STA237 Tutorial 8

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Agenda

1. Review of key concepts
2. Tutorial Problems
3. Q&A

Strong law of large numbers

- The Strong Hotel has infinitely many rooms. In each room, a guest is flipping coins - forever. Each guest generates an infinite sequence of zeros and ones. We are interested in the limiting behaviour of the sequences in each room.

- The strong law of large numbers says that in **virtually every room of the hotel** the sequence of averages will converge to $1/2$. And not only will these averages get arbitrarily close to $1/2$ after a very long time, but each will stay close to $1/2$ for all the remaining terms of the sequence. Those sequences whose averages converge to $1/2$ constitute a set of "probability 1." And those sequences whose averages do not converge to $1/2$ constitute a set of "probability 0."

Strong law of large numbers

Result

Let $X_1, X_2, \cdots, X_n$ be an i.i.d sequence of random variables with finite mean μ. For $n = 1, 2, \cdots$, let $S_n = X_1 + X_2 + \cdots + X_n$. Then

$$P\left(\lim_{n \to \infty} \frac{S_n}{n} = \mu\right) = 1.$$

We say that S_n/n converges to μ with probability 1.

- You will receive an email at the end of the tutorial session to upload your work. Also, you will know that which question should be uploaded at that time.
- You will have **4 hours window** to upload your work.
- If you upload the work of others on your Crowdmark link, you will get maximum 10% penalty in your course marks.
- **You should only upload one question that will be instructed on Crowdmark**

Question 1

Write the code to illustrate the Strong Law of Large Numbers (SLLN) for independent and identically distributed (i.i.d) sequence for the Binomial distribution with the number of trials, $s = 12$ and the probability of success,

(a) $p = 0.5$

(b) $p = 0.7$

Simulate 10000 times and use ggplot to generate graphs to visualize SLLN for the above two scenarios.