2. Every person has a creative side, and it can be expressed in many ways: problem solving, original and innovative thinking, and artistically, to name a few. Describe how you express your creative side

To prepare myself for the problems of tomorrow, I've been involved as the main engineer for my school's Science Olympiad team. Whereas most of my teammates would rather just study, I instead chose to invest my time in solving the problems laid out by the various engineering events. My favorites include the Electric Vehicle and Hovercraft.

In Electric Vehicle, the task was to build a fast and accurate electric-powered car. Speed was emphasized over accuracy, to an extent. Since the car started from rest and only covered a short distance, high acceleration was preferable to high top speed. As a result, I spent many nights at the gym, on the floor of its basketball court, balancing various factors from tire choice to gear ratio to optimize acceleration. All of my hard work paid off with a 3rd place medal at nationals, only narrowly beat by slightly slower but more accurate and better-funded cars. To my knowledge, at the national competition my car was the fastest car that worked decently well.

In Hovercraft, the goal was to construct a rather heavy hovercraft that could travel a certain distance in a certain amount of time. Carrying weights was easy compared to timing, the problem I spent countless hours and much iteration on. The difficulty came in not being allowed to use integrated circuits or stopping for more than 3 seconds. After going through various methods from PWM to an H-bridge, I suddenly came up with a pulsed timer circuit. That eureka moment turned the disadvantage of a frictionless craft into an advantage and simplified the problem to an equation. My solution worked so well at nationals that this year transistors aren't allowed, but I've already found a workaround using relays.

I've found that SciOly provides the well-defined problems and limits that encourages innovative outside-the-box thinking more than making random personal projects ever could. The problems presented, coupled with vague-enough rules, create a haven for coming up with multiple approaches to a solution. It's also allowed me to continue my central theme of perfect designs that are effortless to use.

3. What would you say is your greatest talent or skill? How have you developed and demonstrated that talent over time?

Though I have experience in several different fields in the world of engineering, I've always gravitated toward electrical engineering. My love of electricity was sparked in 4th grade when I removed a lightbulb from my microscope and powered it with a battery. From that point on I strove to learn everything I could about electronics. The Arduino Duemilanove – I started before the Uno came out - my dad bought me served as the basis of my learning. I've developed and demonstrated my talent through the many projects I've worked on, including those for SciOly, but my fondest projects have to be my coil guns and lightsabers.

Ever since I was a kid, I've always been fascinated by anything that could shoot a projectile. Thus, early on I built several coil guns, which use a perfectly timed magnetic field to accelerate a steel rod. Initially I used high-voltage capacitors to solve the timing issue since they can dump all of their energy in the blink of an eye. After the first model, I tried a multi-stage design that involved Arduino and some infrared sensors to improve projectile velocity. Years later with far more experience, I developed a third coil gun that used lithium batteries and transistors instead of capacitors to enable rapid firing.

More recently, I've found that building lightsabers were a fun way to demonstrate my ability to design and manufacture electronics. In addition to learning how not to start a fire with a lithium battery, I developed my skill in making PCBs (printed circuit boards) and soldering, necessities for any electrical engineer. With my most recent one, I started using SMD components, those tiny things you find in pretty much all modern electronics. Making the circuit board to mount those components let me learn how to use PCB design software and gave me a chance to use my homemade CNC router to make the PCBs. I also finally learned how to set fuses and registers on an Arduino, enabling more efficient and compact design and coding. What resulted was an exceptionally bright, small, and endlessly amusing lightsaber.

4. Describe how you have taken advantage of a significant educational opportunity or worked to overcome an educational barrier you have faced.

Since I moved some time during elementary school, I had to go to a different middle school than the ones my friends did. The only way my dad convinced me to go to this new middle school was by telling me they had some sort of science program. At first I thought they had a science fair where I could show off things I built, but I was instead pleasantly surprised that my new middle school was home to the reigning champions of SoCal Science Olympiad. Although I didn't get to do quite as much engineering, I learned many invaluable studying and test-taking skills that would and will continue to benefit me throughout my academic career. I competed in many different events ranging in subjects from physics to chemistry to a couple of more miscellaneous ones. It was through these events that I honed my hands-on lab skills which gave me an edge in high school science classes. There were a few engineering events I could have competed in, but my knack for studying relegated me to a more advisory role due to time constraints. Through SciOly, I also learned about the TroyTech program, a STEM program that was another amazing opportunity all on its own.

Through the TroyTech program, I brought along the skills I learned in middle school SciOly to a famously difficult high school. Thankfully, the skills I learned in middle school made even the hardest classes relatively easy, especially when holding up under the pressure of a test, freeing up time to focus on my love of engineering, which I could further advance in my high school's SciOly team. Of course, I also continued competing in physics and chemistry-based events, albeit fewer in number. Interestingly enough, the middle school and high school state-winning SciOly teams are located in different school districts, making me, to my knowledge, the only person in the last decade to compete for SoCal at Nationals five times (hopefully six this year). Going into college, I know I can apply my experience to even higher learning.

6. Think about an academic subject that inspires you. Describe how you have furthered this interest inside and/or outside of the classroom.

My passion for robotics started when I used a Vex kit to work on a robot for my middle school Science Olympiad team. I had a lot of fun learning about the Vex system and driving around a little robot to pick up tennis balls and pennies. Being able to do more with electronics than just controlling some leds with an Arduino was rather amazing. As part of the TroyTech program's engineering pathway at my high school, I took the robotics class before it was cool, which means before it became an honors class. The teacher did a great job of getting just about everyone interested in the subject. The curriculum was a bit too simple, but it let me use some sensors that I never bought and got me started in CAD and 3D printing, quite critical skills for a budding engineer.

Building a robot arm for last year's SciOly Robot Arm event for provided a unique challenge that helped me expand upon my knowledge of robotics. To put it very simply, the task was to move around 50 pennies in 3 minutes. One limiting factor was cost since my team doesn't have much funding. With each iteration of four designs that preceded a national medal-winning one, I modeled in CAD and 3D printed more and more parts, honing skills indispensable in robotics.

Even more, I was able to bring my experience in building robot arms to my internship at the Cal State LA NASA SPACE lab. There, I developed a low-cost lightweight robot arm for a teleoperation robot. The internship provided me a glimpse of where my love of robotics could take me. Building robots didn't have to stay in high school or at home; it could be brought into the real world. After 8 weeks, most of which was spent making a compact 3D-printed harmonic drive gearbox, the robot arm was physically complete, but the code was still in the early stages. The arm was actually impressive enough that a college student was tasked with replicating my arm based on the designs I left behind.