**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

1. What is the test statistic for this situation?
2. Write a sensible null hypothesis for this situation
3. Write a sensible alternative hypothesis for this situation
4. A researcher wants to test, at the 5% significance level, whether the dice is biased

Under what conditions would we reject the null hypothesis?

1. 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…

1. 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.
2. Describe the test statistic
3. Write down a suitable null hypothesis
4. Write down a suitable alternative hypothesis
5. 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.
6. Write down a suitable test statistic
7. Write down two suitable hypotheses
8. 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 $H\_{1}:p>0.35$.
2. Using a 5% significance level, find the critical region for this test
3. State the actual significance level of this test
4. A random variable $X$ has binomial distribution $B(40, p)$. A single observation in used to test $H\_{0}:p=0.25$ against $H\_{1}:p\ne 0.25$.
5. 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
6. 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 $B\left(10,p\right)$, and a value of 1 is obtained. Use this observation to test $H\_{0}:p=0.45$ against $H\_{1}:p\ne 0.45$ 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.