SCR week 3: Plenary Exercise

10. `pmax()`, `pmin()` and play with logicals

We have the following data frame:

```
set.seed(2009)
w <- runif(10)
x <- runif(10)
y <- runif(10)
z <- runif(10)
DF <- data.frame(a = w, b = x, c = y, d = z)
```

We define two intervals using the four columns of the data frame, namely we define the intervals $[\min(a, b), \max(a, b)]$, and $[\min(c, d), \max(c, d)]$. Add a new logical column in the data frame, which should be `TRUE` if the intervals overlap, and `FALSE` otherwise. The output should look like:

```
head(DF)
```

```
##             a          b         c          d overlap
## 1 0.197260832 0.03232136 0.5722249 0.05370368    TRUE
## 2 0.696829870 0.25971113 0.5922310 0.10296065    TRUE
## 3 0.607896252 0.57589595 0.8583711 0.90978420   FALSE
## 4 0.009547638 0.82870195 0.4836649 0.82281090    TRUE
## 5 0.429010613 0.67047141 0.4416763 0.74668683    TRUE
## 6 0.076557244 0.57599446 0.1430793 0.49561776    TRUE
```

Use logical operators and/or if you prefer shorter (and perhaps more readable) code, use the functions `pmin()` and `pmax()`.

Answer

Tedious way...

```
a1 <- DF[1,1]
b1 <- DF[1,2]
c1 <- DF[1,3]
d1 <- DF[1,4]
```

Let's check whether there is NO overlap...

```
a <- DF[, 1]
b <- DF[, 2]
c <- DF[, 3]
d <- DF[, 4]
```

Correct:

```
is_higher <- a > c & b > c & a > d & b > d # higher
is_lower <- a < c & b < c & a < d & b < d # lower
no_overlap <- is_higher | is_lower
overlap <- !no_overlap
all(DF$overlap == overlap)
```

```
## [1] TRUE
```

Incorrect live presentation...

```
a_in_cd <- a > c & a < d | a < c & a > d
b_in_cd <- b > c & b < d | b < c & b > d
overlap <- a_in_cd | b_in_cd
all(DF$overlap == overlap)
```

```
## [1] FALSE
```

What whe did not check is whether c or d is in the interval of ab. So, two extra lines are needed to create `c_in_ab` and `d_in_ab`:

```
a_in_cd <- a > c & a < d | a < c & a > d
b_in_cd <- b > c & b < d | b < c & b > d
c_in_ab <- c > a & c < b | c < a & c > b
d_in_ab <- d > a & d < b | d < a & d > b
overlap <- a_in_cd | b_in_cd | c_in_ab | d_in_ab
all(DF$overlap == overlap)
```

```
## [1] TRUE
```

On the contrary what I said in the plenary lecture, when using the `pmax()` and `pmin()` functions we need fewer lines:

```
checking_ab_cd <- pmax(a, b) < pmax(c, d) & pmax(a, b) > pmin(c, d)
checking_cd_ab <- pmax(c, d) < pmax(a, b) & pmax(c, d) > pmin(a, b)
overlap <- checking_ab_cd | checking_cd_ab
all(DF$overlap == overlap)
```

```
## [1] TRUE
```