GM – Probabilités et Statistique – Exercise Set 8

In class

Exercise 1 How much credit card debt do students typically have when they graduate from university ? Suppose a sample of 20 recent university graduates was obtained. Each of these recent graduates was asked to indicate the amount of credit card debt they had at the time of graduation.

The results : $\bar{x} = $ chf 2430 ; $s = $ chf 2500

Find a 95% CI for the mean credit card debt for all recent university graduates.

Exercise 2 Marketers believe that 92% of adults in Switzerland own a cell phone. A cell phone manufacturer believes that number is actually lower. Two hundred adults resident in Switzerland are surveyed, of which 174 report having cell phones.

Carry out a hypothesis test (show all 5 steps) using a 5% level of significance to test the manufacturer's claim.

Also identify the Type I and Type II errors. If you made an error in your inference, would it be a Type I or Type II error ?

Exercise 3 One kind of plant has only blue flowers and white flowers. According to a genetic model, the offspring of a certain cross have a 75% chance to be blue and a 25% chance to be white, independently of one another. Two hundred seeds of such a cross are raised, and 142 turn out to be blue.

Are the data consistent with the model ?

Exercise 4 An enterprise has developed a new battery. The engineer claims that the new battery will operate continuously for at least 7 minutes longer than the old battery.

To test the claim, the company selects a simple random sample of 100 new batteries and 100 old batteries. The old batteries run continuously for 190 minutes with a standard deviation of 20 minutes ; the new batteries, 200 minutes with a standard deviation of 40 minutes.

Test the engineer's claim that the new batteries run at least 7 minutes longer than the old. Use a 0.05 level of significance.

At home

Exercise 1 Suppose we want to determine whether the mean IQ score of students from an honors program is higher than that from the general population. A random sample of 25 subjects from the honors program has a mean IQ of 107.

Use a significance level of $\alpha = 0.05$ to test the relevant hypotheses. What do you conclude ? Make sure to state your assumptions and give a clear interpretation of your results.

Exercise 2 With a perfectly balanced roulette wheel, in the long run red numbers should turn up 18 times in 38. To test whether its wheel is fair, one casino records the results of 3,800 plays, finding 1,890 red numbers.

Is this result just due to chance variation ? (Use $\alpha = 0.05$.)

Exercise 3 A pharmaceutical company develops a new drug, designed to prevent colds. To test this claim, they choose a a simple random sample of 100 women and 200 men from a large population.

At the end of the study, 38% of the women caught a cold ; and 51% of the men caught a cold.

(a) The company states that the drug is equally effective for men and women. Based on these findings, can we reject the company's claim that the drug is equally effective for men and women ? Use a 0.05 level of significance.

(b) Suppose instead that the company states that the drug is more effective for women than for men. Based on these findings, can we conclude that the drug is more effective for women than for men ? Use a 0.01 level of significance.

Exercise 4 Within a school district, students were randomly assigned to one of two Math teachers - Xavier and Yolande. After the assignment, Xavier had 30 students, and Yolande had 25 students.

At the end of the year, each class took the same standardized test. Xavier's students had an average test score of 78, with a standard deviation of 10 ; and Yolande' students had an average test score of 85, with a standard deviation of 15.

Test the hypothesis that Xavier and Yolande are equally effective teachers. Use a 0.10 level of significance.