

7A Hypothesis Testing

1. Imagine we believe that a dice is biased towards landing on 6s.
We roll the dice 20 times and get a 6 on 8 occasions

a) What is the test statistic for this situation?

b) Write a sensible null hypothesis for this situation

- c) Write a sensible alternative hypothesis for this situation
- d) A researcher wants to test, at the 5% significance level, whether the dice is biased
Under what conditions would we reject the null hypothesis?
- e) What is the probability of getting 8 sixes when rolling a dice 20 times?

Imagine we had rolled 7 sixes instead...

Imagine we had rolled 6 sixes instead...

2. John wants to see whether a coin is unbiased, or whether it is biased towards coming down on heads. He tosses the coin 8 times and counts the numbers of times, X , that it lands heads up.

a) Describe the test statistic

b) Write down a suitable null hypothesis

c) Write down a suitable alternative hypothesis

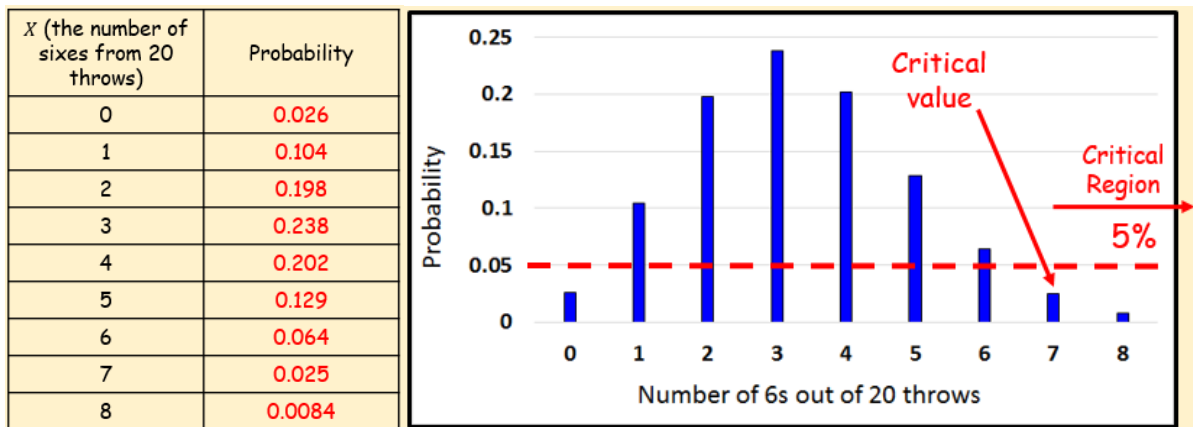
3. An election candidate believe she has the support of 40% of the residents in a particular town. A researcher wants to test, at the 5% significance level, whether the candidate is overestimating her support. The researcher asks 20 people whether they support the candidate, and 3 say that they do.

a) Write down a suitable test statistic

b) Write down two suitable hypotheses

c) Explain the condition under which the null hypothesis would be rejected

7B Critical Regions



1. A single observation is taken from a Binomial distribution $B(6, p)$. The observation is then used to test $H_0: p = 0.35$ against $H_1: p > 0.35$.

a) Using a 5% significance level, find the critical region for this test

b) State the actual significance level of this test

2. A random variable X has binomial distribution $B(40, p)$. A single observation is used to test $H_0: p = 0.25$ against $H_1: p \neq 0.25$.
- a) Using the 2% level of significance, find the critical region of this test. The probability in each 'tail' should be as close to possible as 0.01

- b) State the actual significance level of the test

7C One-Tailed Tests

1. A single observation, x , is taken from a Binomial distribution $B(12, p)$ and a value of 8 is obtained. Use this observation to test $H_0: p = 0.4$ against $H_1: p > 0.4$ using a 5% significance level.

2. The standard treatment for a particular disease has a $\frac{1}{4}$ probability of success. A certain doctor has undertaken research in this area and has produced a new drug which has been successful with 10 out of 20 patients. The doctor claims that the new drug represents an improvement on the standard treatment. Test, at the 5% significance level, the claim made by the doctor.

7D Two-Tailed Tests

1. A single observation, x , is taken from a Binomial distribution $B(10, p)$, and a value of 1 is obtained. Use this observation to test $H_0: p = 0.45$ against $H_1: p \neq 0.45$ using a 5% significance level.

2. Over a long period of time it has been found that in Enrico's restaurant the ratio of non-vegetarian to vegetarian meals sold is 2:1. In Manuel's restaurant, in a random sample of 12 people ordering meals, 2 ordered a vegetarian meal. Using a 5% significance level, test whether or not the proportion of people eating vegetarian meals in Manuel's restaurant is different to that in Enrico's restaurant.