In last week, we have learned some important probability distributions (both discrete and continuous random distributions), including their functions, parameter calculations, and other mechanics. But in most practical applications, we don't really have the data that we need to build up the models. For examples, market researchers wouldn't be able to survey the entire market to conduct a product performance estimation, or quality control department wouldn't be able to test every product they've made to keep the fully satisfied feedback (Evans, 2013). Therefore, Sample statistics would be the information that help us to calculate the population parameters, perform simulation modeling, and eventually, make the decisions based on statistical inference.

The real world example of simulation that I am going to mention is the performance of the Insomnia Pill, Melatonin (Dollins, 1994). In a MIT study, neuroscientists conducted a experiment to discover the effectiveness of Melatonin, a sleeping-inducing hormone. They let healthy adult took Melatonin or placebo (a dummy dedication without Melatonin) and lay down in a dark room at midday. The time of fall in sleep was recorded. We have information from the previous research is that the volunteers fall asleep in 15 mins by taking placebo (i.e., no hormone). This time, there are 20 young male volunteers taken Melatonin. 18 (90%) volunteers took less than 15 minutes to fall asleep. Set up H0 is the drug is not effective by assuming only 50% of volunteers fall in sleep less than 15 mins. Then calculate the proportion of H0. According to the Central Limit Theorem, the sampling distribution proportion is normally distributed. Therefore, the binomial proportion value was calculated as 0.079. Then convert the sample proportion to a standard normal z value, the result is almost 0. In another word, there is almost no chance of observing 90% of sample is effective if the true proportion of fall asleep took less than 15 mins is 50%. So there is enough evidence to reject H0. The true value of proportion for taking the Melatonin pill is much higher than 50%.

In simulation modeling, calculation is always the easy part if we have all the accurate information on hand. So the challenging part would be how to gather the experiment data. In this case, all the volunteers needed to provide a physical exam report to be eligible and 1.5 hours training sessions were taken to get familiar of the testing process. On the experiment day, there were mood questionnaires automated to reduce the possibility of experimenter- induced bias.

Reference:

1. Evans, J. R. (2012). *Statistics, Data Analysis, and Decision Modeling*. Pearson Publishing.

2. Dollins, A. B., Zhdanova, I. V., Wurtman, R. J., Lynch, H. J., Deng, M. H. (March 1, 1994). *Effect of inducing nocturnal serum melatonin concentrations in daytime on sleep, mood, body temperature, and performance.* Retrieved from https://www.researchgate.net/publication/15071141\_Effect\_of\_Inducing\_nocturnal\_serum\_melatonin\_concentrations\_in\_daytime\_on\_sleep\_mood\_body\_temperature\_and\_performance.