CSC 120 (R Section) — Quiz #3 with answers

No books, notes, or calculators are allowed. You have 30 minutes to write this quiz.

Question 1: [30 Marks] In the three blank areas below, write what R will output at that point if the commands shown are typed into the R console window. Note that the "`>`" and `+` characters shown at the beginnings of lines are the R command prompts, not something typed.

```
> x <- 11
> y <- 12
> z <- 13
> funny <- function (x, y) {
+     a <- 2*x + 3*y + z
+     y <- 1000
+     a * y
+ }
> x <- 4
> y <- 20
> z <- 1
>
> funny (8, 3)
[1] 26000

> funny (z, x)
[1] 15000

> 2*x + 3*y + z
[1] 69
```

Question 2: [30 Marks] Consider a function called `mystery` defined as follows:

```
mystery <- function (x) {
    if (any (is.na(x))) {
        if (all (is.na(x) | x<=0))
            x[is.na(x)] <- 0
        else
            x[is.na(x)] <- mean (x [!is.na(x) & x>0])
    }
    x
}
```

Below are three calls of this function. Write after them what R will output as a result of these calls.

```
> mystery (c(9,5,-3))
[1]  9  5 -3

> mystery (c(8,NA,1,-2,3,NA))
[1]  8  4  1 -2  3  4

> mystery (c(-3,NA,NA,-2,-7,NA))
[1] -3  0  0 -2 -7  0
```

Question 3: [10 Marks] Write a definition of a function called `F_to_C` that takes a vector of numbers as its argument, which are interpreted as temperatures in degrees Farenheit, and returns a vector of numbers that are the corresponding temperatures expressed in degrees Celsius. Recall that the Celsius equivalent of a temperature, T, measured in degrees Farenheit is $(T - 32) \times (5/9)$. Here is an example call of this function:

```
> F_to_C(c(23,32,50))
[1] -5  0 10
```

Solution: `F_to_C <- function (T) (T-32) * 5 / 9`

Question 4: [30 Marks] We would like to have a function called `convert_US_temps` that takes as its argument a data frame with variables (columns) `city`, `country`, `min_temp`, and `max_temp` (and perhaps others as well), and returns as its value a data frame like its argument except that for rows with `country` equal to `"US"`, the `min_temp` and `max_temp` variables are converted by calling the `F_to_C` function from Question 3 (since only the US measures temperature in Farenheit.) Here is an example of the use of this function:

```
> data
     city country min_temp max_temp
1   Paris  France        7       17
2 Chicago      US       50       68
3 Toronto  Canada       10       14
4  Boston      US       32       59
> convert_US_temps(data)
     city country min_temp max_temp
1   Paris  France        7       17
2 Chicago      US       10       20
3 Toronto  Canada       10       14
4  Boston      US        0       15
```

a) Write a definition for `convert_US_temps` that changes one value in the data frame at a time, and uses a loop.

```
convert_US_temps <- function (df) {
    for (i in 1:nrow(df)) {
        if (df$country[i] == "US") {
            df$min_temp[i] <- F_to_C (df$min_temp[i])
            df$max_temp[i] <- F_to_C (df$max_temp[i])
        }
    }
    df
}
```

b) Write a definition for `convert_US_temps` without a loop, using logical vector indexes.

```
convert_US_temps2 <- function (df) {
    US_cities <- df$country == "US"
    df$min_temp[US_cities] <- F_to_C (df$min_temp[US_cities])
    df$max_temp[US_cities] <- F_to_C (df$max_temp[US_cities])
    df
}
```