CSC 120 (R Section) — Quiz #1 with answers

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

**Question 1:** [24 Marks] On the six blank lines below, write what R will output at that point if the commands shown are typed into the R console window. Note that the “>” shown at the beginnings of lines is the R command prompt, not something typed.

```r
> 7+3*10
[1] 37
> a <- 5
> b <- a+1
> a <- 2
> a*b
[1] 12
> x <- c(4,3,9)
> x[1]+x[a]
[1] 7
> x*a
[1]  8  6 18
> y <- x
> x[2] <- 10
> x+y
[1]  8 13 18
> s <- "pineapple"
> substring(s,4,4)=="e"
[1] TRUE
```

**Question 2:** [26 Marks] Consider a function called `mystery` defined as follows:

```r
mystery <- function (a) {
  x <- a
  if (a[4]==0)
    x[1] <- 0
  else
    x[1] <- 1
}
```

Below are two calls of this function. Write in the blank lines after them what R will output as a result of these calls.

```r
> mystery (c(3,2,7,0,2))
[1] 550
> mystery (c(7,3,1,4))
[1] 1201
```
Question 3: [25 Marks] Write down a definition for a function called limit that takes as arguments a number \( x \) and a positive number \( \text{lim} \), and returns as its value the argument \( x \) if its absolute value is less than \( \text{lim} \), and otherwise returns \( \text{lim} \) if \( x \) is positive and \(-\text{lim}\) if \( x \) is negative. You must use only R features that have been covered in lectures and labs; in particular, you must not use R’s \text{min} \) or \text{max} \) functions. You may use the \text{abs} \) function if you wish. Examples: \( \text{limit}(-3,7) \) is -3, \( \text{limit}(-9,7) \) is -7, \( \text{limit}(12,7) \) is 7.

Two possible solutions:

\[
\text{limit} \left<- \text{function} \ (x, \text{lim}) \ \{ \\
\qquad \text{if} \ (x < -\text{lim}) \ -\text{lim} \\
\qquad \text{else if} \ (x > \text{lim}) \ \text{lim} \\
\qquad \text{else} \ x \\
\}\right.
\]

\[
\text{limit2} \left<- \text{function} \ (x, \text{lim}) \ \{ \\
\qquad \text{if} \ (\text{abs}(x) < \text{lim}) \ x \\
\qquad \text{else if} \ (x > 0) \ \text{lim} \\
\qquad \text{else} \ -\text{lim} \\
\}\right.
\]

Question 4: [25 Marks] Write down a definition for a function called positive_sum that takes two arguments, called \text{vec1} and \text{vec2}, which you should assume are numeric vectors of the same length (which is at least one). The function should return as its value a numeric vector the same length as its arguments, in which each element is the sum of the corresponding elements of \text{vec1} and \text{vec2}, except that if this sum is negative, the value for that element should be -1. You should use only those R features that we have covered so far in the course.

Here is the output from an example call of this function:

\[
> \ \text{positive_sum} \ (c(3,-18,2,-2,5), \ c(2,13,4,-3,-2))
\]

\[
[1] \ 5 \ -1 \ 6 \ -1 \ 3
\]

Two possible solutions:

\[
\text{positive_sum} \left<- \text{function} \ (\text{vec1}, \text{vec2}) \ \{ \\
\qquad \text{result} <- \text{numeric}(\text{length}(\text{vec1})) \\
\qquad \text{for} \ (i \ \text{in} \ 1:\text{length}(\text{vec1})) \ \{ \\
\qquad \qquad \text{result}[i] <- \text{vec1}[i] + \text{vec2}[i] \\
\qquad \qquad \text{if} \ (\text{result}[i] < 0) \ \text{result}[i] <- -1 \\
\qquad \} \\
\ \} \\
\text{result}
\]

\[
\text{positive_sum2} \left<- \text{function} \ (\text{vec1}, \text{vec2}) \ \{ \\
\qquad \text{result} <- \text{vec1} + \text{vec2} \\
\qquad \text{for} \ (i \ \text{in} \ 1:\text{length}(\text{result})) \ \{ \\
\qquad \qquad \text{if} \ (\text{result}[i] < 0) \ \text{result}[i] <- -1 \\
\qquad \} \\
\ \} \\
\text{result}
\]