Lecture 05 Ticket

COSC 311: Algorithms, Fall 2022

Name: _____

Consider the following method that takes two arrays of numerical values, a and b as input and returns another array c:

```
1  Merge(a, b):
2    i, j, k <- 1
3    c <- new array of size size(a) + size(b)
4    while i <= size(a) and j <= size(b) do
5      if a[i] <= b[j] then
6        min <- a[i]
7        i <- i + 1
8      else
9        min <- b[j]
10       j <- j + 1
11     endif
12     c[k] <- min
13     k <- k + 1
14   endwhile
15
16   while i <= size(a) do
17     c[k] <- a[i]
18     i <- i + 1
19     k <- k + 1
20   endwhile
21
22   while j <= size(b) do
23     c[k] <- b[j]
24     j <- j + 1
25     k <- k + 1
26   endwhile
27
28   return c
```

Argue that if a and b are sorted, then the array c returned by $\mathrm{Merge}(a, b)$ is sorted and contains every element from both a and b. Your argument does not have to be too formal, but you should describe a loop invariant for the first while loop that explains *how* the procedure creates a sorted array.