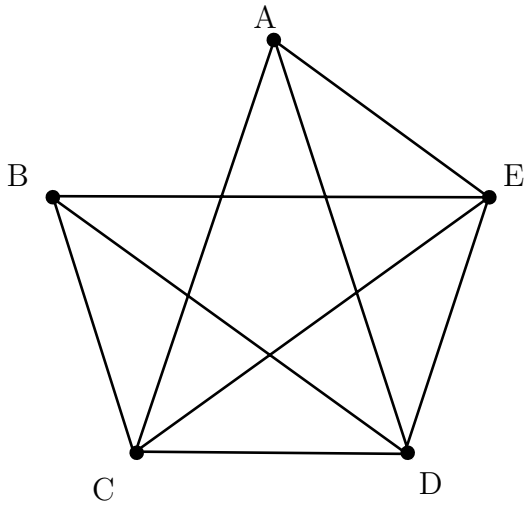
Exam #1

Name: Date: Friday, September 16, 2016

Directions: You have a total of 50 minutes for this examination.

- Make sure to put your name on your exam!
- There are a total of 10 questions (worth 10 points each).
- Please write clearly and justify your answers.
- No calculators.
- No materials other than a pen, pencil, and eraser.
- Do not begin until designated.
- Stop working and close exam when time is called.
- Please note that questions are not necessarily in order of difficulty.

Question 1 (10 points): Consider the graph below.



a.) (1 point) How many vertices does the graph have?

b.) (1 point) How many edges does the graph have?

c.) (1 point) Is the graph 3-colorable?

d.) (1 point) Is the graph 4-colorable?

e.) (1 point) List the valence of each vertex.

f.) (1 point) Is the graph connected?

Decide if each of the following is a path, circuit, or neither.

g.) (1 point) C – B – A

h.) (1 point) C – D – E – C

i.) (1 point) C – B – C

j.) (1 point) C – A – E

Question 2 (10 points):
a.) (3 points) Draw a connected graph on six vertices where each vertex has valence 2.

b.) (2 points) How many edges does your graph in part a.) have?

c.) (3 points) Draw a connected graph on six vertices where each vertex has valence 5.

d.) (2 points) How many edges does your graph in part c.) have?

Question 3 (10 points): True or False. Write your answer clearly.

a.) (2 points) If a graph has an Euler circuit, then it must be connected.

b.) (2 points) If a graph is connected, then it must have an Euler circuit.

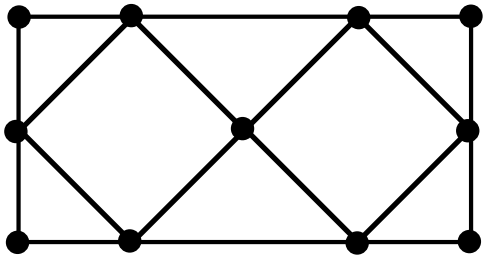
c.) (2 points) There is an easy way to tell if a graph has an Euler circuit.

d.) (2 points) There is an easy way to tell if a graph has a Hamiltonian circuit.

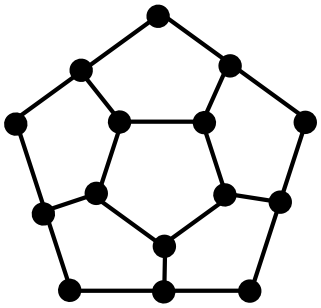
e.) (2 points) If a graph has an Hamiltonian circuit, then it must have an Euler circuit.

Question 4 (10 points):
Determine whether the following graphs have an Euler circuit.
If yes, then number the edges in the order an Euler circuit uses them.
If no, then explain why not.

a.) (5 points)

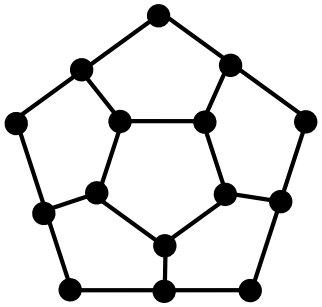


b.) (5 points)

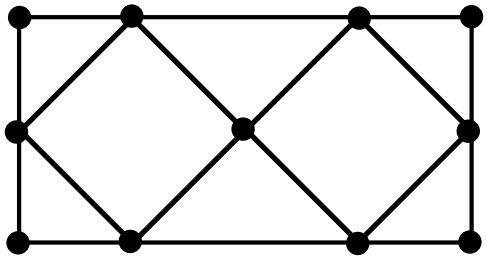


Question 5 (10 points):
Find the chromatic number for each graph below (please justify).
Color the graph with that many colors.

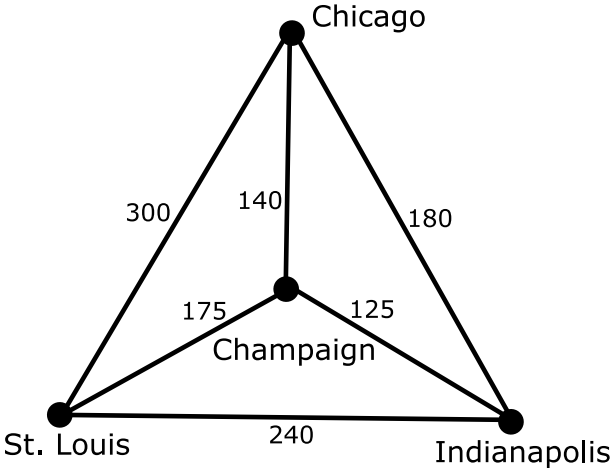
a.) (5 points)



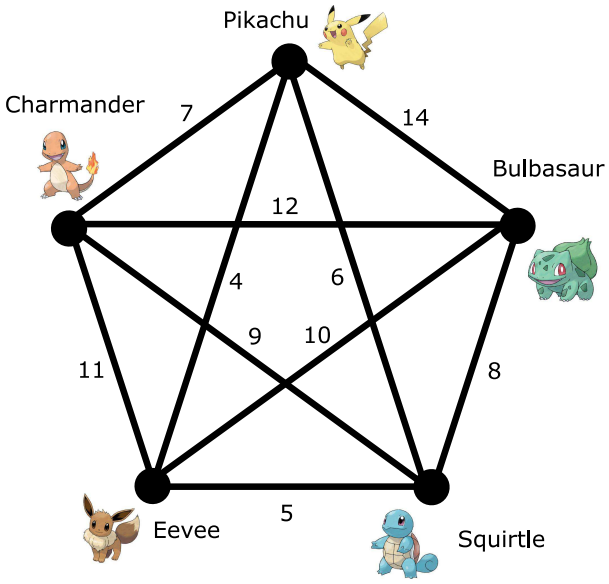
b.) (5 points)



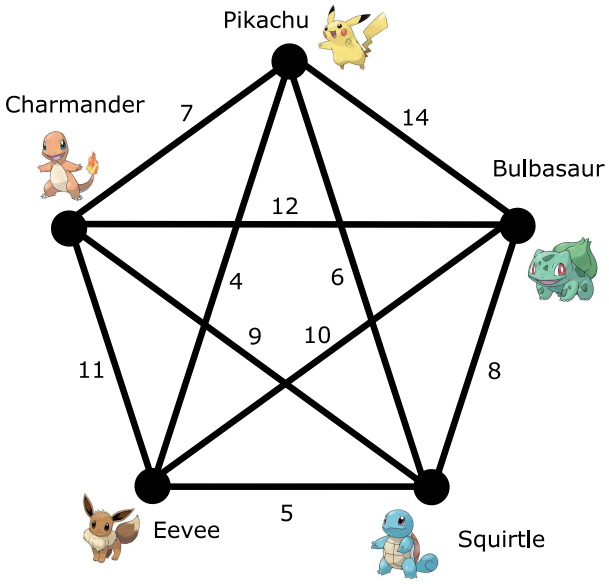
Question 6 (10 points):
Use the method of trees to find Hamiltonian circuits starting at Champaign.



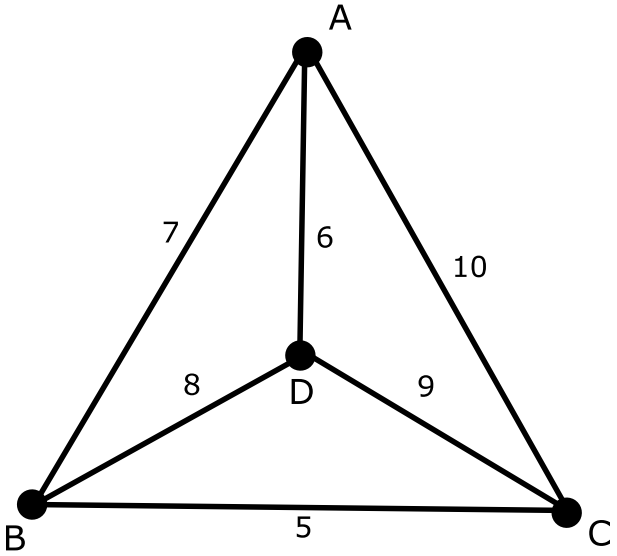
Question 7 (10 points):
(8 points) Use the Nearest Neighbor Algorithm starting at Charmander to find a Hamiltonian circuit.
(2 points) What is the total cost of this Hamiltonian circuit?



Question 8 (10 points):
(8 points) Use the Sorted Edges Algorithm to find a Hamiltonian circuit.
(2 points) Is this a cheaper Hamiltonian circuit than the Hamiltonian circuit you found in Question 7?



Question 9 (10 points):
Use Kruskal's algorithm to find a minimum weight spanning tree.



Question 10 (10 points): Here is the mileage between four cities in Illinois

	Effingham	Indianapolis	Springfield	Champaign
Effingingham	–	147	92	79
Indianapolis	147	–	190	119
Springfield	92	190	–	88
Champaign	79	119	88	–

Represent this by drawing a weighted complete graph on four vertices

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For credit, please clearly indicate the problem number.