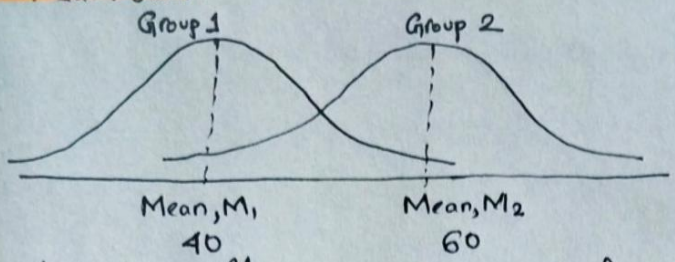
t-Test – Works good for normal distribution.

- The t-test assesses whether the mean of two groups are statistically different from each other.



$= M_2 - M_1$
$= 60 - 40$
$= 20$

Does this 20 is significantly different or not.

$$t \text{ test} = \frac{\text{Difference between mean of two groups}}{\text{Standard error of difference between mean}} = \frac{M_2 - M_1}{(SE \text{ of diff mean})}$$

- Why not directly find difference as (i.e. 20) and say they are different. It means at the mean may show a difference, but we can't be sure if that is a reliable difference.
- Suppose me and you toss a coin 100 times. and find number of heads.
  Your heads = 52, My heads = 49 times.
  So this does not suggest, you will get heads more than me in future. This is only a chance.

→ **Descriptive statistics** – It does not gurantee that this are likely to happen again. These are just stats such as mean that describe data you have, but can't generalized beyond that.

→ **Inferential statistics** – These are stats, such as t-test that allow us to make inference about population beyond our data. Example – Medicines made.

$$t = \frac{\text{variance between groups}}{\text{variance between within groups}}$$

A big t-value = different ~~value~~ groups.
A small t value = similar groups

- Each t-value has a p-value. The p-value tells us likelihood that there is real difference.
- P value will tell if two group are really different or just a fluke. P value is the probability that the pattern of data in the sample could be produced by random data.

$P = 0.10$, there is 10% chance there is no real diffence. (Rejected)

$P = 0.05$, there is 5% chance there is no real difference. $P \leq 0.05$

$p = 0.01$, there is 1% chance there is no real difference (Accepted)

- Bigger samples make it easier to detect differences. With 2 group of 5, $t = 2.0$, $p = 0.09$
  2 group of 10, $t = 2.0$, $p = 0.03$
- A good guideline is to aim for 20 to 30 datapoint in each group.

Types of T-test – i) Independent-sample ii) Paired sample iii) One-Sample

1) Independent sample t test → Testing the average quality of two different batches of beer. Also known as between-sample & unpaired-sample t test

2) Paired sample t test → Test the mean of one group twice. Eg – Testing balance before and after drinking. Also known as within-subjects, repeated measures and dependent sample t test.

3) One sample t test → Test the mean of one group against known population mean. Eg – Testing if your co-workers IQ differs from average of 100.