Graph Theory and Combinatorics MATH-42021/52021.
Home Work 1, due on Saturday June 20
Instructor: Prof. Artem Zvavitch
13 points (yes, 3 extra points!)

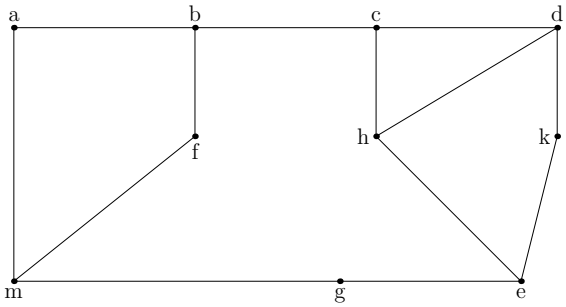

FIGURE 1

Problem 1. *Consider the graph G in Figure 1,*

- *Show a path from vertex a to vertex k.*
- *Give an example of circuit which would contains both a and k. Also how many circuits which contains both a and k are there?* **(note two circuits C and C' are different, if there is a vertex v in one of them, say in C, such that $v \notin C'$, for example, (c, h, d, c) is the same circuit as (h, d, c, h). The same is true about undirected paths)**
- *Two vertices are connected if there is a pass between them. The graph is connected if any two vertices are connected. Can you remove one edge from graph G in such a way that it will disconnects G? (explain!)*
- *Find all sets of 2 edges whose removal disconnects the graph.*
- *What is the minimal number of vertex deletion required to disconnect G? (explain!)*
- *Find the minimal edge cover of G.*
- *Find a maximal independent set of G.*
- *Please, draw subgraphs of vertices of degree 2 i.e. the subgraph of all vertices in G which have degree 2 in G.*
- *Please, also draw subgraph of vertices of degree 3 i.e. the subgraph of all vertices in G which have degree 3 in G..*

Problem 2. *List all* **nonisomorphic** *graphs with four vertices.*

Problem 3. *Give an example of two non-isomorphic, connected graph with 6 vertices and 9 edges each.*

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Problem 4. *Which pairs of graphs among those four are isomorphic (must provide explanation!)?*