

R basics

Assignments, numbers, vectors

```
> x <- 5
```

Assign number 5 to variable x

```
> x
```

```
[1] 5
```

```
> 5*x^2+7
```

Calculate $5x^2+7$

```
[1] 132
```

```
> y <- c(1, 2, 3, 4, 5)
```

Create vector, assign
to variable y

```
> y
```

```
[1] 1 2 3 4 5
```

```
> x*y
```

Multiply each element
in y with the number in x

```
[1] 5 10 15 20 25
```

Strings

A string contains text:

```
> name <- "Claus Wilke"  
> name  
[1] "Claus Wilke"
```

A vector of strings:

```
> animals <- c("cat", "mouse", "mouse",  
  "cat", "rabbit")  
> animals  
[1] "cat"      "mouse"    "mouse"    "cat"  
"rabbit"
```

Factors

Factors keep track of distinct categories (levels) in a vector:

```
> animals
[1] "cat"      "mouse"    "mouse"    "cat"
"rabbit"
```



```
> factor(animals)
[1] cat      mouse   mouse   cat      rabbit
Levels: cat mouse rabbit
```

Data frames

We use data frames to store data sets with multiple variables:

```
> pets <- data.frame(family=c(1,2,3,4,5),  
                      pet=animals)
```

```
> pets
```

	family	pet
1	1	cat
2	2	mouse
3	3	mouse
4	4	cat
5	5	rabbit

Data frames

We access individual columns in a data frame with \$ + the column name:

```
> pets$family  
[1] 1 2 3 4 5
```

```
> pets$pet  
[1] cat      mouse    mouse    cat      rabbit  
Levels: cat mouse rabbit
```

Data frames

R has many built-in data frames:

```
> cars
```

	speed	dist
1	4	2
2	4	10
3	7	4
4	7	22
5	8	16
6	9	10
7	10	18
8	10	26
9	10	34

10	11	17
----	----	----

Data frames

The `head()` function shows the first few lines of a data frame:

```
> head(cars)
  speed dist
1     4    2
2     4   10
3     7    4
4     7   22
5     8   16
6     9   10
>
```


Hypothesis testing: a quick review

H_0 and H_A : Null and alternative hypothesis

H_0 : Null hypothesis, assumption that the data show no signal, that nothing has happened.

H_A : Alternative hypothesis, opposite of H_0 , assumption that something has happened.

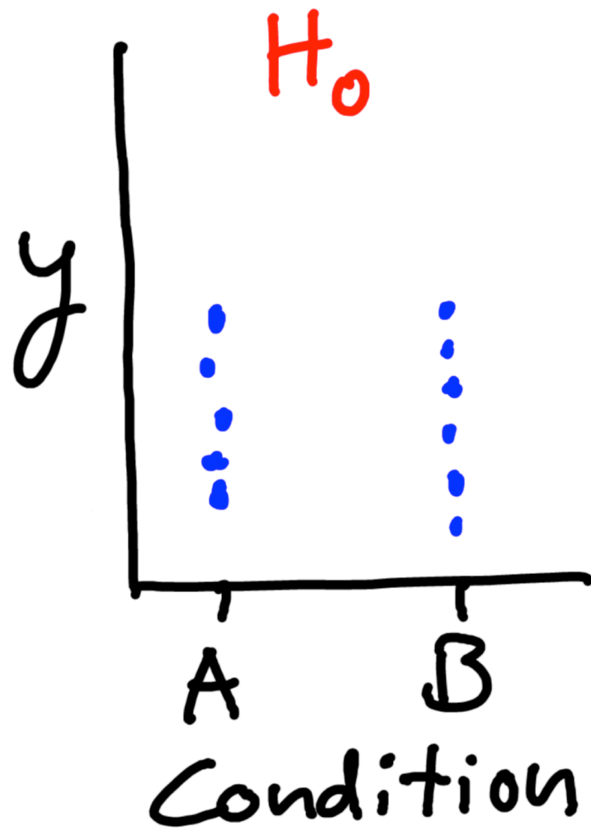
The P value tells us how unexpected the data are

P value: Probability to observe the given data under the assumption that H_0 is true

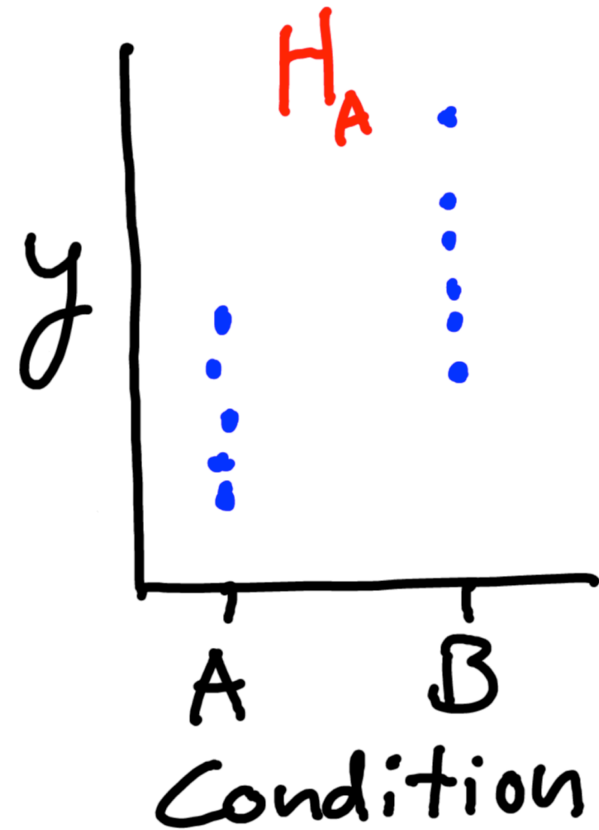
We generally reject H_0 if $P < 0.05$

We **never** accept H_A

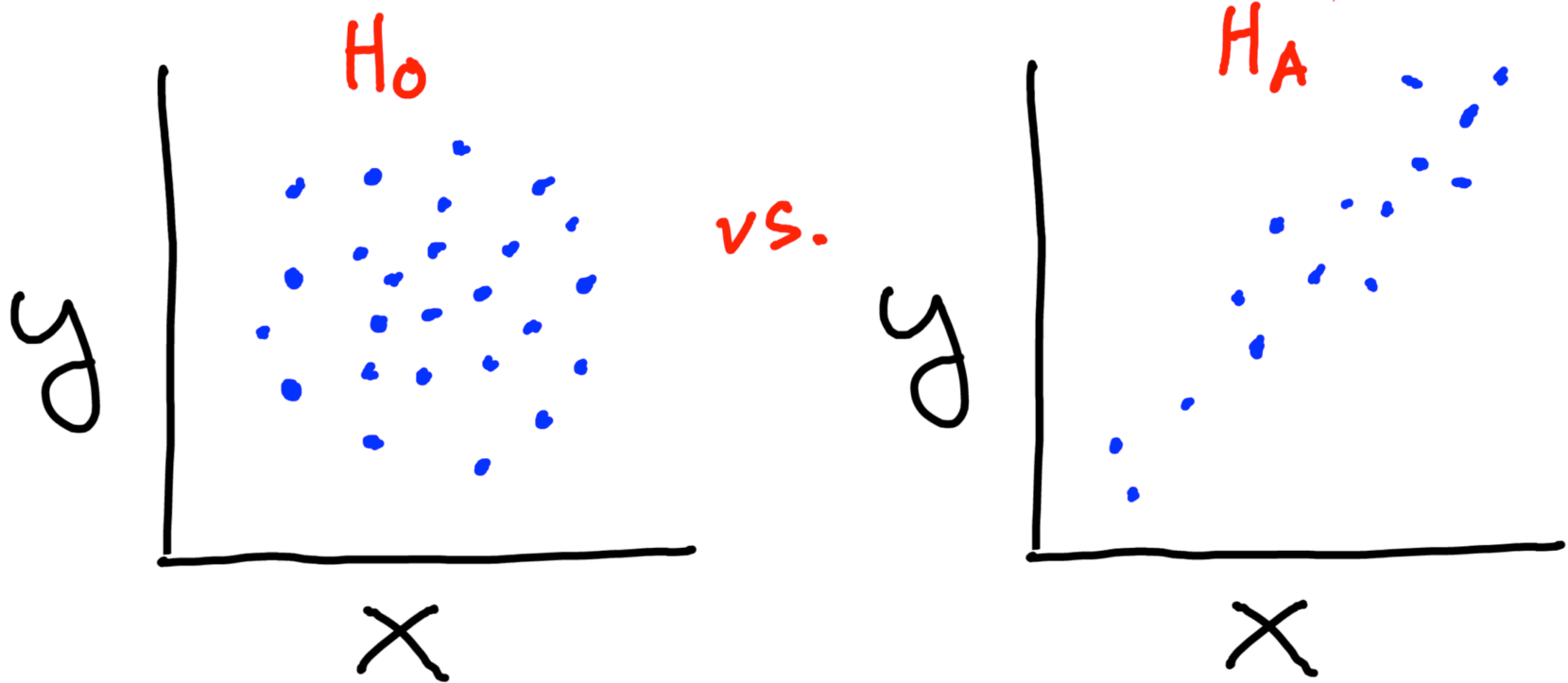
t test: Do two groups of numerical measurements have the same mean?



vs.



Correlation: Do two numerical variables have a relationship with each other?



Multivariate regression: Which predictors have an effect on the response variable?

Example:

