

## 1) (5 pts) ANL (Algorithm Analysis)

What is the best and worst case runtime for the following algorithm, in terms of the input parameter  $n$ ? Give a brief explanation for your answers.

```
int foo(int * arr, int n){  
    if (n == 0)  
        return 0;  
  
    int j = 0, i;  
  
    for (i = 0; i < n; i++)  
        if (arr[i] > arr[j])  
            j = i;  
  
    int nLen = n - j - 1;  
    return arr[j] + foo(arr + j + 1, nLen);  
}
```

**Best Case**

The for loop runs and sets  $j = n - 1$ , which means that  $nLen$  gets set to 0. In this case, the subsequent recursive call will immediately return 0 and the original recursive call will return the value of the last array element. The run time in this case is  **$O(n)$** , since the entirety of the execution includes one for loop that runs  $n$  times and a few other simple statements. From a conceptual standpoint, the for loop identifies the index in between 0 and  $n-1$  that stores the largest value within that range.

**Worst Case**

The worst case is when the array is sorted in reverse order. Every call eliminates only 1 value at the cost of  $n$  operations. The total runtime becomes  **$O(n^2)$** .

**Grading: 2 pts for each answer, 1 pt for all of the explanation.**