

## 1 Hypothesis testing

- Let  $X$  be a measurement of a patient's blood pressure, which follows the normal distribution with  $\sigma = 5$  mmHg center around the true blood pressure. Let the null hypothesis be that the patient's blood pressure is  $\mu = 120$ , and the alternative hypothesis  $H_1 : \mu > 120$  with significance level  $\alpha = 0.05$ ? Supposed that the patient's blood pressure is measure to be 135 mmHg.
  - Is it a one-sided test?
  - Calculate the p-value.
  - Calculate critical value and find the rejection region.
  - Draw a conclusion.
- Let  $X$  be a measurement of a patient's blood pressure, which follows the normal distribution with  $\sigma = 5$  mmHg center around the true blood pressure. Let the null hypothesis be that the patient's blood pressure is  $\mu = 120$ , and the alternative hypothesis  $H_1 : \mu \neq 120$  with significance level  $\alpha = 0.05$ ? Supposed that the patient's blood pressure is measure to be 130 mmHg.
  - Is it a one-sided test?
  - Calculate the p-value.
  - Draw a conclusion.
- You have a coin that you suspect is biased toward coming up heads. You let  $p$  be the probability that the coin will give heads on any one flip. Can you reject the null hypothesis  $H_0 : p = \frac{1}{2}$  in favor of the alternative hypothesis  $H_1 : p > \frac{1}{2}$  with significance level  $\alpha = 0.05$ ?
  - you get 7 heads in 8 flips
  - you get 4 heads in 8 flips
- You have a coin that you suspect is biased toward coming up heads. You let  $p$  be the probability that the coin will give heads on any one flip.
  - Explain why, if you flip the coin three times, then no matter how the three flips turn out, you will NOT have enough evidence to reject the null hypothesis  $p = \frac{1}{2}$  in favor of the alternative hypothesis  $p > \frac{1}{2}$  at significance level  $\alpha = 0.05$ . Hint: calculate the  $p$ -values if you have 0, 1, 2, 3 heads and compare with  $\alpha$ .
  - What is the smallest number of times you need to flip the coin so that having all of those flips turn out to be heads is enough evidence to reject the null hypothesis  $p = \frac{1}{2}$  in favor of the alternative hypothesis  $p > \frac{1}{2}$  at significance level  $\alpha = 0.05$ .