Challenge Set 1

Deadline: Jan 23 2018 at 5pm

Challenge problems are **optional** problems for those interested in testing their abilities. For each correct answer to a challenge question, bonus points of 0.3 are given towards the final overall grade, i.e., you can potentially earn up to 4.5 points towards the final grade if you get all questions correct (note that 4.5 points on your final grade is a non-trivial amount of points because no scaling ratio is applied). Proper workings must be shown to get any points, and there is no partial credit. Also, because these are bonus questions, instructors will not provide any help or hints (unlike typical problem or practice set questions where generous assistance will be provided) to be fair to all students. Please submit your solutions via email (you can simply take a good resolution photo/scan of your solutions with your student ID number and name clearly labelled) to ongsp@eng.ucsd.edu by the deadline.

Q1. You have a nanoparticle suspension of 80 polymeric nanoparticles and 20 metal nanoparticles. Three nanoparticles are extracted randomly, without replacement, with an AFM tip during analysis.

a. What is the probability that the second one selected is a metal nanoparticle? (0.1 pts)

b. What is the probability that the second and third selected ones are metal nanoparticles given that the first one was also metal? (0.1 pts)

c. How does the answer to part (b) change if nanoparticles selected were replaced prior to the next selection? (0.1 pts)

Q2. Redundant array of inexpensive disks (RAID) is a technology that uses multiple hard drives to increase the speed of data transfer and provide redundancy. Suppose that the probability of any hard drive failing in a given day is 0.001, and drive failures are independent. In a RAID6 configuration, up to two drives can fail without loss of data. Let us assume that we have an extremely negligent IT support who does not replace any failed drive for 30 days. At the beginning of the month, there are no failed drives. What is the probability that there will be data loss within the 30 days? (0.3 pts)

Q3. A group of STEM students comprises 12 boys and 8 girls. The students are divided into two groups of 10. What is the probability that at least one of the groups have more girls than boys? (0.3 pts)