summary: overall population has mean μ, sd σ (unknown).
SRS of size n has sample mean $\bar{x}$, sample standard deviation s.
standard error $SE_{\bar{x}} = \frac{s}{\sqrt{n}}$
the standardized sample mean $\frac{\bar{x}-\mu}{s/\sqrt{n}}$ has a t-dist w/ $n-1$ degrees of freedom.
A level C confidence interval is $\bar{x} \pm \underbrace{t^* \frac{s}{\sqrt{n}}}_{\text{margin of error.}}$, where t^* is the value for which $(-t^*, t^*)$ gives area C under the t_{n-1} curve.

Significance tests: $H_0: \mu = \mu_0$ calculate $\frac{\bar{x}-\mu_0}{s/\sqrt{n}}$ and compare with t^*.

§7.2 Comparing two means
Take two SRS from two populations – do they have the same mean?

Population	variable	mean	sd	sample size	sample mean	sample s.d.
1	x_1	μ_1	σ_1	n_1	$\bar{x}_1$	s_1
2	x_2	μ_2	σ_2	n_2	$\bar{x}_2$	s_2

$\underbrace{\mu_1 \quad \sigma_1, \ \mu_2 \quad \sigma_2}_{\text{don't know!}}$

Consider: estimate $\mu_1 - \mu_2$, by $\bar{x}_1 - \bar{x}_2$.

variance ~~of~~ $\bar{x}_1 - \bar{x}_2$ is $var(\bar{x}_1) + var(\bar{x}_2) = \frac{\sigma_1^2}{n_1^2} + \frac{\sigma_2^2}{n_2^2}$

Assume populations both normal $N(\mu_1, \sigma_1)$, $N(\mu_2, \sigma_2)$ and σ_1, σ_2 known.
then the two sample z statistic is $z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1^2} + \frac{\sigma_2^2}{n_2^2}}} \sim N(0,1)$

Suppose we don't know σ_1, σ_2:
two sample t statistic is $t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{s_1^2/n_1^2 + s_2^2/n_2^2}}$. approx t_k
(for significance tests). when $k = \min\{n_1 - 1, n_2 - 1\}$

two sample t confidence interval $(\bar{x}_1 - \bar{x}_2) \pm t^* \sqrt{\frac{s_1^2}{n_1^2} + \frac{s_2^2}{n_2^2}}$ t^* comes from t_k
$k = \min\{n_1 - 1, n_2 - 1\}$