

Booleans and boolean vectors

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Boolean

- A boolean is TRUE or FALSE
- Did you come to class today?
 - TRUE or FALSE?
- Did you complete the lab yesterday?
 - TRUE or FALSE

Shortcut

- TRUE or T are equivalent
- FALSE or F are equivalent

Vectors of Booleans

- Recall:
 - vector is a container that contains elements of the same type.
- `c(T,F,F,T,T,T)`
- `c(T,T,F,F,F,3,4)` # what happens?
- `c(T,T,F,3,4,"gor")` # what happens

How to construct boolean vectors

- Standard operators (functions):
 - $+$, $-$, $*$, $/$, $^$, $\% \%$ (modulus)
- Boolean operators
 - $==$, $!=$, $>$, $>=$, $<$, $<=$, $!$
 - $\&$, $|$
 - $\&\&$, $||$

Standard Operations on vectors

- $a = \text{seq}(23, 43, 7)$
 $b = a * 2$
 $c = a / b$
 $d = a \% \% 3$ (modulus)

Boolean Operations on vectors

- `a = c(3,7,9, 13, 234)` *# vector size 5*
- `a == 7`
`a >= 13`
`a > 13`
`a > 7 & a < 100` *# returns vector of size 5*
`a > 7 && a < 100`
- Difference between “&” and “&&”
- Difference between “|” and “||”

& versus &&

- `a = seq(2, 23, 3)`
returns `c(2,5,8,11,14,17,20,23)`
- `a < 17` returns `c(T,T,T,T, F, F, F, F)`
`a > 10` returns `c(F, F, F, T, T, T, T, T)`
`a < 17 & a > 10` returns
`c(F,F,F, T, F, F, F, F)`
`a < 17 && a > 10` returns `F`

& (and)

- | | | | | |
|---|---|---|---------|---|
| T | & | T | returns | T |
| T | & | F | returns | F |
| F | & | T | returns | F |
| F | & | F | returns | F |

&&

- && returns a single boolean (TRUE/FALSE)
- $a = 2:13$
 $b = c(2,3,4,5,6,7,8,9,10,11,12,13)$

 $a < 5 \ \& \ b < 5$
 $a < 5 \ \&\& \ b < 5$
- $a < 5$ returns a vector.
 $b < 5$ returns a vector
If these two boolean vectors are identical, && returns TRUE. Otherwise, FALSE

| (or)

- | | | | | |
|---|--|---|---------|---|
| T | | T | returns | T |
| T | | F | returns | T |
| F | | T | returns | T |
| F | | F | returns | F |

Examples

- Generate 2000 random numbers
- Determine which ones are less than .83 and greater than .42
- How many of these random numbers are greater than .9 and smaller than .2?
- How many of these random numbers are greater than .9 or smaller than .2?

Next

- We'll use conditional to extract specific elements from vectors.
- Example
 - `a = c(1,20,35,23)`
 - `a[a < 35]` returns `c(1,20)`