CSC 120 (R Section) — Quiz #3 — 2016-03-18

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.

```r
> 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)

> funny (z, x)

> 2*x + 3*y + z
```

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

```r
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.

```r
> mystery (c(9,5,-3))

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

> mystery (c(-3,NA,NA,-2,-7,NA))
```
**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 Fahrenheit, 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 Fahrenheit is $(T - 32) \times \frac{5}{9}$.

Here is an example call of this function:

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

**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 Fahrenheit.)

Here is an example of the use of this function:

```r
> 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.

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