

## Hypothesis Testing : Tutorial Sheet C

- 63 of 100 first time convicts serving at least 3 years re-offended, whereas 70 of 140 first time convicts serving less than 3 years re-offended.
  - Test the null hypothesis that the re-offending rate does not depend on the length of the first sentence at a significance level of 5
  - Calculate a 95% confidence interval for the difference in the re-offending rates of these two groups.
  - Based on this confidence interval, is there any evidence that the re-offending rates differ?
- The typing speeds for one group of eight IT students were recorded both at the beginning of year 1 of their studies and at the end of year 4. The results (in words per minute) are given below:

Subject	A	B	C	D	E	F	G	H
Year 1	173	183	176	191	184	177	175	177
Year 4	172	184	180	190	191	187	181	183

- A study finds that 45% of IT users out of a random sample of 500 in a large community preferred one web browser to all others. In another large community, 30% of IT users out of a random sample of 390 prefer the same web browser.
  - Compute the point estimate for the difference in proportions of IT users who prefer this particular web browser.
  - Compute a 95% confidence interval for this difference in proportions.
  - Based on this confidence interval, test the hypothesis that the proportion of IT users using this web browser is the same for both communities. State your null and alternative hypotheses clearly.
- In a computer hardware manufacturing plant, machine X and machine Y produce identical components. The management investigate whether or not there is a difference in the mean diameter of the components from both machines.
  - A random sample of 144 components from machine X had a mean of 36.38 mm and a standard deviation of 3.0 mm.
  - A random sample of 225 components from machine Y had a mean of 36.88 mm and a standard deviation of 2.8 mm.

Compute a 95% confidence interval for the difference in means. What is your conclusion for this procedure? Justify your answer.

- Two similar machines are making components of a particular length in mm. Compute a 95% confidence interval for the difference in average length between the components

The results for each machine are

- Machine A: {23.7, 23.0, 22.2, 24.0, 21.2, 23.1, 27.1, 24.0} ( $n_1 = 8$ )
- Machine B: {23.4, 15.3, 30.9, 18.8, 25.3, 25.2, 32.1} ( $n_2 = 7$ )

You may assume that the populations are normal with variance 9 for the first machine and 16 for the second machine.

6. In a computer hardware manufacturing plant, machine X and machine Y produce identical components. The management investigate whether or not there is a difference in the mean diameter of the components from both machines.

- A random sample of 144 components from machine X had a mean of 36.38 mm and a standard deviation of 3.0 mm.
- A random sample of 225 components from machine Y had a mean of 36.88 mm and a standard deviation of 2.8 mm.

A hypothesis test was used to determine whether or not the means are significantly different. A 5% significance level was used.

- (a) What is the null and alternative hypothesis?
- (b) Compute the test statistic.
- (c) What is your conclusion for this procedure? Justify your answer.

7. Two similar machines are making components of a particular length in mm. Give a 95% confidence interval for the difference in average length between the components produced by the two machines. Assume that the populations are normal with variance 9 for the first machine and 16 for the second machine.

- The results for each machine are  
**Machine A:** {23.7, 23.0, 22.2, 24.0, 21.2, 23.1, 27.1, 24.0} ( $n_1 = 8$ )  
**Machine B:** {23.4, 15.3, 30.9, 18.8, 25.3, 25.2, 32.1} ( $n_2 = 7$ )

8. 63 of 100 first time convicts serving at least 3 years re-offended, whereas 70 of 140 first time convicts serving less than 3 years re-offended.

- (a) Test the null hypothesis that the re-offending rate does not depend on the length of the first sentence at a significance level of 5
- (b) Calculate a 95% confidence interval for the difference in the re-offending rates of these two groups.
- (c) Based on this confidence interval, is there any evidence that the re-offending rates differ?

9. A study was made of children who were hospitalised as a result of a car accident.

- 290 of the children were not wearing seat belts and 50 of these were seriously injured.
- 123 children wore seat belts and 16 were seriously injured.

Test the hypothesis that the rate of serious injury is the same for children who wear a seat belt or not. Clearly state your null and alternative hypotheses and your conclusion.