CSC208 0404 Lab: Graph Problems

Havin Lim

April 4th, 2023

1 Problem 1: Bipartiteness

a. Bipartite : G = (V,E) where V = {a,b,c,d,e}
E = {(a,d), (a,e), (b,d), (b,e), (c,d), (c,e)}

Non-Bipartite : G = (V,E) where V = {a,b,c,d,e}
E = {(a,d), (a,e), (b,d), (b,e), (c,d), (c,e), (d,e)}
b. In the bipartite case, we can divide the vertices in to two groups, customers and products, where an edge connects a customer to a product if that customer has purchased that product before.

By connecting and analyzing one's purchasing pattern, we can easily recommend products that are favorable.
c. G = (V,E) Where V = {a,b,c,d,e,f}
E = {(a,b), (b,c), (d,e), (e,f)}
This graph is a perfect-matching graph, but if the nodes are connected like this would connect the customers to each other which doesn't make a great example for the one above.

2 Problem 2: Cliques

a. Graph with a 4-clique : G = (V,E) where V = {a,b,c,d}

E = {(a,b), (a,c), (a,d), (b,c), (b,d), (c,d)}
Graph without a 4-clique : G = (V,E) where V = {a,b,c,d,e}

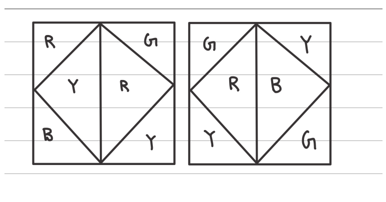
E = {(a,b), (b,c), (b,d), (c,e), (d,e)}

b. The 4-clique example can be interpreted as the friendship between four friends. They are connected to one another showing that they think of one another as friends.
c. In the friendship example, a complete graph would represent a scenario in which all friends are connected to each other. This means that all friends share

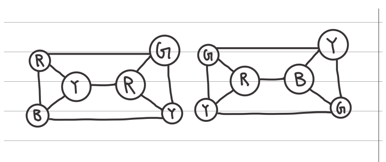
a close relationship with each other and form a single clique. However, in real-world scenarios is is very rare to have equal friendships with one another. //

3 Problem 3: Coloring

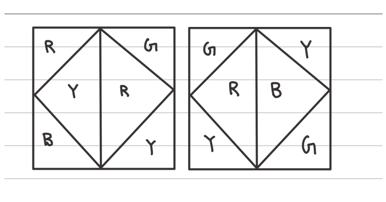
a. Graph with a 3-coloring : G = (V,E) where V = {a,b,c,d,e,f}
E = {(a,d), (a,b), (b,c), (d,e), (b,e), (c,f), (e,f)}
Where the colors are a,e : red / b,d : blue / c,f : green



b.



c.
Nodes represent the regions and edges represent the connection between the regions and the borders.



d.
Working as a Petersen graph, which cannot be colored with 3-colors, since it cannot be colored with colors of 3, it is impossible to be colored with 4 colors as well.