# T-test example

**Q** Brinell Hardness Score measures the hardness of a material. Engineer measured the harness of 25 pieces of ductile iron and got following observations.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 170 | 167 | 174 | 179 | 179 | 187 | 179 | 183 | 179 |
| 156 | 163 | 156 | 187 | 156 | 167 | 156 | 174 | 170 |
| 183 | 179 | 174 | 179 | 170 | 159 | 187 | | |

Engineer hypothesized that mean hardness is more than 170.

(In the chocolate example QA can hypothesize that mean weight is less than 100 gm or if more confident less than 95 gm)

**Ans.**

→ Mean $= 170 + \frac{167 + \cdots}{25} + 187$ $= 172.52$

St. dev $= 10.31$

SE mean $= 2.06$

→ $H_0 : \mu = 170$
$H_A : \mu > 170$

→ T-distribution has just one parameter
df $= 24$

→ $t\text{-val} = \frac{\bar{x} - \mu}{SE\ Mean} = \frac{172.52 - 170}{2.06} = 1.22$

→ For $df = 24$, $\alpha = 0.05$ from t-distribution we get

$$t\text{-critical} = 1.71$$

① → We fail to reject null hypothesis because $t\text{-val} < t\text{-critical}$

② → for $t\text{-val} = 1.22$, for $df = 24$ from t-distribution we get

$$p\text{-val} = 0.117$$

which is not significant so we fail to reject null hypothesis.

Twist

→ $H_0 : \mu = 170$

$H_A : \mu \neq 170$

① → For $df = 24$, $\alpha = 0.025$ from t-distribution we get

$$t\text{-critical} = 2.064$$

② → for $t\text{-val} = 1.22$, for $df = 24$ from t-distribution we get

$$p\text{-val} = 0.117$$

multiply by 2

$$p\text{-val} = 0.117 \times 2$$
$$= 0.234$$