



**CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY**

Name(s) Alexander T. McDowell	Project Number J1409
Project Title Can Wind Chimes Generate Truly Random Numbers?	
<div><div>Objectives/Goals The sound of wind chimes can be used as a seed to generate truly random numbers.</div><div>Methods/Materials A wind chime for recording sound, a fan to control wind speed, a recording device (iPhone), a program that can convert audio to numbers (Audacity), and the Java programming language. I put my iPhone next to the wind chimes to record the sound, and used a fan to control wind speeds. I recorded 60 samples of data, all around 20 seconds long with 4 different tests. First I rang the chimes manually, then I used the fan's 3 wind speeds. Next I ran the files through Audacity to take the Spectrum (or Fast Fourier Transform) of the sound file. These files each consisted of roughly 256 numbers. Then I ran the numbers through a program I created to seed a random number generator. Finally I analyzed the numbers through a program that I created to determine if the sequence were random by using the Chi Square Test.</div><div>Results After going through all 60 files, the Chi Square Test returned that each of the sequences were random, and I compared these results to a control group that consisted of a sequence of truly random numbers and a non-random sequence (Fibonacci).</div><div>Conclusions/Discussion I concluded that the random numbers created by the wind chimes were truly random.</div></div>	
Summary Statement Wind chimes can be used as a seed for a Truly Random Number generator.	
Help Received	