Q14. A hyper-graph is a graph like structure, given by: HG=(V, E). Where V is a finite set of nodes, and E is a finite set of hyper-edges. Unlike edges in simple graphs (that simply connect two nodes), hyper-edges in a hyper-graph may connect m-nodes. In general we say that for e ∈ E we have: e ≠ ∅ and e ⊆ V.

a) Given a hyper graph HG where the number of nodes in all its hyper-edges is at most a constant max (i.e., for all e ∈ E we have: |e| ≤ max) what is the maximum number of hyper-edges in such a hyper-graph?
b) Provide a C++ representation of such a hyper-graph.
c) What is the space complexity of your representation?
d) Show an algorithm for counting the number of the hyper-edges in a given hyper-graph; what is its time complexity?

Hyper-graph example (max=3): HG=(V, E), V={1,2,3,4,5}, E={1,2,3,4,5,1,2,3,4,5}

Q15. (full grade for a T(n)=O(n) algorithm)
An n-vertex graph is a scorpion if it has a vertex of degree 1 (the sting) connected to a vertex of degree two (the tail) connected to a vertex of degree n-2 (the body) connected to the other n-3 (the feet). Some of the feet may be connected to other feet. Devise an algorithm that decides whether a given graph (given as an adjacency matrix) represents a scorpion.

Figure 1: An example of a Scorpion Graph