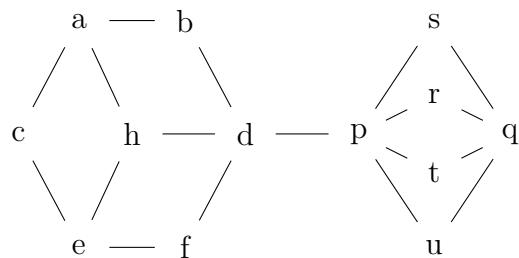


Name: _____

NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) How many isomorphisms are there from G (below) to itself? Justify your answer and/or show your work clearly .



2. (5 points) The wheel graph W_{73} has 73 nodes on the rim. How many edges does it have?

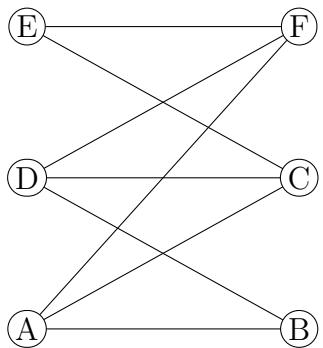
Name: _____

NetID: _____ Lecture: A B

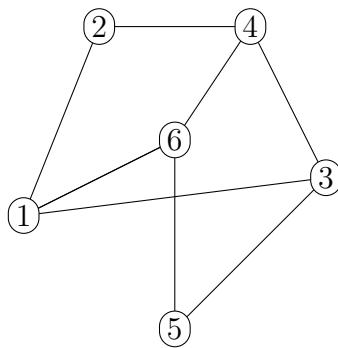
Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.

Graph X



Graph Y



2. (5 points) Show four distinct (i.e. not isomorphic) graphs, each of which is connected and has six nodes and no cycles.

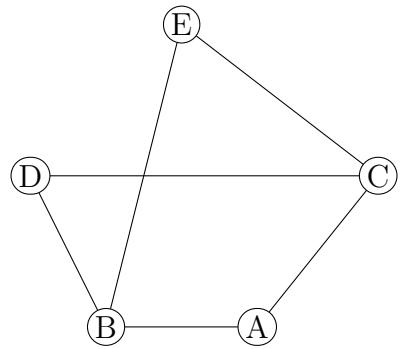
Name: _____

NetID: _____ Lecture: A B

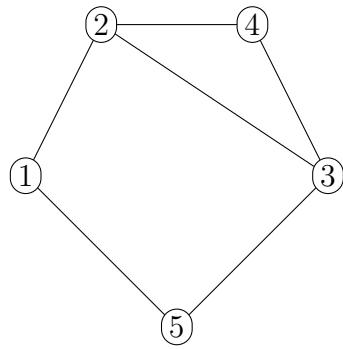
Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.

Graph X



Graph Y



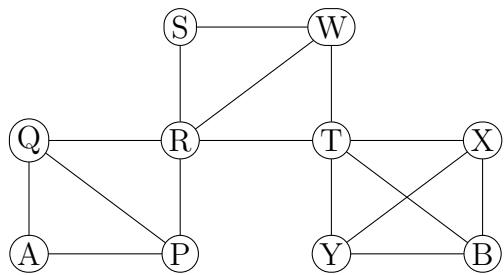
2. (5 points) Is the cycle graph C_4 a subgraph of graph $K_{3,3}$? Briefly justify your answer.

Name: _____

NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) How many isomorphisms are there from G (below) to itself? Justify your answer and/or show your work clearly .



2. (5 points) What is the difference between a path and an open walk?

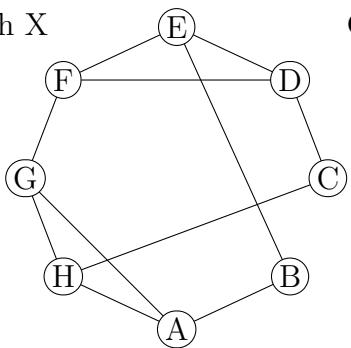
Name: _____

NetID: _____ Lecture: A B

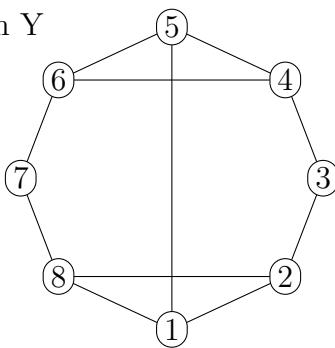
Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.

Graph X



Graph Y



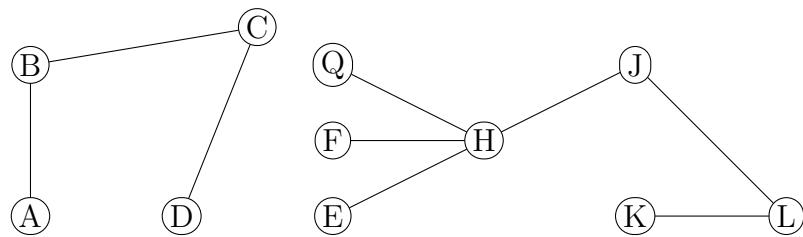
2. (5 points) The degree sequence of a graph is the list of the degrees of all the nodes in the graph, arranged in numerical order, largest to smallest. Suppose that graph G has degree sequence 1, 1, 1, 1, 1. How many connected components does G have?

Name: _____

NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) How many isomorphisms are there from G (below) to itself? Justify your answer and/or show your work clearly .



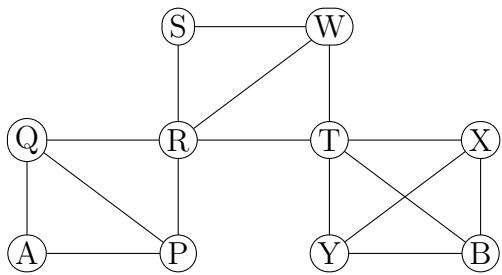
2. (5 points) Is the cycle graph C_{17} a subgraph of the wheel graph W_{23} ? Briefly justify your answer.

Name: _____

NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) How many isomorphisms are there from G (below) to itself? Justify your answer and/or show your work clearly .



2. (5 points) The degree sequence of a graph is the list of the degrees of all the nodes in the graph, arranged in numerical order, largest to smallest. Suppose graph G has degree sequence 1, 1, 1, 1, 2. Is G connected? Briefly justify your answer.

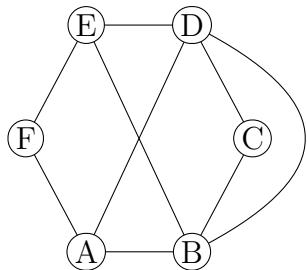
Name: _____

NetID: _____ Lecture: A B

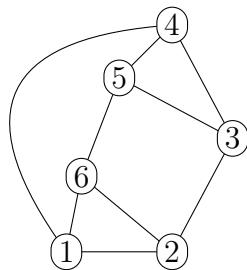
Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.

Graph X



Graph Y



2. (5 points) Is the graph C_{10} bipartite? Briefly justify your answer.

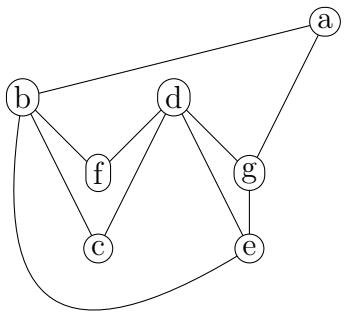
Name: _____

NetID: _____ Lecture: B

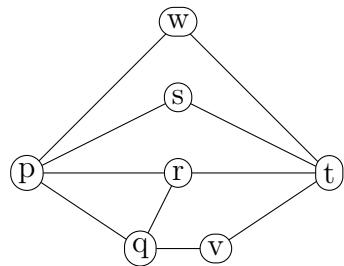
Discussion: Friday 11 12 1 2 3 4

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.

Graph X



Graph Y



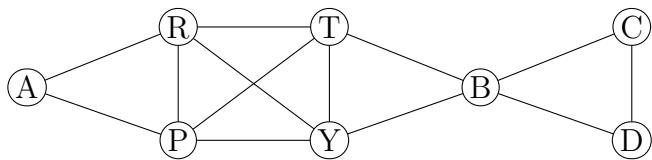
2. (5 points) The complete graph K_8 contains 8 nodes. How many edges does it have?

Name: _____

NetID: _____ Lecture: B

Discussion: Friday 11 12 1 2 3 4

1. (10 points) How many isomorphisms are there from G (below) to itself? Justify your answer and/or show your work clearly .



2. (5 points) Complete this statement of the Handshaking Theorem.

For any graph G with set of nodes V and set of edges E , ...

Name: _____

NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

(10 points) Suppose that $g : \mathbb{N} \rightarrow \mathbb{N}$ is one-to-one. Let's define the function $f : \mathbb{N}^2 \rightarrow \mathbb{N}^2$ by the equation $f(x, y) = (x + g(y), g(x))$. Prove that f is one-to-one. You must work directly from the definition of one-to-one. Do not use any facts about (for example) derivatives or the behavior of increasing functions.

Name: _____

NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

(10 points) Suppose that $f : \mathbb{Z} \rightarrow \mathbb{Z}$ is onto. Let's define $g : \mathbb{Z}^2 \rightarrow \mathbb{Z}^2$ by $g(x, y) = (f(x) + y, y + 3)$. Prove that g is onto.

Name: _____

NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

(10 points) Suppose that $f : (0, \infty) \rightarrow (\frac{5}{4}, \infty)$ is defined by $f(x) = \frac{5x^2+3}{4x^2}$. Prove that f is one-to-one. You must work directly from the definition of one-to-one. Do not use any facts about (for example) derivatives or the behavior of increasing functions.

Name: _____

NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

(10 points) Suppose that $f : \mathbb{Z}^2 \rightarrow \mathbb{Z}$ is defined by $f(x, y) = xy + yx^2 - x^2$. Prove that f is onto.

Name: _____

NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

(10 points) Suppose that A and B are sets. Suppose that $f : B \rightarrow A$ and $g : A \rightarrow B$ are functions such that $f(g(x)) = x$ for every $x \in A$. Prove that g is one-to-one.

Name: _____

NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

(10 points) Suppose that $f : [0, \frac{1}{2}] \rightarrow [1, \frac{5}{2}]$ is defined by $f(x) = \frac{x^2+1}{1-2x^2}$. Prove that f is one-to-one. You must work directly from the definition of one-to-one. Do not use any facts about (for example) derivatives or the behavior of increasing functions.

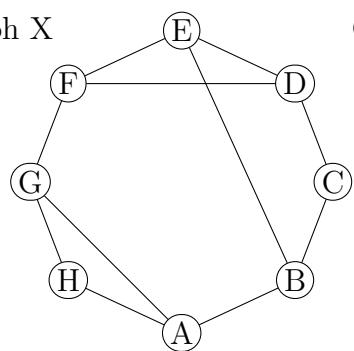
Name: _____

NetID: _____ Lecture: A B

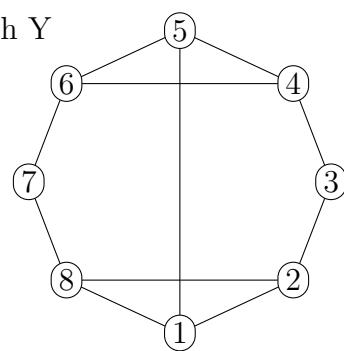
Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.

Graph X



Graph Y



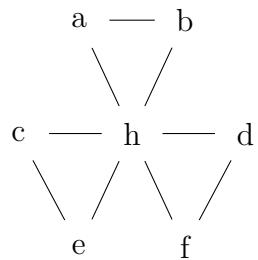
2. (5 points) Draw a picture of the graph $K_{2,3}$.

Name: _____

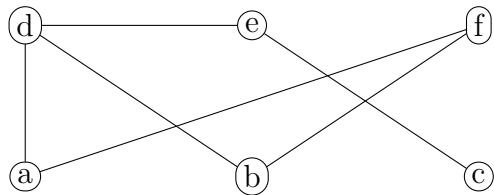
NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) How many isomorphisms are there from G (below) to itself? Justify your answer and/or show your work clearly .



2. (5 points) Is this graph bipartite? Briefly justify your answer.



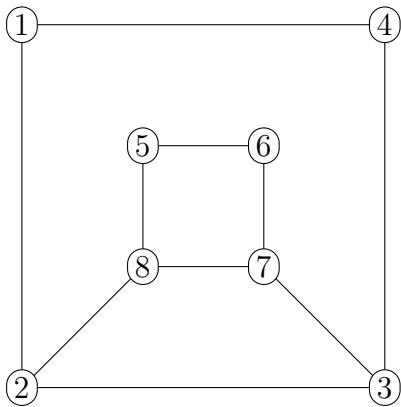
Name: _____

NetID: _____ Lecture: A B

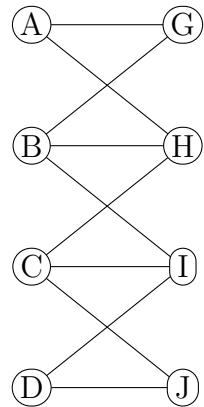
Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.

Graph X



Graph Y



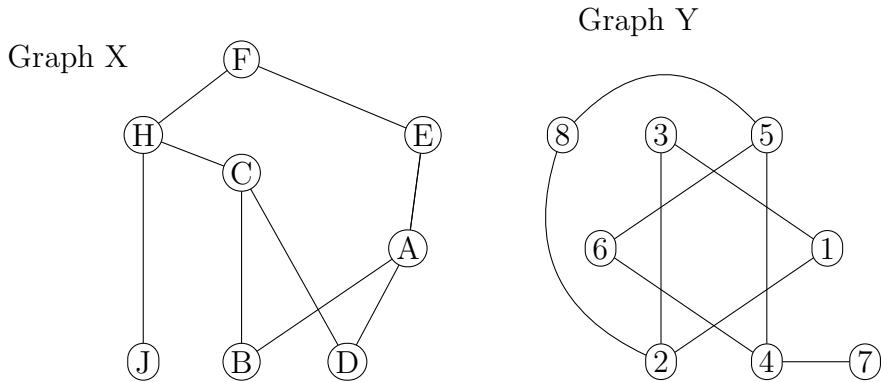
2. (5 points) The degree sequence of a graph is the list of the degrees of all the nodes in the graph, arranged in numerical order, largest to smallest. Is it possible to construct a (simple) graph with degree sequence: 4, 3, 3, 2, 0? Show how or briefly explain why this isn't possible.

Name: _____

NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.



2. (5 points) Suppose that $d(u, v)$ is the distance between nodes u and v (i.e. along the shortest path). Agent K claims that $d(u, v) + d(v, w) = d(u, w)$ for any nodes u , v , and w . Is he correct? Briefly explain why or give a counter-example.

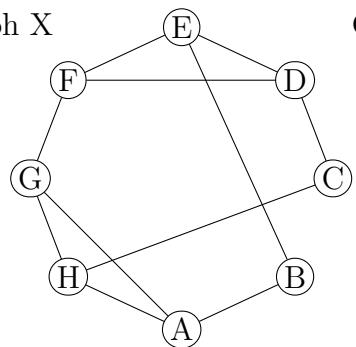
Name: _____

NetID: _____ Lecture: A B

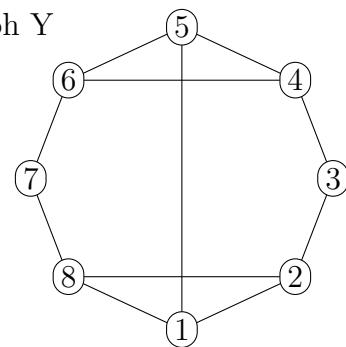
Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.

Graph X



Graph Y



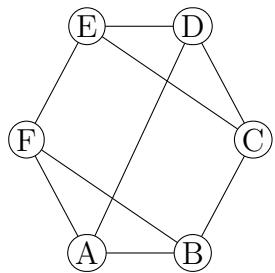
2. (5 points) The degree sequence of a graph is the list of the degrees of all the nodes in the graph, arranged in numerical order, largest to smallest. Is it possible to construct a (simple) graph with degree sequence: 4, 3, 3, 2, 2, 1? Show how or briefly explain why this isn't possible.

Name: _____

NetID: _____ Lecture: A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (10 points) How many isomorphisms are there from G (below) to itself? Justify your answer and/or show your work clearly .



2. (5 points) How many edges are in the complete bipartite graph $K_{10,5}$?

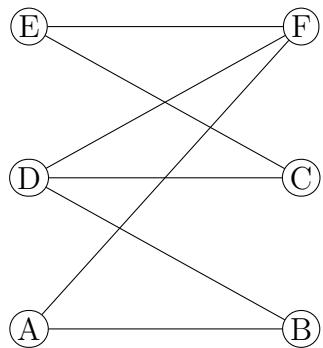
Name: _____

NetID: _____ Lecture: A B

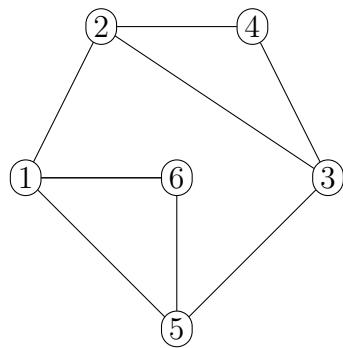
Discussion: Thursday Friday 10 11 12 1 2 3 4 5 6

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.

Graph X



Graph Y



2. (5 points) Show three graphs, each with exactly four nodes and three edges, none of which are isomorphic.

Name: _____

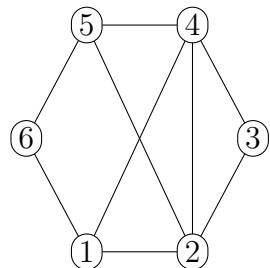
NetID: _____

Lecture: A B

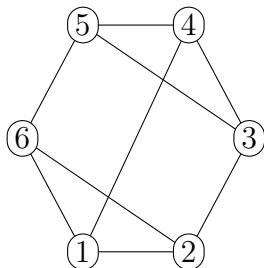
Discussion: Thursday Friday 10 11 12 1 2 3 4 5 6

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.

Graph X



Graph Y



2. (5 points) The degree sequence of a graph is the list of the degrees of all the nodes in the graph, arranged in numerical order, largest to smallest. Is it possible to construct a graph with degree sequence: 5, 3, 2, 2, 2, 0? Show how or briefly explain why this isn't possible.

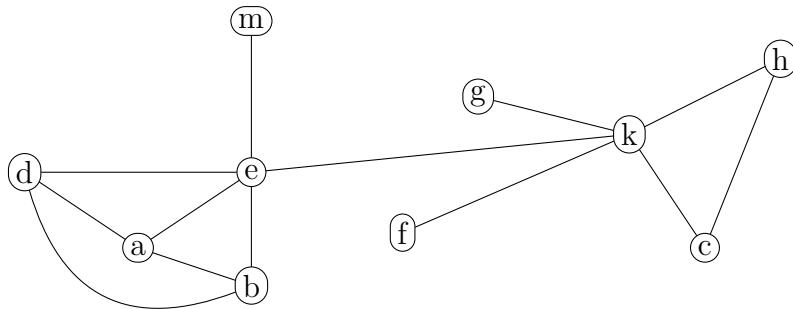
Name: _____

NetID: _____

Lecture: A B

Discussion: Thursday Friday 10 11 12 1 2 3 4 5 6

1. (10 points) How many isomorphisms are there from G (below) to itself? Justify your answer and/or show your work clearly .



2. (5 points) The degree sequence of a graph is the list of the degrees of all the nodes in the graph, arranged in numerical order, largest to smallest. Is it possible to construct a graph with degree sequence: 5, 3, 3, 2, 2, 1? Show how or briefly explain why this isn't possible.

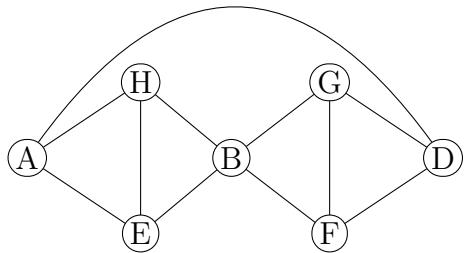
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NetID: _____ Lecture: A B

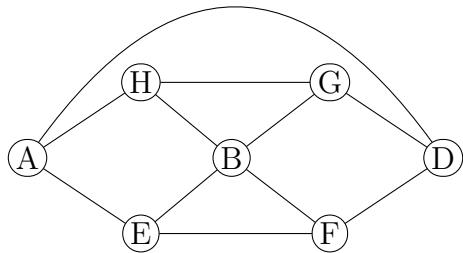
Discussion: Thursday Friday 10 11 12 1 2 3 4 5 6

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.

Graph X



Graph Y



2. (5 points) What is the difference between a cycle and a closed walk?

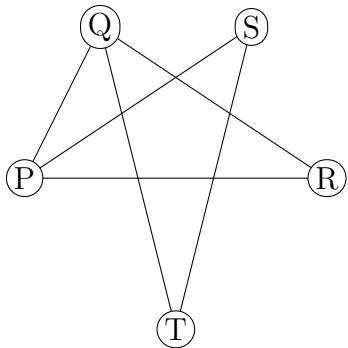
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NetID: _____ Lecture: A B

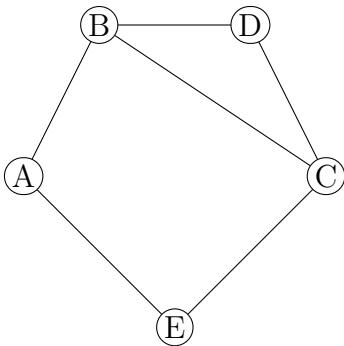
Discussion: Thursday Friday 10 11 12 1 2 3 4 5 6

1. (10 points) Are graphs X and Y (below) isomorphic? Justify your answer.

Graph X



Graph Y



2. (5 points) If G is a graph, its complement G' has the same nodes as G but G' has an edge between nodes x and y if and only G does not have an edge between x and y . Give a succinct high-level description of the complement of $K_{2,3}$. Briefly justify or show work.

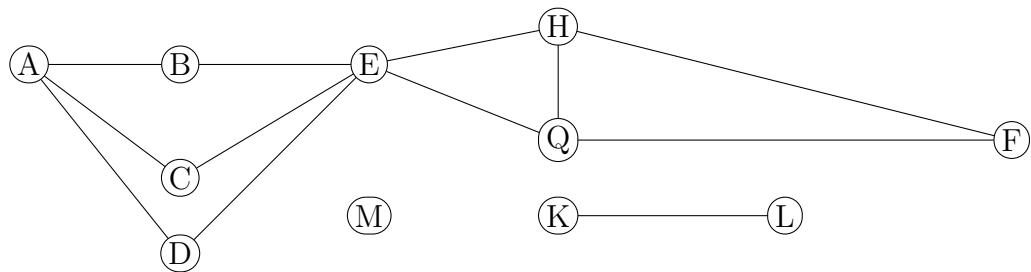
Name: _____

NetID: _____

Lecture: A B

Discussion: Thursday Friday 10 11 12 1 2 3 4 5 6

1. (10 points) How many isomorphisms are there from G (below) to itself? Justify your answer and/or show your work clearly .



2. (5 points) What is the diameter of C_n ?