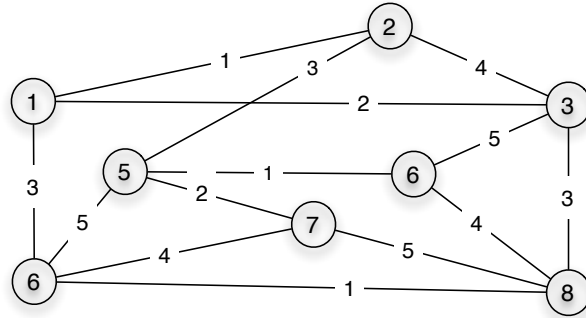


CS/MATH111 ASSIGNMENT 5

Problem 1: An *edge coloring* of a graph is an assignment of colors to edges such that any two edges that share an endpoint have different colors. (It can be proved that if the maximum vertex degree $D \geq 1$, then G can be edge-colored with at most $2D - 1$ colors.)

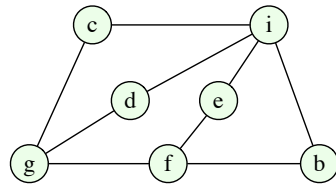
Here is an example of an edge coloring of a graph with 5 colors (colors represented by numbers):



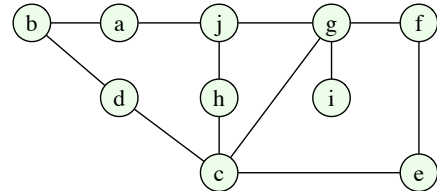
For the graph above, find (show on the graph) an edge coloring with at most 4 colors.

Problem 2: Let G and H be the graphs below. For each graph, determine whether it is bipartite. If the graph is bipartite, determine whether it has a perfect matching. Justify your answer.

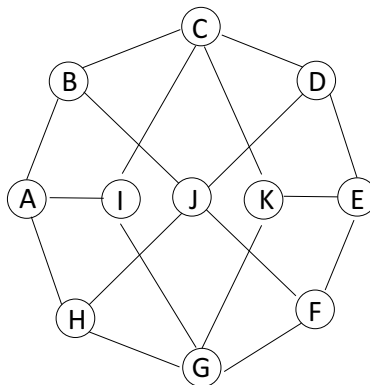
Graph G :



Graph H :



Problem 3: Let G be the graph below.



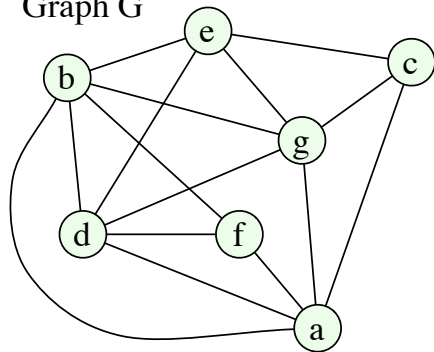
- (a) Determine whether it is bipartite. If the graph is bipartite, determine whether it has a perfect matching. Justify your answer.
- (b) What is the chromatic number of G ? Explain.

(c) Does G have a Hamiltonian Path? Justify.

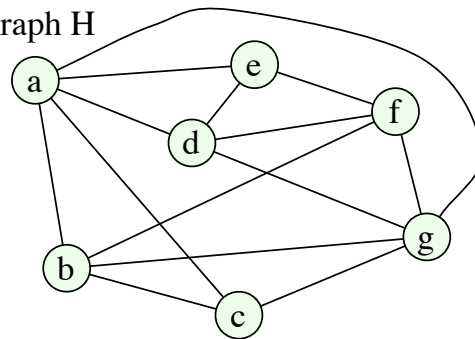
(d) Is G a planar graph? (You need to either show a planar embedding or prove, that G is nonplanar.)

Problem 4: Determine which of the following two graphs is/are planar/nonplanar. Justify your answer. (You need to either show a planar embedding or use Kuratowski's theorem.)

Graph G



Graph H



Submission. To submit the homework, you need to upload the pdf file into ilearn and Gradescope. Pictures should be imported into L^AT_EX in pdf (see the source file to get an idea of how to do that). You can draw them in any drawing software and export in pdf, or draw by hand and scan.