T shirt problem?

100K   L T-shirt   XL T-shirt

500 people   800 L T-shirt
2000 XL T-shirt

Let assume C·I → 95% $\alpha = 0.05$

Let assume 70% of population wear L T-shirt.

∴ $\mu = 70\% = 0.7$ $n = 500$

① $H_0 = 70\%$ ⟹ $P_0 = 0.7$ $q_0 = 0.3$
   $H_1 \neq 70\%$ ⟹ $\hat{P}$

   $\hat{P} = \dfrac{300}{500}$ ⟹ 0.6

② $\alpha = 0.05$ $CI = 0.95$

③ Describe boundary

④ z test $= \dfrac{\hat{P} - P_0}{\sqrt{\dfrac{P_0 q_0}{n}}}$

$= \dfrac{0.6 - 0.7}{\sqrt{\dfrac{0.3 \times 0.7}{500}}} = \dfrac{-0.1 \times \sqrt{500}}{\sqrt{0.21}} = \dfrac{-1 \times \sqrt{5} \times 10}{\sqrt{2}}$

$= -4.879$

-0.025 $+0.25$
-1.96 $+1.96$
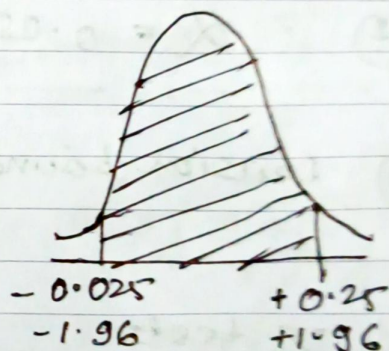
So we will reject the null hypothesis.

x can lies between this

but

$$-1.96 < \frac{0.6-x}{\sqrt{\frac{0.3 \times 0.7}{500}}} < 1.96$$

$$-1.96 \times \frac{\sqrt{0.21}}{\sqrt{500}} < 0.6 - x$$

$$x < \frac{0.6 + 1.96\sqrt{0.4}}{10\sqrt{5}}$$

$$< 0.6 + \frac{1.96}{10}\sqrt{\frac{0.4}{5}}$$

$$\underline{x < 0.6401}$$

$$\frac{0.6-x}{\sqrt{\frac{0.4}{500}}} < 1.96$$

$$0.6 - x < 1.96 \times \sqrt{\frac{0.4}{500}}$$

$$0.6 - x < 0.0401$$

$$0.6 - 0.0401 < x$$

$$0.5599 < x$$

$$\boxed{0.559 < x < 0.6401}$$

$$\boxed{P_0 \Rightarrow 55.9\% \text{ to } 64.01\%}$$

$$\boxed{L \; Tshirt = \frac{55.9 \times 100K}{100} \Rightarrow \quad 55.9K \text{ to } 64.01K \\ L \; Tshirt}$$