

1. What is the running time of the below code?

Algorithm 1 Test function

Test(a, start, end) :

```
1: n = end - start ;
2: if n <= 1
3:   return a[n] ;
4: else
5:   newEnd = start +  $\frac{n}{6}$  ;
6:   newEnd2 = newEnd +  $\frac{2 \cdot n}{6}$  ;
7:   sol1 = Test(a, start, newEnd) ;
8:   sol2 = Test(a, newEnd + 1, newEnd2) ;
9:   sol3 = Test(a, newEnd2 + 1, end) ;
10:  combineSol = combine(a, start, newEnd, end) //  $T(n) = O(n)$ 
11:  return min([sol1, sol2, sol3, combineSol]) ;
12: end
```

2. You are given a matrix called buildings that has locations of all the buildings at a university in a two-dimensional coordinate. We would to construct paved paths that connected the buildings to each other. Implement an algorithm to calculate the minimum budget required to finish the constructions.

1. How would you find the minmum amount to construct the paths?
2. Write the pseudocode for the best algorithm you came up with.
3. Implement your answer using any programming language you want to.
4. What is the time complexity of your answer?

3. You are given an adjaccency matrix that has 0s and 1s in it. Implement an algorithm to find the exact number of connected components on the map.

1. How can you find the total number of connected components?
2. Write the pseudocode for the best algorithm you came up with.
3. Implement your answer using any programming language you want to.
4. What is the time complexity of your answer?