CSE 321 ALGORITHM HW4

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1. Cutting wires

In this method I am taking log2 of the length of wire. If number is less than 3 then log if 1

Otherwise I add 1 to symbolize the cut operation

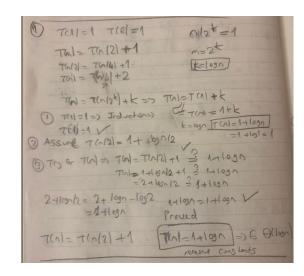
Firstly I take length of the wire. I check the wire length is less than 2, if it is less than 2, this means that we don't need to cut anything. There is no cut operation. Return 0

Otherwise I take log of the length of the wire and I add 1 at each step

```
T(n)=T(n/2)+1
By master theorem a=1 b=2
f(n)=1 \Rightarrow f(n) \text{ is element of the theta}(n^d) \text{ class. D=0. So } n^0=1.
B^d=1 \text{ a=b}^d. \Rightarrow 1=2^0 \Rightarrow 1=1. \text{ So } T(n)= \text{ theta}(n^d* \text{ logn}) \Rightarrow T(n)= \text{theta}(n^0* \text{ logn}) \Rightarrow \text{ theta}(\text{logn})
Test \text{ outputs:}
```

```
Expected cut: 0
n=1, Calculated cuts: 0
-----
Expected cut: 1
n=2, Calculated cuts: 1
-----
Expected cut: 2
n=3, Calculated cuts: 2
-----
Expected cut: 2
n=4, Calculated cuts: 2
```

```
Expected cut: 4
n=9, Calculated cuts: 4
------
Expected cut: 4
n=10, Calculated cuts: 4
------
Expected cut: 7
n=100, Calculated cuts: 7
------
Expected cut: 5
n=18, Calculated cuts: 5
------
Expected cut: 5
n=20, Calculated cuts: 5
```



2. Worst best

```
def find_worst_best(succes_rates):
    if(len(succes_rates)<2):
        return succes_rates[0]_succes_rates[0]

mid=int(len(succes_rates)/2)
    left_half_worst_left_half_best=find_worst_best(succes_rates[0:mid])
    right_half_worst_right_half_best=find_worst_best(succes_rates[mid:n])
    return min(left_half_worst_right_half_worst)_max(left_half_best_right_half_best)
</pre>
```

I take success rates as an argument. Firstly I check the length of the array, if length is less 2 this means that min and max is zeroth element of the array. Then I found middle element index of the array. I divide length by 2. Then continuously I find left half worst(min) left half best(max) and right half worst(min) right half best(max) of the array by using recursive. Then I compare the worst ones and best ones. Then I return the results.

```
T(n)=2T(n/2)+1(finding mid)
```

By master theorem a=2 b=2

 $f(n)=1 \Rightarrow f(n)$ is element of the theta(n^d) class. D=0. So $n^0=1$.

 $B^d=1 \text{ a>b}^d$. => 2>2° => 2>1. So T(n)= theta($n^{\log}_b{}^a$) => T(n)=theta($n^{\log}_2{}^2$) => theta(n)

Test Outputs:

```
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Loperate 'divides nh2

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```

```
Input [20, 25, 97, 10, 15, 0, 99]

Expected worst: 0 Expected best: 99

Calculated worst: 0 Calculated Best: 99

Input [20, 25, 97, 10, 15]

Expected worst: 10 Expected best: 97

Calculated worst: 10 Calculated Best: 97

Input [2, 6, 7, 15, 9, 10]

Expected worst: 2 Expected best: 15

Calculated worst: 2 Calculated Best: 15

Input [1, 2, 20, 6, 5, 15, 9, 10]

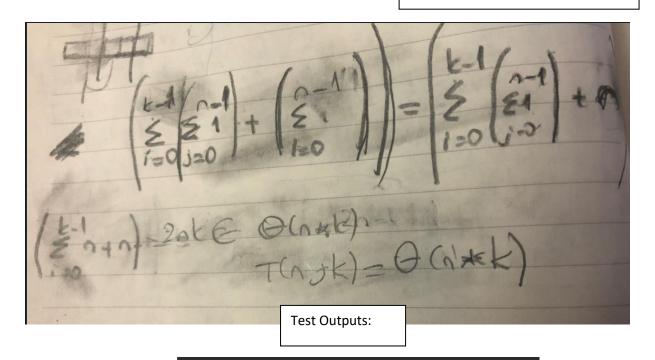
Expected worst: 1 Expected best: 20

Calculated worst: 1 Calculated Best: 20
```

3. Find kth meaningful

In this function I take success rates as an argument and I found the min value of the input array. Then I find the index of that value. Then I remove it from array because it is meaningless for our experiment

I take success rates and number k as an argument. Firstly I iterate until k. I decrease the input size by 1 at each iteration. At the end I remove k-1 elements from array. Then I returned the min value of the array. Which is first meaningless value.



```
Input array: [20, 25, 97, 10, 15, 0, 99]
Expected 5th smallest: 25
Calculated 5th smallest: 25
.----
Input array: [20, 25, 97, 10, 15]
Expected 3rd smallest: 20
Calculated 3rd smallest: 20
.----
Input array: [7, 10, 4, 3, 20, 15]
Expected 2nd smallest: 4
Calculated 3rd smallest: 4
Process finished with exit code 0
```

4. Reverse ordered pairs

I used merge sort algo to find the reverse ordered pairs.

I just find the reverse ordered pairs when the element of the right sub array is copied to the merged array. I increased the counter at that time. This means that we have find the reverse ordered pair.

```
while i < n1 and j < n2:
    if LEFT[i] <= RIGHT[j]:
        arr[k] = LEFT[i]
        i += 1
    else:
        arr[k] = RIGHT[j]
        count += (n1 - i)
        j += 1
        k += 1</pre>
```

```
Input array [20, 1, 2, 6, 7, 15, 9, 10]
Expected number of rop 9:
Calculated number of rop: 9
-----
Input array [20, 25, 97, 10, 15, 0, 99]
Expected number of rop 11:
Calculated number of rop: 11
-----
Input array [1, 2, 20, 6, 7, 15, 9, 10]
Expected number of rop 7:
Calculated number of rop: 7
-----
Input array [1, 2, 20, 6, 5, 15, 9, 10]
Expected number of rop 8:
Calculated number of rop: 8
```

5. Exponential Problem

```
def exponential_brute_force(a,n):
       res=res*a
def exponential_divide_and_conq(a,n):
   elif (n\%2==0): return exponential_divide_and_conq(a_n/2) * exponential_divide_and_conq(a_n/2)
    else : return a * exponential_divide_and_conq(a,n-1)
```

In brute force algorithm I just used for loop and each iteration I just multiplied the numbers.

In Divide and Conquer algorithm firstly I checked the if the exponent is zero or not then if it is zero I returned 1. Otherwise I take mod of the exponent to divide the problem into 2.

If it can't be divided into two then I take number and I decreased the number by 1.

For Brute Force Algorithm

T(n)=sum base=> I=0 ceil=> n-1 inside 1 => theta(n)

```
T(n)=2T(n/2)+1(multiplication)
By master theorem a=2 b=2
f(n)=1 \Rightarrow f(n) is element of the theta(n^d) class. D=0. So n^0=1.
B^d=1 a>b^d. => 2>2^0 => 2>1. So T(n)= theta(n^{\log_b a}) => T(n)=theta(n^{\log_2 2}) =>
                                        Durdo pol cogo => T(n=27(n|2)+1 = 1
theta(n)
```

```
2^5 BRUTE FORCE: 32
2<sup>5</sup> DIVIDE AND CONQUER: 32
5^3 BRUTE FORCE: 125
5^3 DIVIDE AND CONQUER: 125
```

(a) T(n) = 2 T(n/2) + 1 Multiplying Lopingia 'dividusinalia
TON = 276/21+1 TON = 7 (11=70)=1 WHEN COR
T(n)21 = 2T(n)41 + 1 $T(n) = 2(2T(n)4) + 1)(+1)$ $t = 100$
-16A = 2 + + 1 + 2 + - 1
T(n) = 2 1000 T(11 + 2 1000 - 1 = in + n-1 (D(n)
-20-1
1) for n=1=7 T(1)=1 2.1-1=) 2.1-1=1 / proved 1) for 7/4/121=7 2(1/2)-1=> n-1 assure
=>2(n-1)+1= m-1
701 = 2n-1 e O(n) = 2n-1= or proved