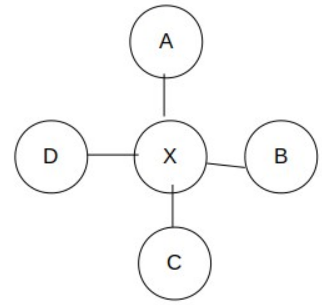
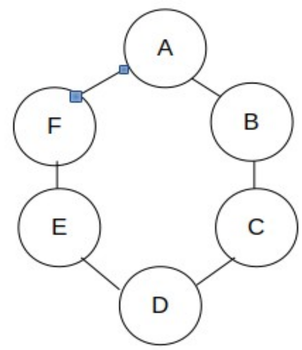
Alex Johnson
CS 581
I pledge my honor that I have abided by the Stevens Honor System.

1. The graph on the right depicts a graph consisting of five nodes where the node X is in the middle. X is pivotal for every pair of nodes not including X because in order to get from any one node to another you must pass through X, and since this is the only option, it is also the shortest.




2. The example on the right shows a graph in which every node is pivotal for at least one pair of nodes. This is true because every node has two adjacent nodes. For example. A has adjacent nodes F and B so for a path F to B, A is pivotal because it falls along the shortest path. This works for every node in this graph by finding the shortest path between its two adjacent neighbors.




3. Nodes E and C are gatekeepers in Figure 1. E is a gatekeeper because it lies on every path from any node on the left side of it, to the right side. For example E is in every path from C to F. Node C is also a gatekeeper because it is in every path from any node (besides C) to A. For example this holds true in the path E to A.

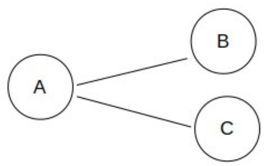
4. Nodes F, G and A are not local gatekeepers in figure 1. F and G are not local gatekeepers because they both have only two adjacent nodes in which the adjacent nodes are connected by an edge. Node A is not a local gatekeeper because it only has one adjacent node which violates the definition of a local gatekeeper in which a local gatekeeper needs two adjacent nodes.

5. Nodes C and E are both pivotal. Node C is pivotal because it is gatekeeper node that leads to A. This means that the only way to get to A is through C making it pivotal in the shortest path from any node to A. E is also pivotal for a similar reason that in order to get to F or G you must pass through E, making it a part of any shortest path to those nodes.

6. A network with no gatekeepers such as in figure 2, can be purposefully designed this was so that there is multiple connections to every node. A good example of this would be suggested friends. This example is if the edges in the graph showed mutual online friends and each node was a user. The system could suggest potential friends through who your friends are friends with. If there was a gatekeeper some friend suggestions could never be seen without being friends with a specific person. This is  not ideal however so there should be multiple ways to get everyone as a suggestion.

7. UCSB and STAN are two nodes that are not pivotal in figure 2. These two nodes are not pivotal because the two nodes they are each adjacent to (SRI and UCLA) has a direct edge between the two. Therefore UCSB and STAN would never be a part of the shortest path.

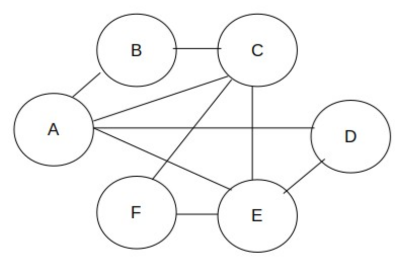
8. A triadic closure is if two people share the same friend, they have a higher probability of becoming friends in the future. For example in the figure below, if A is friends with B and C, most likely B and C will become friends because they share a common interest. This continues to expand a social network because then B may be a common friend for two other people and then they connect and the process keeps expanding.



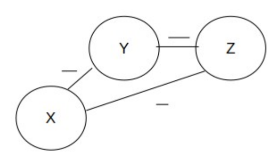

9. The edge connection b to c would be labeled weak. This is because nodes b and c already have two ties each and therefore the next tie added would have to be weak.

10. One link that would form would be from B to E. This is because both B and E share a strong tie with C. After that tie has been formed, another will be created between A and E because they both share a strong tie with B.

11. In the triangle formed by A, C and E, there are three different affiliations compared to the other triangles where they are all friends because they are affiliated with one thing. This is true because A and E are both affiliated to X, Y, and Z while X is only affiliated with X and Z. However since C is still affiliated with the other two groups X and Z they are still friends with A and E.




12. This network is not balanced. For instance, if you divide the network into 3 groups by village (x, y and z) everyone in those groups would be positive. This would be balanced. However each group would be negatively connected to each other which is not balances and therefore the network is unbalanced.



13.

- AB: Positive: (A,B,C), (A,B,E), (A,B,D): 1 Balanced, 2 Unbalanced
- BD: Positive: (B,D,E), (B,D,C), (B,D,A): 1 Balanced, 2 Unbalanced
- DE: Positive: (D,E,C), (D,E,A), (D,E,B): 1 Balanced, 2 Unbalanced
- EC: Positive: (E,C,A), (E,C,B), (E,C,B): 1 Balanced, 2 Unbalanced
- CA: Positive: (C,A,B), (C,A,D), (C,A,E): 1 Balanced, 2 Unbalanced
- AD: Negative: (A,D,E), (A,D,C), (A,D,B): 2 Balanced, 1 Unbalanced
- AE: Negative: (A,E,B), (A,E,C), (A,E,D): 2 Balanced, 1 Unbalanced
- BC: Negative: (B,C,A), (B,C,D), (B,C,E): 2 Balanced, 1 Unbalanced
- BE: Negative: (B,E,A), (B,E,C), (B,E,D): 2 Balanced, 1 Unbalanced
- CD: Negative: (C,D,A), (C,D,B), (C,D,E): 2 Balanced, 1 Unbalanced