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HW1

Pseudocode:

```
int binaryCount(1D matrice, low, high)
{ initial sum=0
  mid=(low+high)/2
  if(low or high equals to mid(that means if 2 index left for search))
  {if(low=a) sum++
   if(high=a) sum++
   return sum}
  if(mid=a)
  { if((high-low)/2=0) sum++
   sum+=(high-low)/2
   sum++
   return sum+ binaryCount(matrice,Mid+1,high)}
   if(mid=b)
  { return binaryCount(matrice, low, mid)
   }
   return sum
   }
int binarySearchForA(1D matrice)
 { return binaryCount(matrice,0,matrice.length-1)
 }
int aCount(2D matrice){
   result=0
for(i=0;i<n;i++)
{
 result+=binarySearchForA(ith row of 2D matrice)
}return result
}
```


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Time complexity analysis

Binary count

in the if statements, another recursive function is been called with half searching range of the original function, and other lines costs constant time so,

$$T(N) = C + T(N/2)$$
$$= T(N/2) = C + T(N/4)$$
$$T(N/4) = C + T(N/8)$$
$$\vdots$$
$$T(N) = k \cdot C + T(N/2^k)$$
$$T(n) = \log n \cdot C + T(1) = C(\log n + 1)$$

$T(n)$ is $O(\log n)$ because $C\log n + C \leq (C+1)\log n$ → it can be anything greater than $(C+1)$

$$= C \leq \log n$$
$$= 2^C \leq n \quad \forall n \geq 2^C$$ → constant

dCount

In this function, binaryCount function iterates n times, so time complexity for that function would be $O(n \cdot \log n)$

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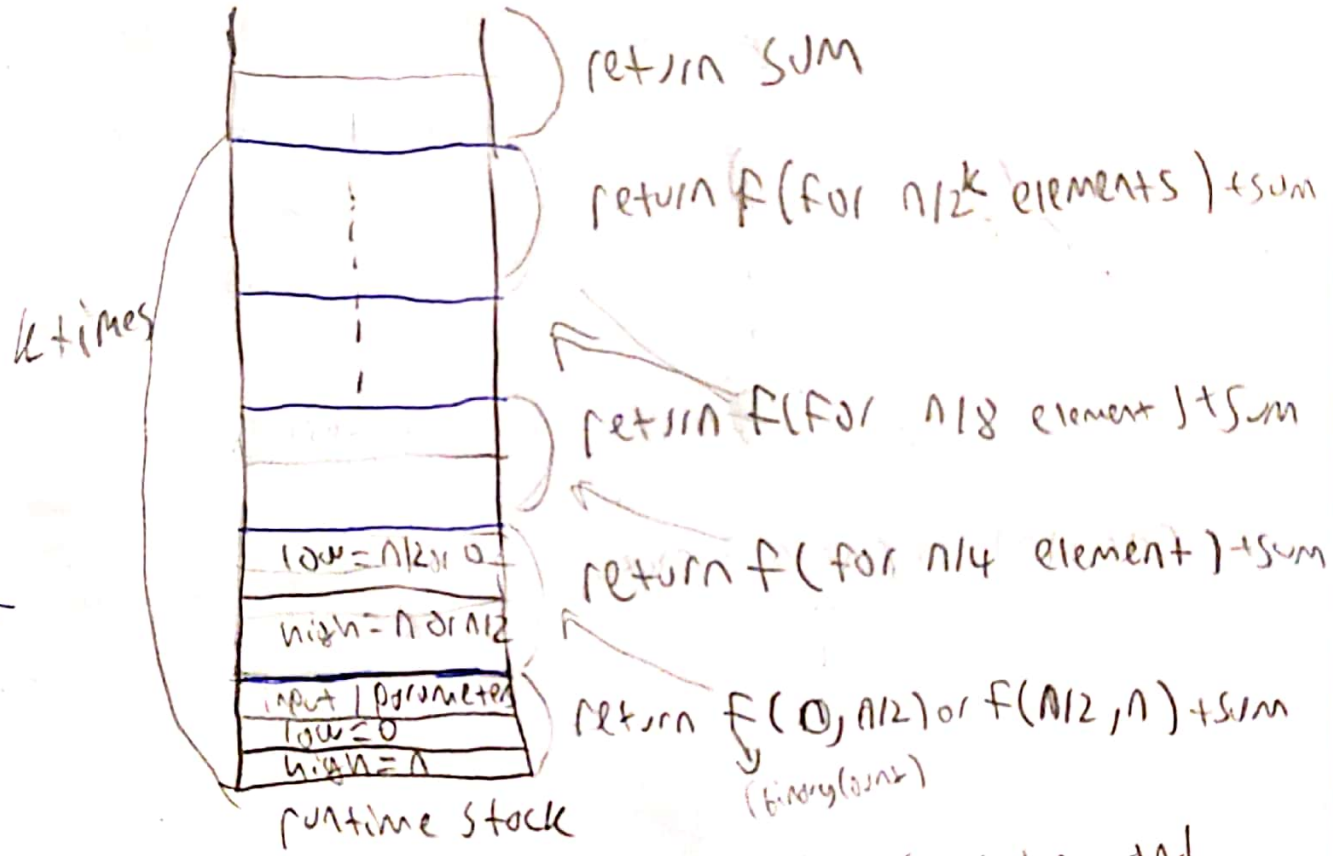
Space Complexity Analysis

Binary Count



$n/2^k$ should be 1 to function returns sum, and it can be seen that k should be $\log n$ to achive that, so it costs $\log n$ memory, so space complexity is $O(\log n)$

Acount

it's an iterative function, even though it includes a function in the for loop, before Acount returns, all that functions was deleted from runtime stack so space complexity is $O(1)$

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Honor Code

I have completed this assignment individually, without support from anyone else. I hereby accept that only the below listed sources are approved to be used during this assignment:

(i) course textbook,
(ii) All material that is made available to me by the professor (e.g., via Blackboard for this course, course website, email from professor/TA),
(iii) Notes taken by me during lectures.

I have not used, accessed or taken any unpermitted information from any other source. Hence, all effort belongs to me.

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