ECS 455: In-Class Exercise # 3

Instructions

1. Separate into groups of no more than three persons.
2. The group cannot be the same as your former group.
3. Only one submission is needed for each group.
4. ***Write down all the steps*** that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
5. **Do not panic.**

Date: 08/02/2017			
Name	ID (last 3 digits)		
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Find the 10 smallest unique values of cluster size, starting with N = 1.

$N = i^2 + j^2 + ij$

When $i = j$, $N = i^2 + i^2 + i^2 = 3i^2$

	$i \backslash j$	0	1	2	3	4
$N = j^2$	0	$\cancel{0}$	1	4	9	16
$N = j^2 + j + 1$	1		3	7	13	21
$N = j^2 + 2j + 4$	2			12	19	28
$N = j^2 + 3j + 9$	3				27	37
	4					48

We don't have to find the values of N here because the formula $i^2 + j^2 + ij$ is symmetric.

First, we consider $i \le 2$, $j \le 2$.

We still don't have 10 distinct values of N. So, we expand our calculation.

We consider $i \le 3$, $j \le 3$.

Again, we only have nine distinct values of N. So, we further expand our calculation.

Now, consider $i \le 4$, $j \le 4$.

Here, we have 14 distinct values of N. We need 10. So, the current 10 lowest values are

1, 3, 4, 7, 9, 12, 13, 16, 19, 21.

Note that we can't stop here yet. We need to show that for the i, j values that we haven't considered, they can't give N that is < 21.

This is easy to show because for the (i,j) pairs that we haven't considered, at least one of the i and j must be ≥ 5. This implies they will give $N \ge 25$. Therefore, we can't miss any $N < 21$ by stopping our consideration at $i \le 4$, $j \le 4$.

So, the ten smallest values of N are

1, 3, 4, 7, 9, 12, 13, 16, 19, 21.