公司生產100個平均壽命1580，測試時平均壽命為1600

$\begin{cases} H_0: \mu = 1600 \\ H_1: \mu \neq 1600 \end{cases}$ | xbar = 1580, mean = 1600

-

政校想知道大多生睡眠不到6時，選36名學生，平均5.8，sd = 1.7

$\begin{cases} H_0: \mu \geq 6 \\ H_1: \mu < 6 \end{cases}$ | xbar = 5.8, mean = 6

- less

化設為平均花費超過170才獲利，選40人平均178，sd = 65

$\begin{cases} H_0: \mu \leq 170 \\ H_1: \mu > 170 \end{cases}$ | xbar = 178, mean = 170

- make profit

台灣均壽79.15歲，若有人取100人，平均80時 sd = 4

$\begin{cases} H_0: \mu = 79.15 \\ H_1: \mu \neq 79.15 \end{cases}$ | xbar = 80, mean = 79.15

-

公司說旅遊估計為1700，如果不高的合理嗎？抽12旅行社，平均1298

$\begin{cases} H_0: \mu \geq 1700 \\ H_1: \mu < 1700 \end{cases}$ | xbar = 1298, mean = 1700

- cheaper

男孩平均重83公斤，有教訓學校吃不飽，抽25人，均重80.94，

$\begin{cases} H_0: \mu = 85 \\ H_1: \mu \neq 85 \end{cases}$ | xbar = 80.94, mean = 85

- Underfed 營養不良

Tom's nice Foo 是否把比較的主題，抽6份記錄平均比較，sd = 76

$\begin{cases} H_0: 613 \\ H_1: \neq 613 \end{cases}$ | xbar = 596, mean = 613

- different from 和一樣

大多說平均花至少30 min找車位，找5個人，平均20，sd = 6

$\begin{cases} H_0: \mu \geq 30 \\ H_1: \mu < 30 \end{cases}$ | xbar = 20, mean = 30

- least

保險最多180元，實際高於此，找40人，平均195，sd = 50

$\begin{cases} H_0: \mu \leq 180 \\ H_1: \mu > 180 \end{cases}$ | xbar = 195, mean = 180

IS2 | 左尾(Left-tail) | 右尾(Right-tail) | 雙尾(Two-tail)

F檢定
多變量

$F = sv1/sv2$

雙尾 (Two-tail):

male	n1=100	mean=3.2	sd=1.2
fem	n2=64	mean=3.0	sd=1.1

Is different from mean?

$H_0: pv1 = pv2$
$H_1: pv1 \neq pv2$

$(sv1 = (1.1)^2, n1 = 100;\ sv2 = (1.2)^2, n2 = 64)$

$F = 1.19$

若 $2P < \alpha$,

$= 2*pf(F, df1 = n2-1, df2 = n2-1, lower.tail = FALSE)$

White: 5, 2, 6.9... Yellow: 7.6, 8, 5...		Size / Variance: A: $n_1 = 16$, $s_1^2 = 2.09$; B: $n_2 = 21$, $s_2^2 = 1.10$	m: c(8.9, ... 8.2) f: c(8.9 ... 7.3)

F檢定

- fewer error on avg?
  $H_0: pv1 \geq pv2$
  $H_1: pv1 < pv2$
  (sv1 = var(w), n1 = sum(-); sv2 = var(y), n2 = sum(-))
  F = 2.98
- evidence A higher B.
  $H_0: pv1 \leq pv2$
  $H_1: pv1 > pv2$
  (sv1 = 2.09, n1 = 16; sv2 = 1.10, n2 = 21, α = 0.05)
  F = 1.9
- inconsistent to female 不一致
  $H_0: pv1 = pv2$
  $H_1: pv1 \neq pv2$
  (sv1 = var(m), n1 = sum(complete.case(m)); sv2 = var(f), n2 = sum(complete.case(f)); α = 0.05)
  F = 9.55

P-Value

- 若 Pvalue < α: `pf(F, n1-1, n2-1, lower.tail = TRUE)`
- 若 Pvalue < α: `pf(F, n1-1, n2-1, lower.tail = FALSE)`
- 若 2Pvalue < α: `pf(F, df1 = n-1, df2 = n-1) lower.tail = FALSE)`

Import var.test

- `var.test(mydata$W, $Y, ratio = 1, "two.sided")`
- `var.test(A, B, ratio = 1, alternative = "two.sided")`
- `var.test(m, f, ratio = 1, alternative = "two.sided")`

two All

t-test

- `t.test(mydata$W, $Y, mu = 0, "less", var.equal = TRUE)`
- `t.test(A, B, mu = 0, alternative = "greater", var.equal = FALSE)`
- `t.test(m, f, mu = 0, alternative = "two.sided", var.equal = FALSE)`

Two Dependence

- $H_0: MuD > 0$, $H_1: MuD < 0$
  `t.test(white, yellow, mu = 0, alternative = "less", paired = TRUE)`
- $H_0: MuD < 0$, $H_1: MuD > 0$
  `t.test(A, B, mu = 0, alter = "greater", paired = TRUE)`

- Can we infer that A and B differ in expense?
  A: 245, 386; B: 385, 372
  `var.test(x, y, ratio, "two", conf.level)`
  `t.test(x, y, mu, "two", paired = FALSE, var.equ = FALSE, con)`
- target diameter of 2.5. In past the sd = 0.035, Sample 25, sd = 0.025, is there evidence the population sd less than 0.035?
  `require(EnvStats)`
  `varTest(x, "less", conf.level, sigma.squared = 1, data.name = Null)`
- collect sample of 10, determin the mean, with sd = 2, (greater)
  Raw data: 8, 11, 5, 6, 7, 8, 6, 4, 8, 3
  `t.test(x, y = NULL, "greater", mu = 0, paired, var.equal, conf.level)`
- Do these data allow us to differ between two?
  Teller1: 7.2, 5.4 ...; Teller2: 10.9, 6.0 ...
  `Var.test(x, y, ratio = 1, "two")`
- Doctor say average is more than 20, Sample = 10, Do you allow?
  Raw: 16, 23, 18 ..
  `t.test(x, y = NULL, alternative = c("greater"), mu = 0, paired = FALSE, var.equal = FALSE, con)`
- population of VISA ave = 27, sd = 7, What is probability more than 30?
  `pnorm(q, mean = 20, sd = 1, lower.tail = TRUE, log.p = FALSE)`
- What is the probability 336 or more 1200 will major in accounting
  `prop.test(x, n, p = NULL, "greater", con.level, correct = TRUE)`
- To verify what can they conclude rather given the result?

Item	279	178
warranty	97	25

`prop.test(x, n, p = NULL, "greater", conf.level, correct = TRUE)`