Paired t Test

Assuming that two populations from which paired samples of size n are selected are distributed with means μ_1 and μ_2 respectively, then the differences between pairs will also be normally distributed with mean $\mu_1 - \mu_2 = \mu_d$ and variance σ_d^2

Hence a test of:

$H_0: \mu_1 = \mu_2$ is equivalent to $H_0: \mu_d = 0$

The paired t test allows us to test for a difference between two means from paired data when the standard deviation of the population is unknown and the central limit theorem cannot be used as $n < 30$.

Notation

$\bar{d}$: the mean of a sample of n paired differences

s_d^2 : the standard deviation of a sample of n paired differences

Then

$$\bar{d} = N(\mu_d, \frac{\sigma_d^2}{n})$$

And hence ...

$$Z = \frac{\bar{d} - \mu_d}{\frac{\sigma_d}{\sqrt{n}}} \sim N(0, 1) \qquad \frac{\bar{d} - \mu_d}{\frac{s_d}{\sqrt{n}}} \sim t_{n-1}$$

This is given to you in the formula booklet

H_0:	$\mu_d = 0$
H_1:	$\mu_d \neq 0$ or $\mu_d < 0$ or $\mu_d > 0$ (for < and > the order of subtraction is important)

1 if > or < 2 if ≠	Tailed test

5% unless otherwise stated	Significance level

differences	Calculate the difference between each pair of data values

$\bar{d}$ =	Mean of the differences	s_d =	Sample s.d.	n =	Number of pairs of data	ν =	Degrees of freedom n - 1

Test Statistic:	$\dfrac{\bar{d} - \mu_d}{\frac{s_d}{\sqrt{n}}}$

Critical Region:	Taken from Table 5 in the formula booklet

Compare	- Draw a t (normal) curve - Mark the critical value(s) found on the curve - Shade the 'tail(s)' on the curve – this is the critical region - Plot the test Statistic

Conclude:	
Hence we REJECT H_0 when the test statistic lies in the critical region	
Therefore there is	