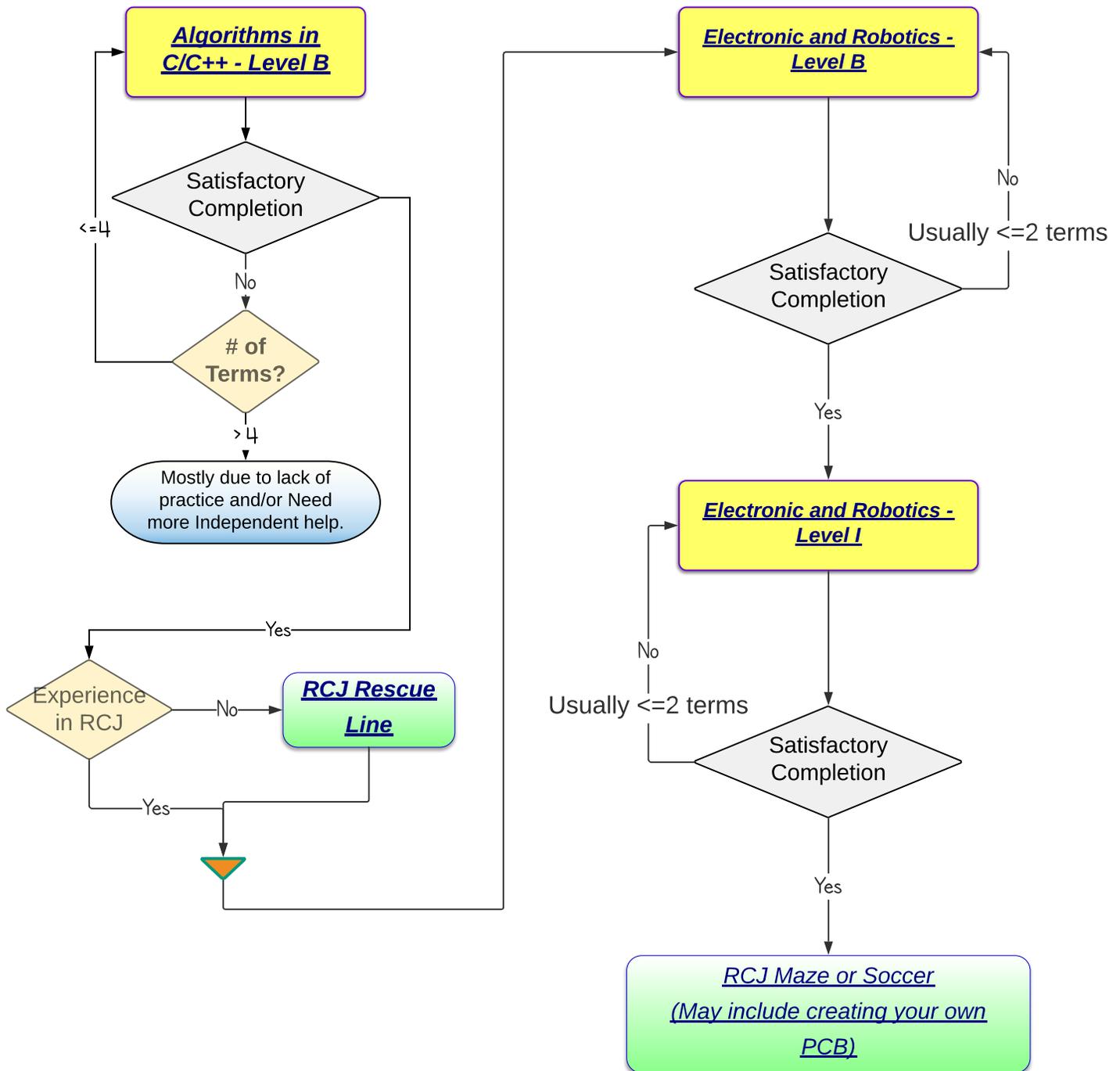




# Learning Roadmap

Gr. 8+ : Robotics and Computer Engineering Track

For students with exceptional ability in Mechanical Building Skill, and not interested in Software programming may switch to this track.



# Computer Science Track

Algorithms in C/C++

<http://cs.stormingrobots.com>

**Detailed syllabus at : <http://cs.stormingrobots.com>.**

Many things in the world involve automation in this technology age. Good Computer Science program go far beyond just programming itself but mainly problems solving skill with computing, even for grade schools. While Robotics animates Problem Solving effort, Computer Science with computational thinking strengthens the foundation.

This sub-group aims to build that core foundation and sharpen students' problem solving skills in computing world, no matter whether in engineering, or even liberal arts fields.

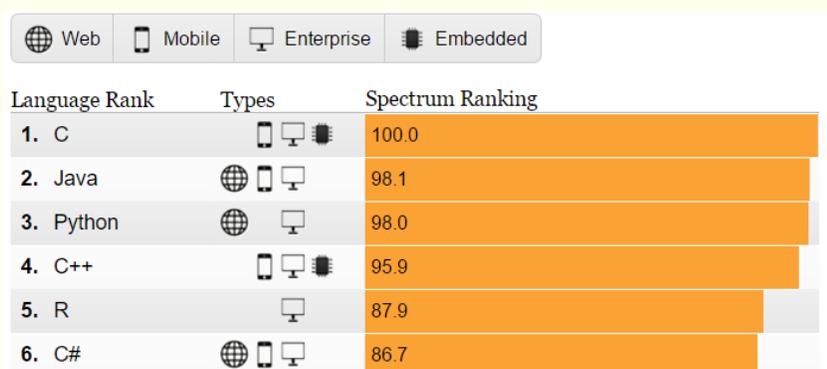
## Characteristics:

1. Stress in Computational Thinking and Efficiency.
2. Focus on problems solving/software development skill, so students will not work with a physical robot.
3. Self-paced. Students will be allowed to move quickly to the next concept when they demonstrate satisfactory level of understanding through their homework and pop-quiz in class. Those with gaps in their prerequisite knowledge will receive additional exercises to address the shortcomings.
4. Excellent work quality requirement. All assigned exercises are to be completed with excellent quality, with efficiency, memory consumption, readability, maintainability, etc. This is to ensure all students will master a concept and build a strong foundation before tackling new concepts.
5. Allow students to embed other competitions in-between levels.

## Why C ?

C programming allows high flexibility and the power to perform closer to the machine than “modern” languages. It is still often used in embedded systems or high-performance computing. It is considered to be lingua franca of programming. We focus on educating students to “understand” the underlying structure, think efficiency and analysis with algorithms. *This aims to equip students the skill to adapt the rapid changes in the mechanics of future modern languages and various algorithms and optimization techniques, not to learn a specific language.*

**The Top Programming Languages along a different axis of popularity - published by IEEE (26th July, 2016)**



# Competitions, Advanced Project

<http://compete.stormingrobots.com>

<http://mp.stormingrobots.com>

Competition is one of the multiple channels where they will apply all the knowledge that they have compiled throughout their Roboclub sessions, and summer workshops. Another channel is through Advanced Projects (required building online portfolio). Students further strengthen their knowledge base through hands-on, scaffold environment where new concepts constantly are introduced.

We choose only the competitions and projects which are artificial intelligence oriented. Our program aims to help in bridging students from high school not just to competitive colleges, but far importantly, to become a resourceful, self-driven life-long learner. History has shown SR alumuni has gained competitive edge in obtaining internship in College.

Main goals of our participation into any of the competitions and independent advanced projects are to:

- Sustain motivation and inspiring more inquiries in in-depth knowledge about system engineering through robotics;
- Encourage students to delve in learning about full automation, and exploration in the realm of artificial intelligence.
- Strengthen competitiveness in science and technology, with integrity, sportsmanship, and professionalism.

See the criteria for participation into the following competitions:

<http://www.stormingrobots.com/prod/pdf/criterias.pdf>



## MIT/NASA ZeroRobotics

- Heavily Mathematics and physics oriented
- High School only.
- Online competition working with virtual simulation.
- do not work with physical robot. The physical robot is the Satellite itself located in MIT and Space!
- Minimum Algebra II, prefer Trigonometry.
- Linear Algebra is a BIG Plus. Almost all of our students self-learned LA.

## RCJ = RobocupJunior

- AI-oriented, Algorithms-based Tournament
- Age : 12-18.
- Students are expected to improve their platform year after year, that includes hardware and software
- Usually participate in the same game throughout several years.
- From USA to World Event .

## Advanced Independent Projects

- Not a competition
- High School Only.
- Duration depends on project scope.
- Require strong work discipline.
- Create Engineering / Computer Science Maker Portfolio.
- Opportunity to conduct Tech Talk in public forum.

## C/C++ Certification

- Not a competition.
- Exam throughout the year at qualified test centers.
- Any age. However, top 10 students from SR will receive invitation for taking the exam at no cost (\$300 value otherwise).
- Focus on the mechanics in C/C++ programming skill.



## USACO:

- Not a competition.
- Online Exam from December to April. One exam per month.
- USA Computing Olympiad.
- Age 13+ (usually high school only)
- HEAVILY Algorithmic based programming.
- Online Exams from Bronze to Platinum levels.
- From USA to World Event

# Description about Levels

In order to maximize learning, and keep students engaged, groups are divided into Levels, mainly based on ability to apply (technical skills sets), interests and attentiveness, etc.

When a student demonstrates much improvement during a term, he/she will be given more challenging tasks, or even moved to a more advanced group. This goes true on the opposite side. In order to minimize the chance where we must move a student down, we usually stay conservative before moving a student up a level.

Students move by their own pace and assigned based on the following criteria, not the duration spent on a level.

<b>P</b>	Exploratory. Beginner level.. Shows some understanding in the topics & learning process.
<b>L - I</b>	Demonstrates memorization of semantics & apply a single level of abstraction and control structure
<b>L - II</b>	Apply 2 levels of abstraction & control structures. Start to involve more computational thinking with geometry and algebra.
<b>L - III</b>	Demonstrates ability to analyze and apply 2+ levels of abstraction, & control structure. Can finish projects but require considerable guidance. Perform mathematical application, if needed.
<b>L - IV</b>	Can handle multiple levels of abstraction, new data & structure design with minimal guidance. Ability to perform mathematical application along with physics concepts if needed.
<b>ADV</b>	Self-learner, self-driven, & demonstrates self-guided level of resourcefulness. Design with minimal guidance. Ability to research on new topics & extend projects with minimum guidance

**The following keys will assist parents to understand how we assign at evaluation time:**

## **Application thru understanding over memorization:**

- ▶ Mastery of a level means they "demonstrate" that they can apply without frequent assistance from the instructor, but not by memorization.
- ▶ Whether one enjoys in active learning and problem solving, not conventional passive learning, is important. This will also a good indicator for their level of interest in open-ended challenge, and engineering.

## **About Projects assignment in classes:**

- ▶ Project content bespoke to each group. Challenge level bespoke to each individual. That's why even two groups in the same group may end up working on different level of challenge; ie.. various phases of a particular project.
- ▶ Placement is determined by instructor based on their interest and strength, and most importantly, it needs to keep students engaged and challenged.

## **About Analytical level**

- ▶ Require high proficiency in Pre-Algebra (level I), and Introduction to Algebra or Algebra I (level II+)
- ▶ Require more in-depth analysis, patience in following thru engineering process and trouble shooting.