R Notebook

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–1–

1.1)

```r
vec1 <- seq(1,20)
vec1
```

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

1.2)

```r
vec2 <- seq(20,1,-1)
vec2
```

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

1.3)

```r
vec3 <- c(seq(1,20),seq(19,1,-1))
vec3
```

```
##  [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
```

1.4)

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

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

1.5)

```r
vec4 <- rep(c(4,6,3),10)
vec4
```

```
##  [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
```

1.6)

```r
vec5 <- rep(c(4,6,3), times=c(11,10,9))
vec5
```

```
##  [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
```

1.7)

```r
t <- seq(3, 6, 0.1)
vec6 <- exp(t) * cos(t)
vec6
```

```
##  [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
```

1.8)

```r
vec7 <- seq(1, 25, 1)
vec7 <- (2^vec7)/vec7
vec7
```

```
##  [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
```

1.9)

```r
vec8 <- seq(10, 100)
vec8 <- sum(vec8^3 + 4*vec8^2)
vec8
```

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

1.10)

```r
vec9 <- seq(1, 25)
vec9 <- sum((2^vec9)/vec9 + (3^vec9)/(vec9^2))
vec9
```

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

–2–

2.1)

```r
set.seed(123)
vec2_1 <- sample(c(0,1), 1000, TRUE)
vec2_1
```

```
##    [1] 0 0 0 1 0 1 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 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 1 1 0 0 0 1 1 0 1 0 1 0 1 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 0 1 1 1 1 0 0 0 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 0 0 0 0 0 0 0 1 0 1 0 0 0 1 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 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 0 1 1 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 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
```

2.2)

```
vec2_2 <- factor(vec2_1, levels=c(0, 1), labels = c('No', 'Yes'))
vec2_2
```

```
##    [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  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  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  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 No  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  Yes No  No  No
## [868] Yes Yes Yes Yes Yes Yes Yes No  No  No  Yes Yes No  Yes No  No  No
## [885] No  No  No  Yes Yes No  No  Yes Yes No  No  No  Yes No  No  Yes Yes
## [902] Yes No  No  Yes Yes Yes No  No  Yes Yes 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  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
```

2.3)

```
vec2_3 <- 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))
vec2_3
```

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

–3–

3.1)

```
m3_1 <- matrix(data = c(3,1,-2,-3,2,1,-2,6,3) , nrow = 3, ncol = 3, byrow = TRUE)
m3_1
```

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

3.2)

```
m3_2 <- matrix(data = c(1, 2, -2, 0, 2, -1), nrow = 2, ncol = 3, byrow = TRUE)
m3_2
```

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

3.3)

```
m3_3 <- matrix(data = c(1,2,3,4), nrow = 2, ncol = 2, byrow = TRUE)
m3_3
```

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