Data Science and R – Assignment 1

This is a graded assignment for your course. Please submit your solution file as <your_initials-assign1.R>, e.g. `HJW-assign1.R` via iCampus.

Questions that require "Code" should be supplied with R code that can be run in your file. Any answer/information/comment that is not a runnable R code should be typed in a line starting with `#`, so that when your whole R file is run, there are no errors. Include your name and ID before the answers.

1. Scalars and functions (10 marks)

i) The area of a circle is given by the formula π x radius^2. Create a variable `area` which stores the area of a circle with radius 5. The constant π is available in R as `pi`.

```
Code required
```

ii) How many times is the area of a circle with radius 6 bigger than the area of a circle with radius 5? Calculate and round the answer to 2 decimal places in R. Create/modify variables as you see fit.

```
Code required
```

2. Vectors (20 marks)

We define `x` and `y` as:

```
x <- c(3, 1, 5, 7, 10:15); y <- rep(1:5, c(1,3,2,2,1))
```

i) How many elements does `x` have?

```
Code required
```

ii) Modify `y` so that its last element appears 2 times instead of once.

```
Code required
```

iii) Is the 5th element of `y` a multiple of the 5th element of `x`?

```
Code required
```

iv) Concatenate `x` and `y` into a new vector `z`.

```
Code required
```

v) List the unique elements of `z` that are bigger than 3 and are NOT divisible by 2. You may want to use the function `unique()`.

```
Code required
```

3. Matrices (20 marks)

Use the `matrix()` function to generate the following matrices, `m1` and `m2`

i) `m1`

```
     [,1] [,2]
[1,]    4   31
[2,]    3   32
[3,]    2   33
[4,]    1   34
```

```
Code required
```

ii) `m2`

```
     [,1] [,2] [,3] [,4]
[1,]    4    3    2    1
[2,]   31   32   33   34
```

```
Code required
```

iii) Add a column to `m1` to produce the following matrix, `m3`

```
     [,1] [,2] [,3]
[1,]    4   31    1
[2,]    3   32    3
[3,]    2   33    5
[4,]    1   34    7
```

```
Code required
```

iv) Add a row to `m2` to produce the following matrix, `m4`

```
     [,1] [,2] [,3] [,4]
[1,]    4    3    2    1
[2,]   31   32   33   34
[3,]    2    0   -2   -4
```

```
Code required
```

v) What is the result of multiplying (element-by-element) the 1nd row of `m3` with the 2nd column of `m4`? Provide your code and answer below.

```
Code required
```

4. Factors (20 marks)

Consider the following survey results for 6 people.

`"Agree", "Strongly Agree", "Disagree", "Disagree", "Strongly Disagree", "Agree"`

i) Create an unordered factor `survey_factor` to store these results.

`Code required`

ii) You think that it's more appropriate to order the answers by the level of their agreement. i.e. `"Strongly Disagree"` being the lowest and `"Strongly Agree"` being the highest. Modify `survey_factor` to be ordered according to these levels.

`Code required`

iii) Another person took the survey and answered `"Neutral"`. Write R code that will include `"Neutral"` as a new entry to the factor (the final length of `survey_ factor` will be 7). The new level `"Neutral"` should be between `"Disagree"` and `"Agree"`

`Code required`

iv) Change the answer levels to the following – `Strongly Disagree:"SD", Disagree:"D", Neutral:"N", Agree:"A", Strongly Agree:"SA"`

`Code required`

v) How many answers are `"N"` or bigger?

`Code required`

5. Sampling (20 marks)

i) You'd like to generate 100 random numbers between 0 and 1 by sampling from 0.1 to 4.1 and dividing the number that is sampled with the square root of 2. Store the values in vector `s`.(*Hint:* divide by `sqrt(2)` after the `sample()` function).

`Code required`

ii) How many numbers in `s` are bigger than 0.5?

`Code required`

iii) Resample from the same data using the same function for `s`, but this time assign unequal probabilities to its elements using this probability vector: `c(0.1, 0.2, 0.1, 0.7, 0.1)`. Save the generated data in `s`.

`Code required`

iv) How many numbers in `s` are bigger than 0.5 now? Why did this happen?

`Code required`

`Answer (why) required`