I initially thought that we need to look at slightly bigger than 6 node graphs.

Here is an unweighted graph that is robust in some way no matter what node defects:

It has 2 central nodes A,B connected by one node C, and other nodes connected to them. If A or B defects, only the nodes connected to it will defect, and if any other nodes initially defect the hole graph will cooperate at the end.

This led me to the following two ideas, which try to delay by one or more turns the spread of defection between nodes with high degree:

1. Have two types of nodes:
   * The normal type that we used up till now.
   * And a temporary node which will disappear if it defects.

n nodes t nodes

In this case we have two central nodes A and B each having n and t normal nodes connected to it, and there is a temporary node C that connects the two central nodes.

If any normal node defects, except for A and B, the hole graph will cooperate at the end. If C defects, it will cooperate because A and B have a higher score then him. If A ( or B) defects it will make all nodes connected to it to defect, including C, and then we will reach a stable position in which case the temporary node C will disappear making the graph look like this:

n nodes t nodes

In this case if n+5 > 3\*t (or t+5> 3\*n when B initially defects) The hole graph will cooperate at the end, after which A and B will decide to make a temporary node C between them to increase the graphs potential robustness.

1. Another idea is to group the graphs into clusters so that there are multiple central nodes in the manner shown below:

n nodes p nodes t nodes

We have 3 types of nodes:

* Normal nodes:
* Central nodes:
* Minor Central nodes:

The all behave in the same way but Central nodes have a very high degree, minor central nodes have a slightly smaller degree and normal nodes have a small degree.

To assure that the graph will end up cooperating we need to make sure that:

* The score of C right after it defects is lower than the score of A and B when they cooperate. (5\*p + 10 < 3\*n & 3\*t)
* The score of C when it cooperates is bigger than the score of A or B 1 turn after they defected, when the normal nodes they are connected to defect to. (3\*p + 3 > n+5 or t+5)
* The score of A (or B) when it cooperates needs to be higher than the score of B (or A) 1 turn after it defected. ( n\*3 > t+1 and t\*3 > n+1)

Both of these are on unweighted graphs but they should behave similarly with weighted graphs.