

# Criteria for Entering Various Competitions | Exams | Advanced Projects

by Storming Robots. Last updated: March 1st, 2018

	⑥ RoboCupJunior			ZeroRobotics	USACO	C / C++ Certification	① RVMG Math Contest
	Rescue Line	OnStage / Soccer	Maze				
<b>Time Demand</b>	High	Highest	Highest	Moderate	Moderate	Moderate	Low
<b>Type</b>	Competition			Competition	Exam	Exam	Competition
<b>Venue</b>	Away	Away	Away	Online	Online	Away	Away
<b>Hardware</b>	Mindstorms / VexIQ / Arduino / Raspberry PI			None	None	None	None
<b>URL</b>	robocupjunior.org			zeroRobotics.mit.edu	usaco.org	cpp-institution.org	math.stormingrobots.com
<b>Add'l cost to SR fee</b>	\$50 - \$100 (Approximation)			\$0	\$0	\$0 for top 10 students. \$300ea. For Others.	\$0 - \$35
<b>Age</b>	12 to 19			High School	② High School	High School	Gr. 6+
<b>Math</b>	Algebra I basic Combinatorial Mathematics			④ Pre-Cal	③ Algebra I basic Combinatorial Mathematics	Algebra I	Algebra I +
<b>Programming (min)</b>	Robotics Projects with RobotC - Level III	Algorithms in C/C++ - Level I	Algorithms in C/C++ - Level II	Algorithms in C/C++ - Level I	⑤ Algorithms in C/C++ - Level I	Algorithms in C/C++ - Level II for C - Level III for C++	--

① **Math Contest focusing on Combinatorial Mathematics (Analysis of Algorithms in the most general term.) (<http://math.stormingrobots.com>)**

\* **Combinatorial Math usually is not available in regular school program. You may take the Math Contest in order to join Math Group by Raritan Valley Math Group.**

② Usually High School, Not a must.

③ Knowledge in Statistics and Combinatorial math will be greatly helpful, esp. for Gold and Platinum.

④ Minimum Pre-Cal. Linear Algebra and Motion in Physics will be a big plus.

Most high schools do not offer Linear Algebra, nor cover Physics/Motion until Senior Year. Most below 12th grade participants also learn it as they go.

⑤ Algorithms in C/C++ - Level I-II for Silver. Level II-III for Gold. Level IV for Platinum

⑥ Must be in Robotics Projects Track - Level II Analytics and receive approval from instructor and director.

# Why Combinatorial Mathematics?

By Wolfram MathWorld " the branch of mathematics studying the [enumeration](#), [combination](#), and [permutation](#) of [sets](#) of elements and the mathematical relations that characterize their properties.

It is a large subset of [discrete mathematics](#) that includes [graph theory](#).

By MIT : Combinatorics involves the general study of mathematical reasoning about discrete objects. This may encompass :

- Biology
- Applied Physics
- Computer Science
- Numerical Analysis

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## **Combinatorial Mathematics** is about **Analysis of Algorithms**

Any time when memory or time efficiency is desired, combinatorial mathematics will be applicable.

C.M. is used in order to compute, measure, and maximize the efficiency minimizing the usage of memory, and/or iterations.

Simple example:

- santa claus with dirty sock problem.
- sorting ... using the rudimentary sorting of 100 elements, such as bubble sort which will require  $100^2$ , ie 10,000, but use some algorithms such as quick sort is about  $n \log n$  , i.e. about 200s times.

It also is used in many real world problems such as Routing, scheduling, assignment, etc. are, at their core, graph theoretic problems. Many real world problems turn out to be using Combinatorial Maths with graph theory.