

DAY 1 EXERCISES w/ SCRIPT and OUTPUT

1. Give R assignment statements that set the variable z equal to (where $x = 123$, $a = 1.1$, and $b = 1.2$):

- (a) $x a^b$ (x raised to the power of a raised to the b^{th} power)
- (b) $(x a)^b$
- (c) $3x^3 + 2x^2 + 6x + 1$ (try to minimize the number of operations required)
- (d) $z + 1$

```
> x <- 123
> a <- 1.1
> b <- 1.2
```

```
> # a
> (z <- x^(a^b))
[1] 220.3624
```

```
> (z <- x^a^b)
[1] 220.3624
```

```
> # b
> (z <- (x^a)^b)
[1] 573.6867
```

```
> # c
> (z <- 3*x^3 + 2*x^2 + 6*x + 1)
[1] 5613598
```

```
> (z <- (3*x + 2)*(x^2 + 2) - 3)
[1] 5613598
```

```
> # d
> (z <- z + 1)
[1] 3
```

2. Give R expressions that return the following matrices and vectors:

(a) (1,2,3,4,5,6,7,8,7,6,5,4,3,2,1)

(b) (1,2,2,3,3,3,4,4,4,4,5,5,5,5,5)

(c) $\begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{pmatrix}$

(d) $\begin{pmatrix} 0 & 2 & 3 \\ 0 & 5 & 0 \\ 7 & 0 & 0 \end{pmatrix}$

```
> # QUESTION 2
> # a
> c(1:8, 7:1)
[1] 1 2 3 4 5 6 7 8 7 6 5 4 3 2 1
```

```
> # b
> rep(1:5, 1:5)
[1] 1 2 2 3 3 3 4 4 4 4 5 5 5 5 5
```

```
> # c
> matrix(1, 3, 3) - diag(3)
      [,1] [,2] [,3]
[1,]    0    1    1
[2,]    1    0    1
[3,]    1    1    0
```

```
> # d
> matrix(c(0,0,7, 2,5,0, 3,0,0), 3, 3)
      [,1] [,2] [,3]
[1,]    0    2    3
[2,]    0    5    0
[3,]    7    0    0
```

3. Use R to produce a vector containing all integers from 1 to 100 that are not divisible by 2, 3, or 7.

```
> # QUESTION 3
> x <- 1:100
> idx <- (x %% 2 != 0) & (x %% 3 != 0) & (x %% 7 != 0)
> x[idx]
[1]  1  5 11 13 17 19 23 25 29 31 37 41 43 47 53 55 59 61 65 67 71 73 79
83 85 89 95 97
```

4. Suppose that `queue <- c("Steve", "Russell", "Alison", "Liam")` and that `queue` represents a supermarket queue with Steve first in line. Using R update the supermarket queue as successively:
- Barry arrives.
 - Steve is served.
 - Pam talks her way to the front with one item.
 - Barry gets impatient and leaves.
 - Alison leaves. Do not assume where in the queue Alison is standing.
 - Use function `which()` to find the position of Russell in queue.

```
> # QUESTION 4
> (queue <- c("S", "R", "A", "L"))
[1] "S" "R" "A" "L"
```

```
> # a
> (queue <- c(queue, "B"))
[1] "S" "R" "A" "L" "B"
```

```
> # b
> (queue <- queue[-1])
[1] "R" "A" "L" "B"
```

```
> # c
> (queue <- c("P", queue))
[1] "P" "R" "A" "L" "B"

> # d
> (queue <- queue[1:(length(queue)-1)])
[1] "P" "R" "A" "L"

> # e
> (queue <- queue[queue != "A"])
[1] "P" "R" "L"

> # f
> which(queue == "R")
[1] 2
```