	FIRST - FLL, FTC, FRC	ROBOCUP - ROBOCUPJUNIOR (RCJ)
Regionals vs World	Multiple events within a State Top Scores are invited to World Event. There may be over 25 different awards. World Event has always been held in the United States.	One single event in the US. It has been held in either NJ or NY. Top Scorers are invited to the World Event. There are about 5 to 6 awards for each league. World Event location changes every year. Various countries usually bid on holding such an event.

Leagues / Divisions	Simple Leagues Divisions ranging from elementary to high school levels.
	JrFLL - age 6 to 9
	FLL - age 9 to 14
	FTC - age 15+
	FRC - age 15+
	So, there are 4 leagues under the umbrella of F.I.R.S.T.
		Two major Divisions: Major (from undergraduate to Ph.D. Research Level **) and Junior (for pre-college)**
		4+ Leagues from each Division.
		RoboCup Major Leagues -
		College as well as Research levels. View RoboCup Official Website for a more detailed breakdown.
		RoboCupJunior Leagues -
		Pre-college levels. This is where Storming Robots teams actively participate:
		Secondary (Open) League - age 15 to 18 (must be before college)
		Primary League - age 10 to 14 (the USA only).
		Common Leagues include:
		   • Soccer - Light-weight and Open (Heavy-weight)
		   • Rescue Maze Challenge
		   • Rescue Lined Challenge
		   • Robot On-Stage

Pre-college Only?	**Yes, it is up to High school Grade 12:** The FRC (the highest one) involves industrial level mechanical machinery which demands high mechanical skill, but mostly human remote-control with minimal automation.	**Up to Graduate Research level:** RCJ sits at the entry-level of the international RoboCup. **Initiative:** RoboCup is a world-renowned A.I intensive game. There are many graduate schools teams from prestigious US universities, such as Carnegie Mellon, UPenn, Stanford, etc.

Well Funded	The administration of this event is financed by strong-armed companies such as the LEGO Company, National Instrument, and more others, while judges and referees are mostly volunteers. FIRST has been very successful in gaining awareness and participation from grade school children. The volume of participants has been quite large.	**Non-Funded.** This event is run and supported completely by volunteers only. Even administrative work is performed by college professors and teachers themselves. While the Major Leagues are well-known among Colleges, the Junior levels (i.e. Pre-college) do not gain the level of traction nearly close to FIRST has.
Field Dynamic	**Static Field:** Fields and locations of objects are 100% predefined. In FLL, fields objects are given an exact dimension and location.	**Dynamic field:** Field is filled with variable elements. In other words, dimensions and locations of objects remained uncertain in most part of the game.
	Colorful field: Fields looks very colorful and appealing, especially for FLL & FTC. The FLL field simulates the technical topics in a very cartoony way. It usually generates a WOW effect from viewers.	**Non-colorful field:** RCJ's field is meant to remain simple looking, but offers much higher technical challenge in terms of full automation.
Theme	**Broader and more inclusive:** Encourage learning in a variety of topics, from helping elderlies to Mars exploration. It focuses on the simulation of various real-world topics. For JFLL and FLL, it requires research and presentation work on the topics itself as well. This category definitely is much more inclusive. It tailors students with various interests and strength not only in robotics aspect but also include other areas such as entrepreneurship, marketing, etc.	**More esoteric into AI development:** Stress the learning in automation gearing towards artificial intelligence. RCJ delves much more deeply into computer science and algorithmic programming. Many facets of the games require algorithms used in Computer Science, Engineering and Artificial Intelligence fields.
	Theme changes every year: Theme drastically changes from year to year. Therefore, participants must deal with a whole new set of rules from year to year. Students need to buy and build new arenas every year. A whole new set of rules inherently present new set of	**The theme remains mostly similar from year to year.** The level of unpredictability of most challenge inherently presents a multitude of levels of analysis between the Computational and the Algorithmic thinking. In order to provide scaffold learning opportunities, the theme does not have a drastic change every year. This allows students to delve in developing much more sophisticated solution.

	challenges in strategies, especially in mechanical building aspects, but not much in the programming aspect. Once you master the conversion of distance and motor encoder calculation and programming, programming will remain mostly similar. In FLL level, you will be required to conduct studies and research on the topics.	Sometimes, the non-experienced would misunderstand that was just repetitious. On the contrary, no major changes in themes encourage students to delve further in learning to create much more robust solutions with automation; which most often become more and more sophisticated from year to year.
Self-awareness	**Dead-Reckoning:** Mostly based on dead-reckoning method, (relying on motor rotations). Thus, the robustness of the machine itself (the drive train and gear system) is highly important in order to allow consistent rotation and movements. In FLL (age9-14), most activities are based on accuracy in turning. Semi-automation as frequent retrieval of the robot is part of the game. May use sensors as well, but limited. In FTC or FRC (age14-17), robot automation is not mandated per se; it does require "heavily" in mechanical, and somewhat electronic aspects. Participants use remote controlling for motion navigation during the game. However, some for the mechanical designs are quite impressive. Up to 2019, within FRC game's 2 minutes of the game, only 1st 15 secs is mandated for automation. The rest is with human-controlled.	**Complete self-awareness:** Closer to behavioral-based robotics, application of interrupt driven, and stress in algorithmic analysis. From elementary to high school levels, participants MUST focus on robot's self-awareness of the environment with effective usage of various sensors. Therefore, the game heavily focuses on algorithms and programming the intelligence of the robot, and no remote controlling is allowed. Maze and Soccer are especially challenging in terms of robot automation. Soccer features a constantly changing environment in which the outcome of every action is uncertain. It also requires the robots to cooperate with one another via wireless communication. Some software and electronic design are indeed impressive. Software algorithms achieved by high school students reach college level algorithms study.
Cost	Far much higher due to investment in a new arena, and mechanical requirement. Can be very costly in materials and time in order to adopt new rules, approx. 5K+. It was reported to me that some teams spend close to10K. The registration cost is also higher.	The investment in the field is only at first participation. After that, the increments in cost will be mostly in investing on in the robot hardware in order to incorporate more robust/ sophisticated solutions, such as a new controller, sensors, etc. The registration is considerably also lower than most others'.
Focused Engineering disciplines	**The very different requirement on the Mechanical requirement from year to year:** The mechanical portion is very demanding and very different from year to year. Since theme changes from year	**Continuous improvement in the mechanical requirement from year to year:** It heavily stresses towards more sophisticated mechanical and electronic solution to the same rules from year to year - very much

	to year, you will need to invest much in new hardware in order to build a new field and new robot. It is undoubtedly to add new excitement to students. Most require SUPERB mechanical building skill. For the FLL levels, many folks thought, "it is LEGO, my kids can build a star wars ship... this must be easy.." This is a far understatement. There are true mechanical concepts that students will have to overcome, frictions, weight-distribution, C.O.G., concepts in hardware decomposition, stability, etc. which simply not so much in concern for building a stationary structure.	like in the real world. There are no complete robots that can be used every year. One of their games called Robot OnStage, which requires different robots every year.
	Heavily in Mechanical: Since theme and field change every year, it posts very different challenge in mechanical construction with some minimal levels in electronic.	**Can be Mechanical and Electronic Centric:** Rules are left similar from year to year but encourage continuous improvement. This allows scaffold learning which inherently encourages more in-depth learning. Since it allows open platform, many advanced students also incorporate electronic implementation.
Proprietary	**Proprietary Hardware/Software:** Participants must use hardware/software dictated by the organization.	**Non-proprietary Hardware/Software** In RoboCup / RCJ, they are the participants' choice. In the advanced level, some students would even completely design their own micro-controller, 3D-design their parts, create their own sensors, etc.
Female participants	Just like any other robotic game, higher male participants. However, it has gained ground in getting more female participation every year.	Just like any other robotic game, higher male participants. However, the robot on-stage competition historically had enticed mostly female participants than male.
Attainability	**More attainable by a novice:** Due to the 100% pre-defined field and in-field objects, obtaining a somewhat satisfactory result is attainable by a novice.	**Less attainable by a novice (Maze & Soccer):** RCJ leagues target age 10 to 18. However, due to the nature of the requirement on the robot's full automation working in a field with variable setup, most participants have been mostly older than age 10, usually 12+.

	For FLL, the majority of the challenge requires rotations. Although at times, it does get tedious, a novice may obtain a satisfactory result.	Nevertheless, novice still can participate and continuously improve from year to year.
Game Day	VERY loud music. Some people may need to carry ear-plugs throughout the event. FIRST games usually do a wonderful job in creating a very grand and lively atmosphere – a good analogy is like a football game. At the game day, team members, parents, and mentors are all together. For FRC, usually, only mentors and the main technical members hang out in the pit area. For FLL though, mentors, parents, and members can be all together.	Quiet. The loudest noise ever will just be from periodical excitement cheering from Robot Soccer. RCJ carries a far more subdue atmosphere. **Strictly no mentor/adult assistance:** Unlike most other robotics competitions, RCJ practices strict clause on prohibiting mentor/adult/parents from entering the entire members' pit area. In some events, there are interviews conducted with technical judges to ensure all work is done by the members. This may include questioning the teams' code and design work. Sometimes, team members may even be asked to explain their code during the interview (line-by-line if necessary).

How do we choose which games?

Our choice of competitions is not based on their popularity, but the technical value gained and balanced with the cost in time, effort, and expense.

Before high school level - FIRST LEGO League will be best facilitated a school or community within close distance and students with various interests, from technical, writing, reading, marketing, etc. It is definitely a game for a more inclusive environment. The team will be best to form by students with a variety of interests. At SR, students are from 2 to 50 miles away. Majority of them are mainly interested only in robotics, computer programming, and mathematics. Thus RCJ is definitely a much better fit for our students.

For the high school level - we do not participate in FIRST. It focuses heavily on mechanical with a somewhat electronic aspect, where machines involved are in industrial quality. It is very costly in materials and time just to adopt new rules and build an entirely new field from year to year.   Meanwhile, participants do remote controlling during most part of the game, not autonomous. This veers away from what Storming Robots chooses to focus on, i.e. behavior-based robotics, or towards artificial intelligence.

We participate in RCJ and ZeroRobotics. Storming Robots focuses on the development in the self-awareness of the robots. Besides, RCJ is a pre-college level competition from a world-renowned RoboCup, where teams from the School of Engineering of various prestigious universities also participate every year. Our participation in RCJ lends our high school nice transition to continue their robotics and A.I. interest in college. Therefore, RCJ is our preference. ZeroRobotics focuses on satellite computer programming, physics, and mathematics.