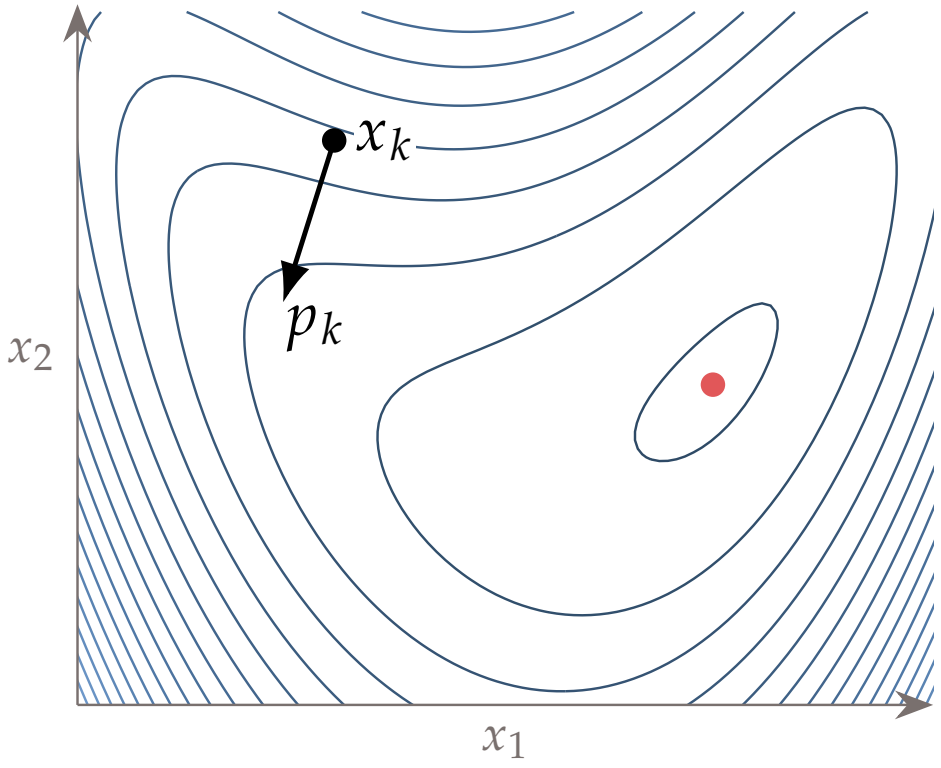
Confidence Intervals (continued)



ME EN 275
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Sample Statistics

Formula for confidence interval of a mean

Confidence interval for μ

$$= \bar{x} \pm z_c \frac{s}{\sqrt{n}}$$

sample mean

sample stdev

sample size

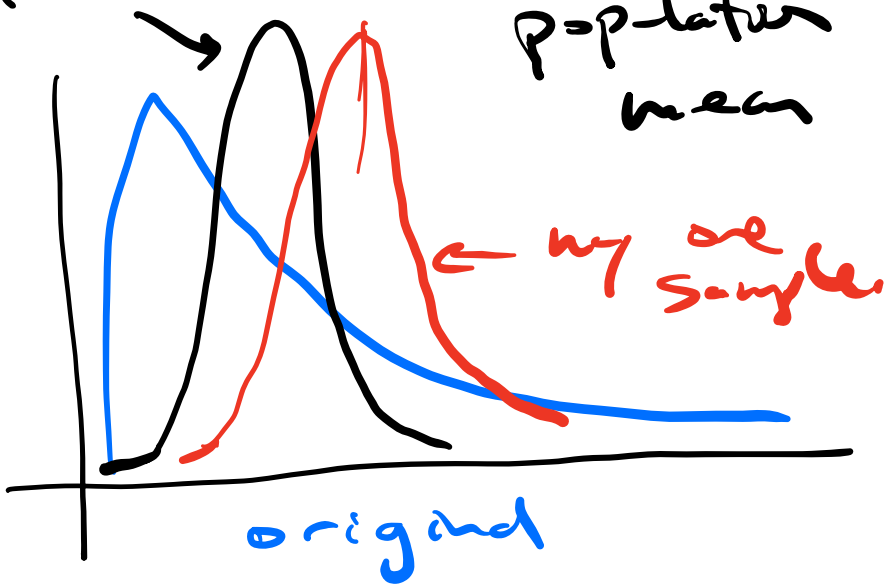
z-score associated w/ my confidence level.

distribution of averages

population mean

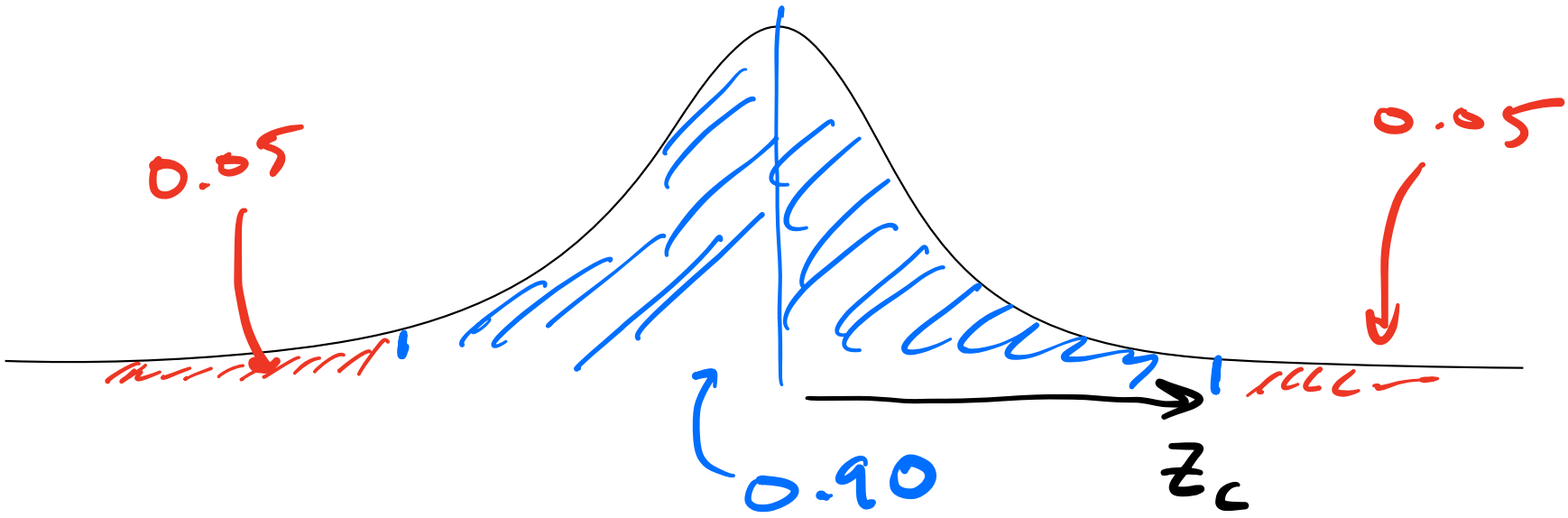
my one sample

original



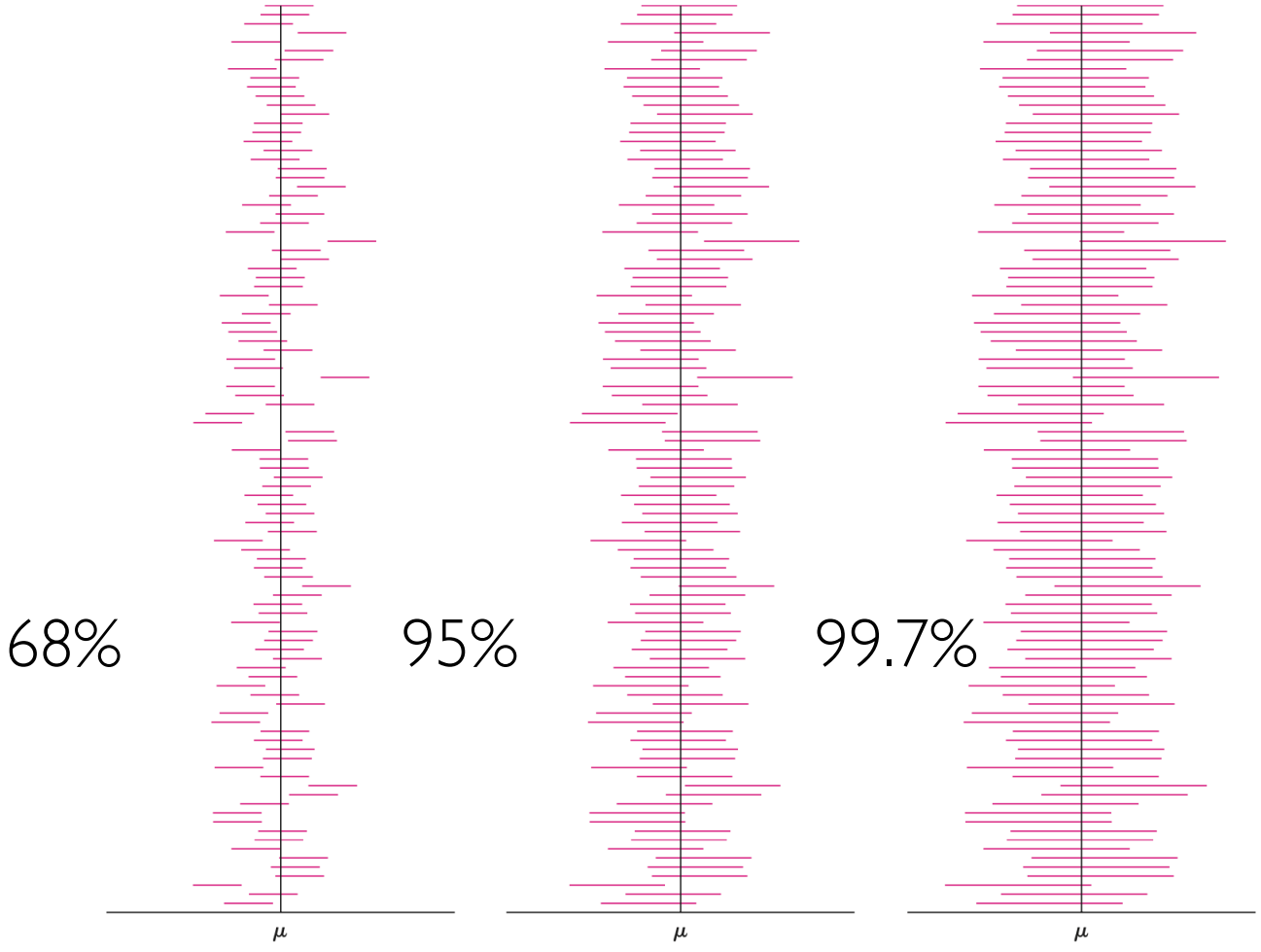
How do set set z_c

First, choose confidence level, say 90%



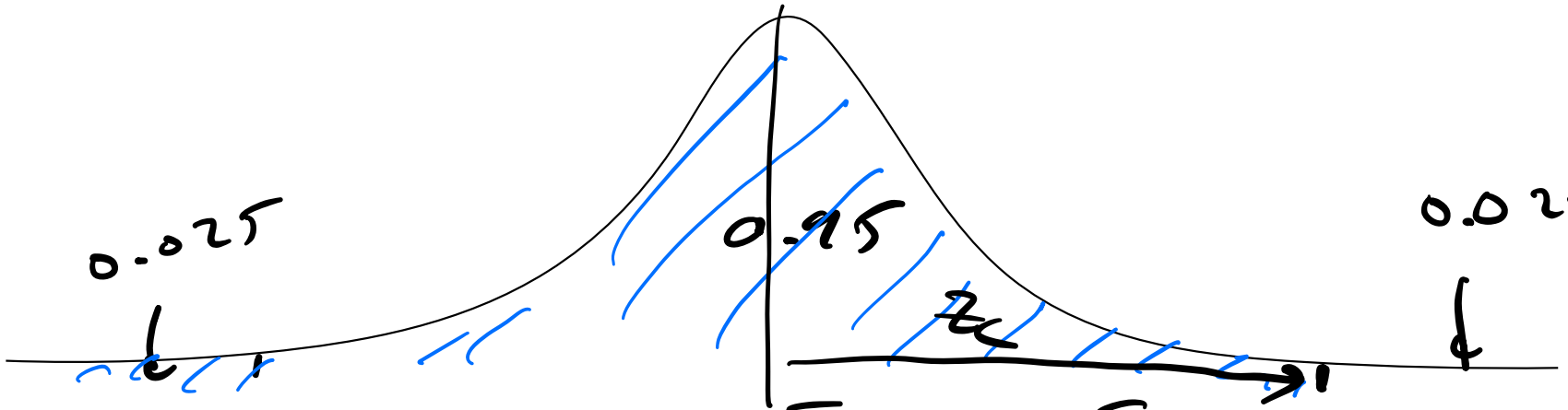
$z_c = \text{norm.ppf}(0.95) = 1.645$

What confidence level should I use?



Statistics for Engineers and Scientists, Navidi

Example (heights)



$\bar{x} = 67$ inches

$s = 6$ inches

$n = 50$ people.

95% C.I.

$\bar{x} + z_c \frac{s}{\sqrt{n}}$

z_c = norm.ppf(0.975)

Now you try it

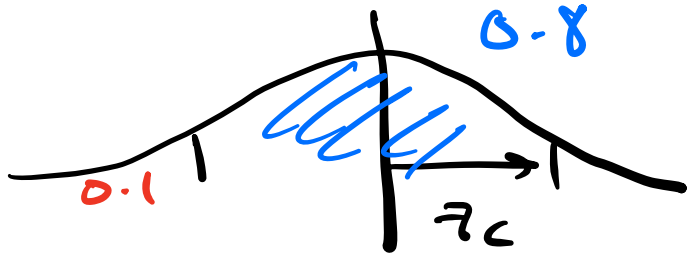
sample size = 50

$\bar{x} = 12$

$s_x = 1$

find 80% confidence interval

$$\bar{x} \pm z_c \frac{s}{\sqrt{n}}$$

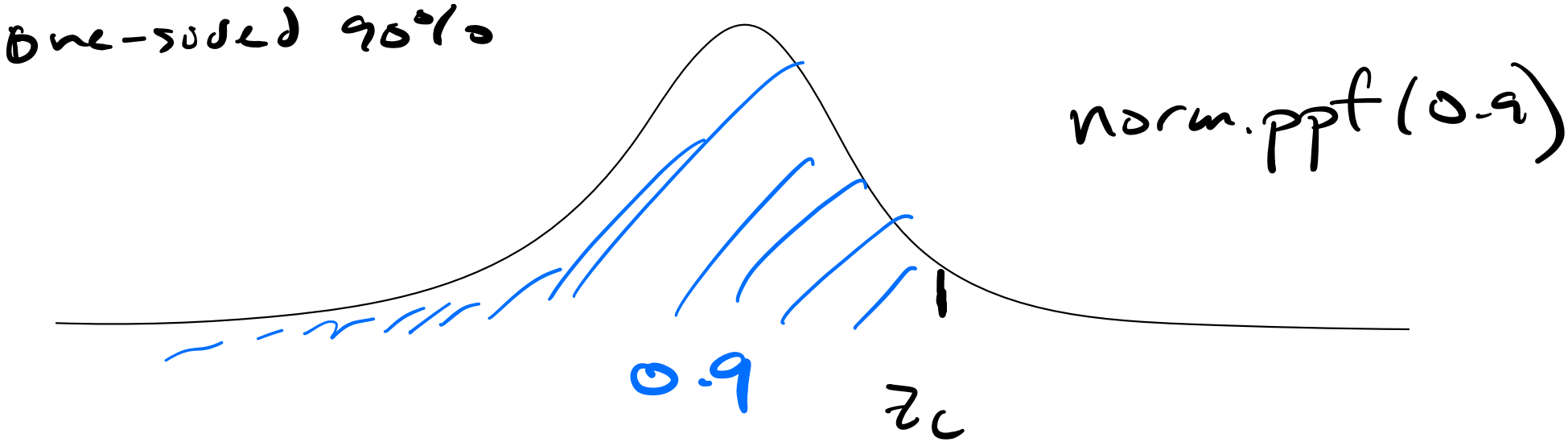


z_c = norm.ppf(0.9)
= 1.28

norm.interval $\left(0.8, 12, \frac{1}{\sqrt{50}}\right)$

→ [11.82, 12.18]

Sometimes one-sided confidence intervals are used



$\bar{x} + z_c \frac{s}{\sqrt{n}}$ upper confidence bound

$\bar{x} - z_c \frac{s}{\sqrt{n}}$ lower confidence bound

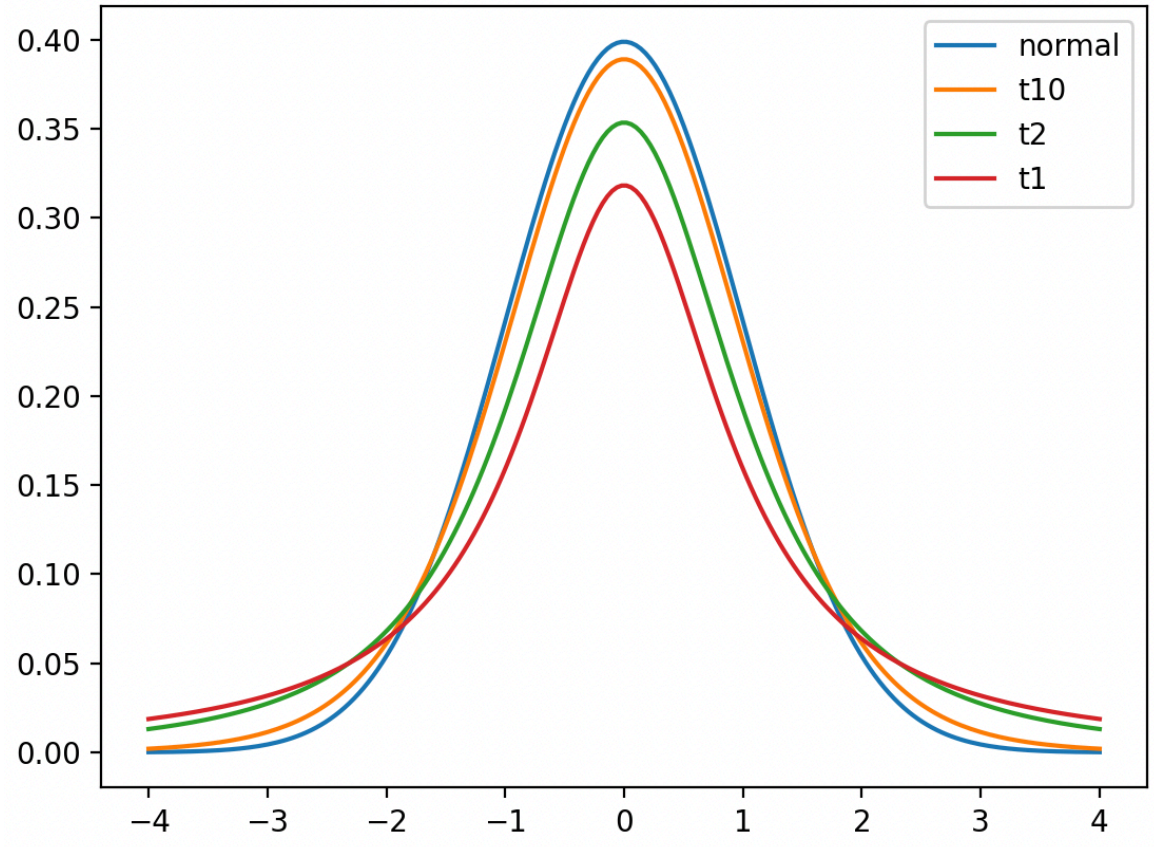
What is the sample size (n) is not large (n < 30)

$$\bar{x} \pm t_{n-1,c} \frac{s}{\sqrt{n}}$$

Student t

scipy.stats.t

cannot have outlier



Example

scipy.stats.t

sample of 15 concrete beams have shear strength with sample mean 668.27 and sample standard deviation of 192.089. What is 99% confidence interval for mean shear strength?

$$t.interval(0.99, 14, 668.27, \frac{192.089}{\sqrt{15}})$$

$$(520.6, 815.9)$$

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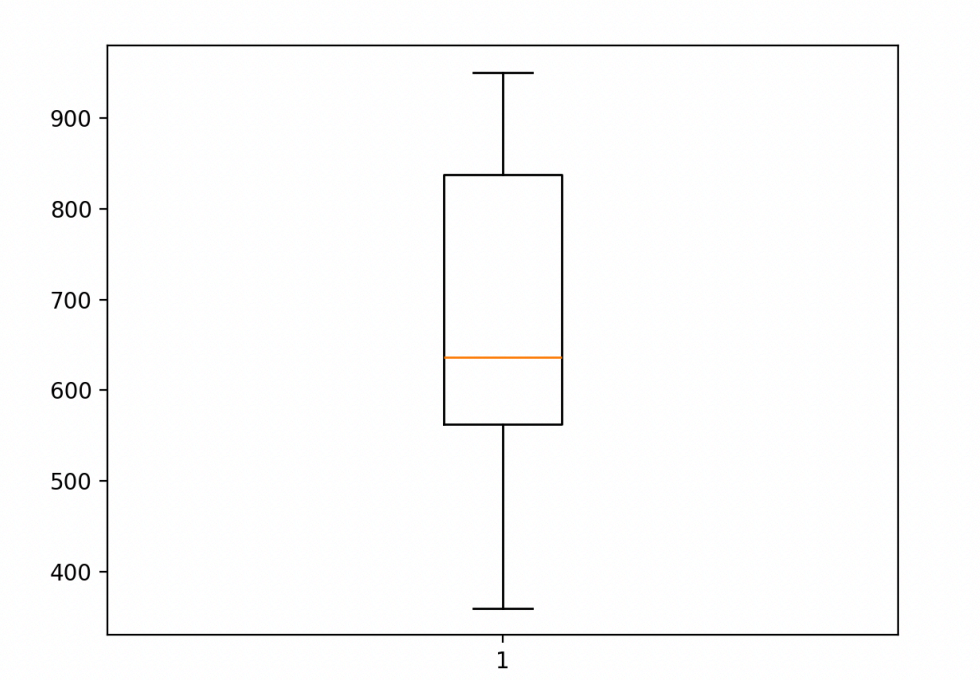
Boxplot



plt.boxplot([580, 400, 428, 825, 850, 875, 920, 550, 575, 750, 636, 360, 590, 735, 950])

Confidence Interval for Difference Between Two Means

$$\text{Interval}_{\mu_x - \mu_y} = (\bar{x} - \bar{y}) \pm z_c \sqrt{\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}}$$

Example

	n	mean	var
Female	17	5.353	2.743
Male	17	3.882	2.985

$\bar{x} - \bar{y} = 1.471$

Confidence level 95%

$z_L \sim 1.97$

$$\sqrt{\frac{2.743}{17} + \frac{2.985}{17}} = 0.5805$$

$df = 32$

$$0.29 \leq \mu_f - \mu_m \leq 2.65$$

Online Stats Book, David Lane