Hw6: Stat355, F 2016, Due October 24

1. The hardness of pins of a certain type is known to be have a mean of 50 and standard deviation of 1.2.

   (a) If the distribution is normal, what is the probability that the sample mean hardness for a random sample of 9 pins is at least 51?

   (b) Without assuming population normality, what is the (approximate) probability that the sample mean hardness for a random sample of 40 pins is at least 51?

2. A binary communication channel transmits a sequence of "bits" (0s and 1s). Suppose that for any particular bit transmitted, there is a 10% chance if a transmission error (a 0 becoming a 1 or a 1 becoming a 0). Assume that bit errors occur independently of one another.

   (a) Consider transmitting 1000 bits. What is the approximate probability that at most 125 transmission errors occur?

   (b) Suppose the same 1000-bit message is sent two different times independently of one another. What is the approximate probability that the number of errors in the first transmission is within 50 of the number of errors in the second?

3. Show that $Cov(X, Y + Z) = Cov(X, Y) + Cov(X, Z)$

4. If the amount of soft drink that I consume on a given day is independent of consumption on any other day and is normally distributed with $\mu = 13$ oz and $\sigma = 2$ oz, and if I currently have two six-packs of 16-oz bottles, what is the probability that I still have some soft drink left at the end of 2 weeks (14 days)?

5. Two airplanes are flying in the same direction is adjacent parallel corridors. At time $t = 0$, the first airplane is 10km ahead of the second one. Suppose the speed of the first plane (km/hr) is normally distributed with mean 520 and standard deviation 10 and the second plane's speed is also normally distributed with mean and standard deviation 500 and 10, respectively.

   (a) What is the probability that after 2 hr of flying, the second plane has not caught up to the first plane?

   (b) Determine the probability that the planes are separate by at most 10 km after 2 hrs.

   Consider the 12 replicated measurements n flexural strength (MPa) for concrete beams of a certain type: 5.9, 7.2, 6.3, 8.1, 6.8, 9.0, 18.2, 8.4, 6.6, 7.1, 8.8, 9.0.

   (a) Calculate a "reasonable" point estimate of the man value of strength for the conceptual population of all beams manufactured in this fashion.

   (b) Calculate a point estimate of the strength value that separates the weakest 50% of all such beams from the strongest 50%.

   (c) Calculate a point estimate of the proportion of all such beams whose flexural strength exceeds 10 MPa.