

Homework 1

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Zadanie 1

a)

```
v1 <- seq(from=1, to=20, by=1)
v1
```

```
## [1] 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
```

b)

```
v2 <- seq(20,1,length=20)
v2
```

```
## [1] 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
```

c)

```
v3 <- c(seq(from=1, to=20, by=1),seq(19,1,length=19))
v3
```

```
## [1] 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 19 18 17
## [24] 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
```

d)

```
tmp <- c(7,8,1)
tmp
```

```
## [1] 7 8 1
```

e)

```
v4 <- rep(c(4,6,3),10)
v4
```

```
## [1] 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3
```

f)

```
v5 <- rep(c(4,6,3), times=c(11,10,9))
v5
```

```
## [1] 4 4 4 4 4 4 4 4 4 4 4 6 6 6 6 6 6 6 6 6 6 3 3 3 3 3 3 3 3 3
```

g)

```
x <- seq(from=3, to=6, by=0.1)
v6 <- exp(x) * cos(x)
v6
```

```
## [1] -19.884531 -22.178753 -24.490697 -26.773182 -28.969238 -31.011186
## [7] -32.819775 -34.303360 -35.357194 -35.862834 -35.687732 -34.685042
## [13] -32.693695 -29.538816 -25.032529 -18.975233 -11.157417 -1.362099
## [19] 10.632038 25.046705 42.099201 61.996630 84.929067 111.061586
## [25] 140.525075 173.405776 209.733494 249.468441 292.486707 338.564378
## [31] 387.360340
```

h)

```
v7.1 <- seq(from=1, to=25, by=1)
v7 <- (2^v7.1)/v7.1
v7
```

```
## [1] 2.000000e+00 2.000000e+00 2.666667e+00 4.000000e+00 6.400000e+00
## [6] 1.066667e+01 1.828571e+01 3.200000e+01 5.688889e+01 1.024000e+02
## [11] 1.861818e+02 3.413333e+02 6.301538e+02 1.170286e+03 2.184533e+03
## [16] 4.096000e+03 7.710118e+03 1.456356e+04 2.759411e+04 5.242880e+04
## [21] 9.986438e+04 1.906502e+05 3.647221e+05 6.990507e+05 1.342177e+06
```

i)

```
i1 <- seq(from=10, to=100, by=1)
v8 <- sum(i1^3 + 4*i1^2)
v8
```

```
## [1] 26852735
```

j)

```
i2 <- seq(from=1, to=25, by=1)
v9 <- sum((2^i2/i2) + (3^i2/i2^2))
v9
```

```
## [1] 2129170437
```

Zadanie 2

a)

```
set.seed(123)
v10 <- sample(c(0,1), 1000, TRUE)
v10
```

```
## [1] 0 0 0 1 0 1 1 1 0 0 1 1 1 0 1 0 1 0 0 0 0 1 0 0 0 0 1 1 0 1 0 1 0 1
## [35] 1 0 0 0 0 1 0 1 1 0 0 0 0 1 0 0 1 0 0 0 0 1 1 0 1 0 0 1 1 0 0 1 0 0
## [69] 0 0 1 0 0 0 0 1 1 0 1 1 1 1 0 1 1 1 0 0 1 0 1 1 0 1 1 0 0 1 0 0 0 1
## [103] 1 0 1 1 0 0 0 1 1 1 1 0 0 1 1 1 0 1 0 1 0 0 0 1 1 0 0 0 1 0 1 1 1 1
## [137] 1 1 1 0 1 1 1 0 1 1 1 0 1 1 0 1 0 1 0 0 0 0 0 0 0 1 1 1 0 1 0 0 1 0
## [171] 1 1 1 1 0 0 0 1 1 1 1 0 0 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 0 1 1 1 1 0
## [205] 1 1 1 0 1 1 1 0 0 1 1 1 1 0 1 0 1 0 0 0 1 1 0 0 1 0 0 1 1 0 1 1 1 1
## [239] 1 0 0 1 0 1 0 0 0 1 1 1 0 1 1 0 0 0 0 0 1 0 1 1 1 0 1 0 1 0 0 0 0 0
## [273] 0 1 0 1 0 0 0 0 1 1 0 0 0 1 1 1 0 1 0 0 0 0 0 1 1 1 0 0 1 1 0 1 0 0
## [307] 1 0 0 0 1 0 1 0 1 1 1 1 0 0 0 1 0 0 1 0 0 1 0 1 1 1 0 0 0 0 1 0 0 0
## [341] 0 1 1 0 1 0 0 0 1 0 0 0 1 0 0 1 0 0 0 1 1 0 0 0 1 0 1 0 1 0 0 0 1 1
## [375] 0 0 1 0 0 1 0 1 1 1 1 1 1 1 1 0 1 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 1 0
## [409] 1 0 1 1 1 1 1 0 1 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 1 1 0 1 0 1 0 0 0 0
## [443] 1 1 0 1 1 1 1 1 1 0 1 1 1 0 1 1 0 1 1 0 1 0 0 1 1 0 1 0 0 0 1 1 0 0
## [477] 0 0 1 0 1 1 1 1 0 1 1 0 1 1 0 1 0 1 1 1 1 0 0 0 1 1 1 1 0 0 0 0 1 0
## [511] 1 0 1 0 1 1 1 0 1 1 1 1 0 1 0 1 0 0 0 0 1 1 1 0 0 1 1 1 1 0 0 0 1 1
## [545] 1 0 0 1 1 0 1 0 1 1 1 0 1 1 1 1 0 1 1 0 1 1 1 1 1 0 1 0 1 0 0 1 0 1
## [579] 1 0 0 1 0 0 1 0 0 1 1 0 0 1 0 1 0 1 0 0 1 1 1 1 1 0 0 0 0 1 0 1 0 0
## [613] 1 0 1 1 1 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 1 0 1 0 0 0 1 1 1 1 0 1 1 0
## [647] 0 1 0 1 0 0 0 0 1 1 1 1 0 1 0 0 1 0 0 0 0 0 1 1 1 0 0 0 1 1 1 1 0 1
## [681] 0 0 0 1 0 1 1 0 1 0 1 0 0 1 1 1 1 1 1 1 1 0 0 0 1 0 0 0 1 1 0 1 0 1
## [715] 0 1 1 1 0 0 1 1 1 1 0 0 1 0 1 0 0 0 0 0 1 1 0 1 0 0 0 1 0 0 0 0 1
## [749] 0 1 1 1 0 0 0 1 1 0 1 0 1 0 1 1 1 1 1 1 1 0 0 1 0 0 1 0 0 1 1 0 0
## [783] 0 0 0 0 1 1 1 1 0 1 0 1 0 0 0 1 1 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0 1 0
## [817] 1 0 1 1 0 1 1 0 0 1 1 0 1 0 1 1 1 0 0 1 1 1 0 0 1 0 1 1 1 1 0 1 1 0
```

```
## [851] 0 1 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 1 1 1 1 1 1 1 0 0 1 1 0 1 0 0 0
## [885] 0 0 0 1 1 0 0 1 1 0 0 0 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 0 0 0 1 1 0 0
## [919] 1 0 0 1 0 1 0 0 1 1 0 1 1 1 1 1 1 1 0 0 1 0 1 1 0 0 1 0 1 1 0 0 0 1
## [953] 0 1 1 1 0 0 0 0 0 0 0 1 1 1 0 0 0 0 1 0 1 1 0 0 1 0 1 0 1 1 1 0 1 0
## [987] 0 1 1 1 0 1 0 1 0 0 1 1 1 1
```

b)

```
f1 <- factor(v10, levels = c(0,1), labels = c("No", "Yes") )
f1
```

```
## [1] No No No Yes No Yes Yes Yes No No Yes Yes Yes No Yes No Yes
## [18] No No No No Yes No No No No Yes Yes No Yes No Yes No Yes
## [35] Yes No No No No Yes No Yes Yes No No No No Yes No No Yes
## [52] No No No No Yes Yes No Yes No No Yes Yes No No Yes No No
## [69] No No Yes No No No No Yes Yes No Yes Yes Yes Yes No Yes Yes
## [86] Yes No No Yes No Yes Yes No Yes Yes No No Yes No No No Yes
## [103] Yes No Yes Yes No No No Yes Yes Yes Yes No No Yes Yes Yes No
## [120] Yes No Yes No No No Yes Yes No No No Yes No Yes Yes Yes Yes
## [137] Yes Yes Yes No Yes Yes Yes No Yes Yes Yes No Yes Yes No Yes No
## [154] Yes No No No No No No Yes Yes Yes No Yes No No Yes No
## [171] Yes Yes Yes Yes No No No Yes Yes Yes Yes No No No No Yes Yes
## [188] No No Yes Yes No No Yes Yes No No Yes No Yes Yes Yes Yes No
## [205] Yes Yes Yes No Yes Yes Yes No No Yes Yes Yes Yes No Yes No Yes
## [222] No No No Yes Yes No No Yes No No Yes Yes No Yes Yes Yes Yes
## [239] Yes No No Yes No Yes No No No Yes Yes Yes No Yes Yes No No
## [256] No No No Yes No Yes Yes Yes No Yes No Yes No No No No No
## [273] No Yes No Yes No No No No Yes Yes No No No No Yes Yes Yes No
## [290] Yes No No No No No Yes Yes Yes No No Yes Yes No Yes No No
## [307] Yes No No No Yes No Yes No Yes Yes Yes Yes No No No Yes No
## [324] No Yes No No Yes No Yes Yes Yes No No No No Yes No No No
## [341] No Yes Yes No Yes No No No Yes No No No No Yes No No Yes No
## [358] No No Yes Yes No No No Yes No Yes No Yes No No No Yes Yes
## [375] No No Yes No No Yes No Yes Yes Yes Yes Yes Yes Yes Yes No Yes
## [392] No No No No No No No Yes Yes No No No No No No Yes No
## [409] Yes No Yes Yes Yes Yes Yes No Yes No No No No No No No No
## [426] No Yes Yes No No No Yes Yes No Yes No Yes No Yes No No No
## [443] Yes Yes No Yes Yes Yes Yes Yes Yes No Yes Yes Yes No Yes Yes No
## [460] Yes Yes No Yes No No Yes Yes No Yes No No No Yes Yes No No
## [477] No No Yes No Yes Yes Yes Yes No Yes Yes No Yes Yes No Yes No
## [494] Yes Yes Yes Yes No No No Yes Yes Yes Yes No No No No Yes No
## [511] Yes No Yes No Yes Yes Yes No Yes Yes Yes Yes No Yes No Yes No
## [528] No No No Yes Yes Yes No No Yes Yes Yes Yes No No No Yes Yes
## [545] Yes No No Yes Yes No Yes No Yes Yes Yes No Yes Yes Yes Yes No
## [562] Yes Yes No Yes Yes Yes Yes Yes No Yes No Yes No No Yes No Yes
## [579] Yes No No Yes No No Yes No No Yes Yes No No Yes No Yes No
## [596] Yes No No Yes Yes Yes Yes Yes No No No No Yes No Yes No No
## [613] Yes No Yes Yes Yes No Yes Yes Yes Yes Yes Yes Yes No No No No
## [630] No No Yes No Yes No No No Yes Yes Yes Yes Yes No Yes Yes No
## [647] No Yes No Yes No No No No Yes Yes Yes Yes No Yes No No Yes
## [664] No No No No No Yes Yes Yes No No No Yes Yes Yes Yes No Yes
## [681] No No No Yes No Yes Yes No Yes No Yes No No Yes Yes Yes Yes
## [698] Yes Yes Yes Yes No No No Yes No No No Yes Yes No Yes No Yes
## [715] No Yes Yes Yes No No Yes Yes Yes Yes Yes No No Yes No Yes No
## [732] No No No No Yes Yes No Yes No No No Yes No No No No Yes
```

```
## [749] No Yes Yes Yes No No No Yes Yes No Yes No Yes No Yes Yes Yes
## [766] Yes Yes Yes Yes Yes No No Yes No No Yes No No Yes Yes No No
## [783] No No No No Yes Yes Yes Yes No Yes No Yes No No No Yes Yes
## [800] Yes No No Yes Yes No No No No No No No No No No Yes No
## [817] Yes No Yes Yes No Yes Yes No No Yes Yes No Yes No Yes Yes Yes
## [834] No No Yes Yes Yes No No Yes No Yes Yes Yes Yes No Yes Yes No
## [851] No Yes Yes No No No No No No No No No No No Yes No No No
## [868] Yes Yes Yes Yes Yes Yes Yes Yes No No Yes Yes No Yes No No No
## [885] No No No Yes Yes No No Yes Yes No No No No Yes No No Yes Yes
## [902] Yes No No Yes Yes Yes No No Yes Yes No No No No Yes Yes No No
## [919] Yes No No Yes No Yes No No Yes Yes No Yes Yes Yes Yes Yes Yes
## [936] Yes No No Yes No Yes Yes No No Yes No Yes Yes No No No Yes
## [953] No Yes Yes Yes No No No No No No No No Yes Yes Yes No No No
## [970] No Yes No Yes Yes No No Yes No Yes No Yes Yes Yes No Yes No
## [987] No Yes Yes Yes No Yes No Yes No No Yes Yes Yes Yes
## Levels: No Yes
```

c)

```
v11 <- paste0((rep(c("q"), 15)),(rep(c(1:5), times=c(3,3,3,3,3))), (rep(c("s"), 15)), rep(c(1:3), 5))
v11
```

```
## [1] "q1s1" "q1s2" "q1s3" "q2s1" "q2s2" "q2s3" "q3s1" "q3s2" "q3s3" "q4s1"
## [11] "q4s2" "q4s3" "q5s1" "q5s2" "q5s3"
```

Zadanie 3

a)

```
vm1 <- c(3,1,-2,-3,2,1,-2,6,3)
m1 <- matrix(data = vm1, nrow = 3, ncol = 3, byrow = TRUE)
m1
```

```
##      [,1] [,2] [,3]
## [1,]    3    1   -2
## [2,]   -3    2    1
## [3,]   -2    6    3
```

b)

```
vm2 <- c(1, 2, -2, 0, 2, -1)
m2 <- matrix(data = vm2, nrow = 2, ncol = 3, byrow = TRUE)
m2
```

```
##      [,1] [,2] [,3]
## [1,]    1    2   -2
## [2,]    0    2   -1
```

c)

```
m3 <- matrix(data = c(1,2,3,4), nrow = 2, ncol = 2, byrow = TRUE)
m3
```

```
##      [,1] [,2]
## [1,]    1    2
## [2,]    3    4
```