ECS 122A Homework 2

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1. (a)

```
function SET-INTERSECTION(X, Y)
    X' ← SORT(X)
    Y' ← SORT(Y)
    i ← 0
    j ← 0
    intersection ← EMPTY-SET
    while i < LENGTH(X') AND j < LENGTH(Y') do
        if X'[i] < Y'[j] then
            i ← i + 1
        else if X'[i] = Y'[j] then
            intersection ← INSERT(intersection, X'[i])
        else if X'[i] > Y'[j] then
            j ← j + 1
        end if
    end while
     return intersection
end function
```

Assuming we have a sort function that runs in $O(n \lg n)$ time and an insertion function that runs in $O(1)$ time, this algorithm should take $O(n \lg n)$ time.

We first sort the two sets in $O(n \lg n)$ time.

When we're iterating over the two arrays, we take a maximum of $O(n)$ time as each iteration runs in $O(1)$ time. This is less than $O(n \lg n)$ time, so our upper bound has not changed.

Thus, we have an intersection algorithm that runs in $O(n \lg n)$ time.

(b)

```
function SET-INTERSECTION(X, Y)
    intersection ← EMPTY-SET
    table ← HASH-TABLE
    for all elements in X do
        hash each element into table
    end for
     return intersection
end function
```