# Assignment two: Hypothesis Testing @ Probability and Statistics: To p Or Not To p

The included items in my Assignments are:

* the calculation of the sample mean from the raw observations
* the formulation of the hypotheses, H0 and H1
* calculation of the test statistic value
* calculation of the $$p$-value$
* a decision of whether or not to reject H0
* an inferential conclusion about what the test result means
* Indication of which type of error might have occurred.

**The sample mean from the raw observations:**

**Formulation of the hypotheses,**H0**and**H1

Let X denote the quantity of water in a bottle such that:

X∼N(μ,σ2)

and we wish to test:

H0:μ=1000ml vs H1:μ≠1000ml.

**Calculation of the test statistic value**

We proceed by **standardizing** **x̅** such that:

Z= ∼N(0,1)

Acts as our **test statistic**. Note the test statistic includes the effect size, **x̅**−μ, as well as sample size, n.

Using our sample data, we now obtain the test statistic value (noting the **influence of both the effect size and the sample size**, and hence ultimately the influence on the pp-value):

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#### Calculation of the p-value

The p-value is the probability of our test statistic value or a more extreme value conditional on H0. Noting that H1:μ≠1000, ‘more extreme’ here means a z-score > 3.5 and z< -3.5. Due to the symmetry of the standard normal distribution about zero, this can be expressed as:

p-value=P(Z≥∣3.5∣)=0.00046.

**A decision of whether or not to reject H0**p**-value decision rule**

The decision is to **reject**H0**if the**p**-value is**≤α. Otherwise, H0 is not rejected.

So, We have from the Assignment description Test the manufacturer's claim at the 1% significance level. It means

**and the default value for .**

By recall the p**-value decision rule**, and since 0.00046 < 0.05 we reject H0 and conclude that the result ‘statistically significant’ at the 5% significance level (and also, of course, at the 1% significance level).

#### An inferential conclusion about what the test result means

Hence there is (strong) evidence that μ≠1000. Since **x̅**<μ we might go further and suppose that μ<1000.

#### Indication of which type of error might have occurred

As we have rejected H0 this means of two things:

* we have correctly rejected H0
* and that mean we have committed a Type I error.

And we know that the p-value is very small, which indicates that highly unlikely that is a type I error, but we cannot be certain that which outcome has occurred.