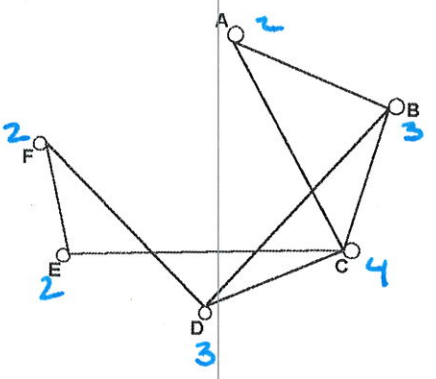
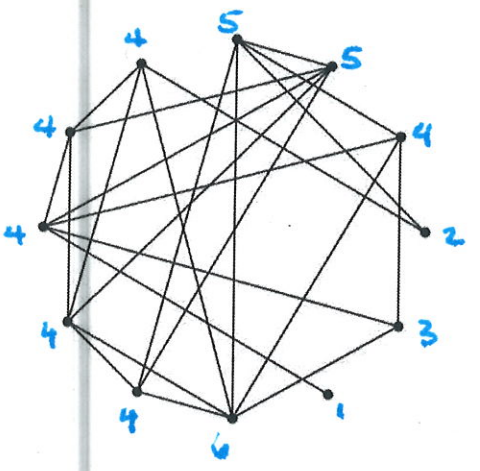
MAT 100, Exam #4, Spring 2017 Name KEY

**Instructions**: Show all work. Use exact answers unless specifically asked to round. Be sure to complete all parts of each problem.

1. Determine which, if either, of the following graphs contain an Euler circuit, an Euler path, or neither. Explain your choice. (5 points each)

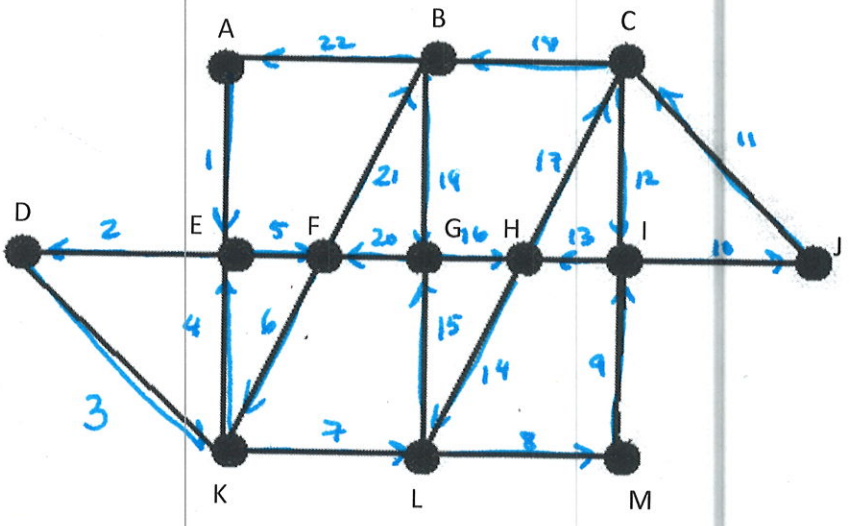



Contains an Euler path
2 odd vertices



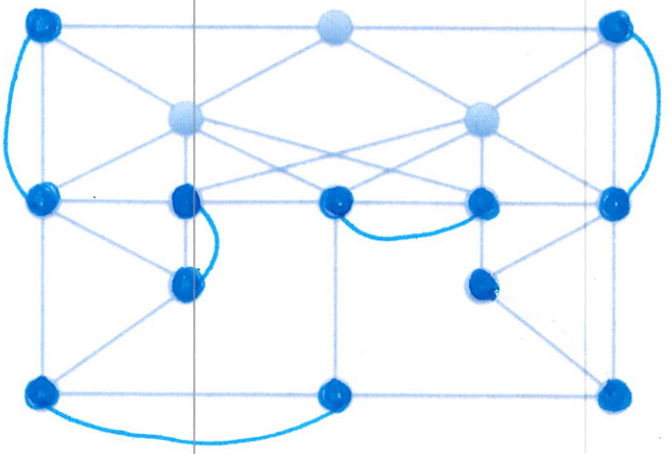
none
4 odd vertices

2. Use Fleury's Algorithm on the graph below to find an Euler circuit (or path). List the vertices you travel through in order, or number the edges as you use them. (8 points)




Answers will vary

3. Semi-Eulerize the graph below. What is the minimum number of edges that might be used to semi-Eulerize this graph, and how many did you actually use? (8 points)

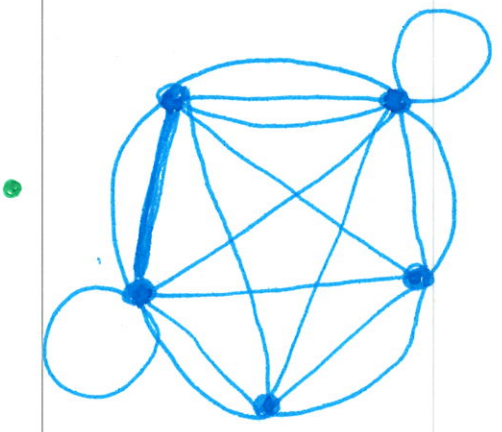


answers will vary

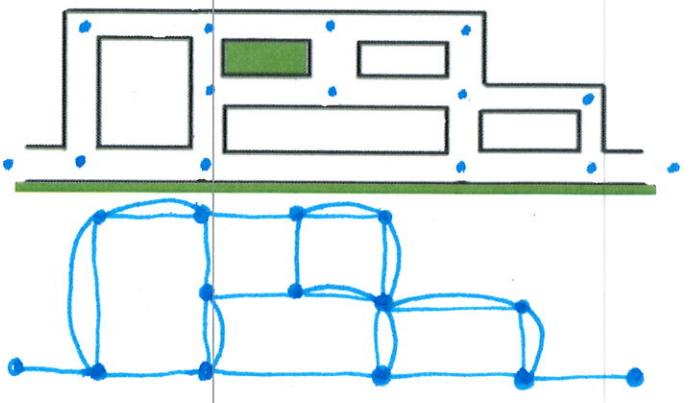
12 vertices
minimum 6 are needed to Eulerize
5 to semi Eulerize

I actually used 5

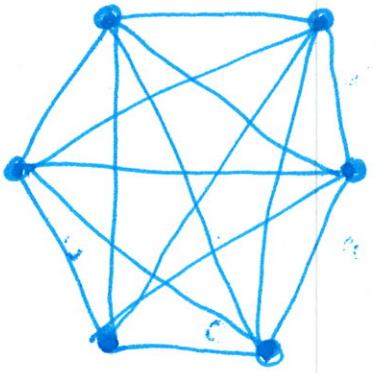
4. Draw a graph with 7 vertices, 18 edges (including two loops). (6 points)



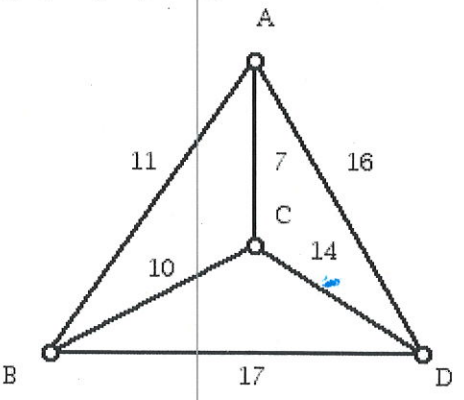
5. The graph below represents a small neighborhood. Canvasers are planning to go door-to-door to pass our flyers for the school board candidate they support. Assuming that houses line both sides of the street, except where shaded in green, and that they intend to start at the left edge of the graph, and finish on the right edge where their ride will pick them up. Construct a map of the neighborhood. (7 points)



6. Draw the $K_6$ graph. (6 points)



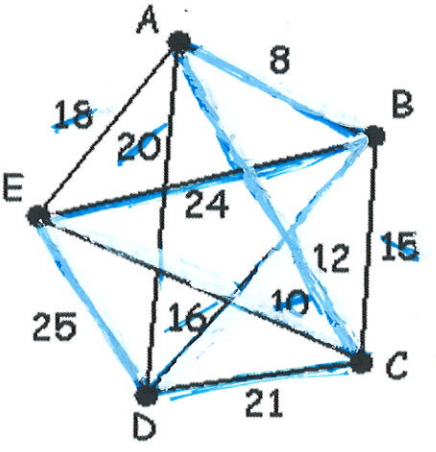
7. Find the highest value Hamilton circuit by Brute Force. Be sure to state the weight of the final graph. (10 points)




ABCDA = 11 + 10 + 14 + 16 = 51
ABDCA = 11 + 17 + 14 + 7 = 49 ←
ACBDA = 7 + 10 + 17 + 16 = 50

highest cost circuit is ABCDA at 51.

8. Use the graph to the right to answer the following questions. Clearly state the final weight of your circuit.
   a. Find the (approx.) lowest cost Hamilton circuit by the Nearest Neighbor Algorithm, starting at C. (10 points)




CEABDC
10 + 18 + 8 + 16 + 21 = 73

   b. Find the (approx.) maximum cost Hamilton circuit by the "Cheapest Link" Algorithm (in this case, the "Most Expensive Link"). (10 points)

ABEDCA
25 + 24 + 21 + 12 + 8 = 90

9. Use the Nearest Neighbor Algorithm to find the (approx.) lowest cost Hamilton circuit using the table below. What is the length of the final circuit? (10 points)

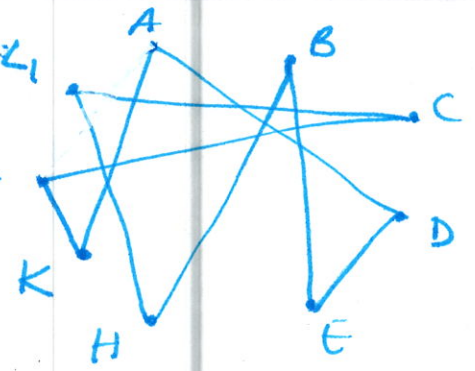
| Aberdeen | Bristol | Cambridge | Dover | Exeter | Hereford | Kendal | Leeds | Lincoln |
|---|---|---|---|---|---|---|---|---|
| ~~513~~ | | | | | | | | |
| ~~473~~ | ~~171~~ | | | | | | | |
| 595 | ~~206~~ | 124 | | | | | | |
| 587 | 83 | 250 | 244 | | | | | |
| ~~482~~ | 54 | 153 | ~~224~~ | ~~128~~ | | | | |
| 279 | ~~236~~ | 252 | ~~355~~ | ~~310~~ | 204 | | | |
| ~~328~~ | ~~219~~ | 147 | ~~272~~ | ~~294~~ | ~~188~~ | 72 | | |
| ~~389~~ | ~~185~~ | 94 | ~~249~~ | ~~259~~ | 153 | 177 | ~~142~~ | |

Distance in kilometres

Starting in Aberdeen

A K L C L H B E D A

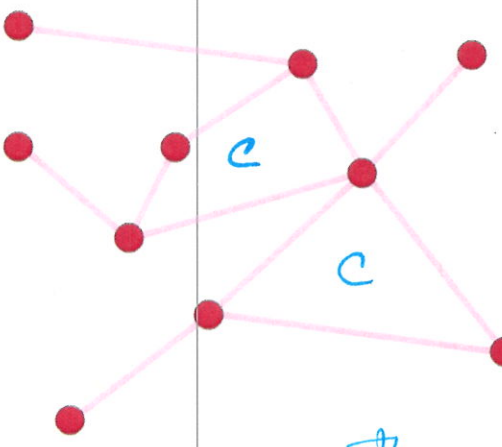
279 + 72 + 147 + 94 + 153 + 54 + 83 + 244 + 595 = 1721




10. Which of the following algorithms are optimal? Circle all that apply. (3 points)
    a. Brute Force
    b. Cheapest Link
    c. Nearest Neighbor
    d. Kruskal's
    e. Repeated Nearest Neighbor

11. Which of the following algorithms are efficient? Circle all that apply. (3 points)
    c. Brute Force
    d. Cheapest Link
    c. Nearest Neighbor
    d. Kruskal's
    e. Repeated Nearest Neighbor

12. Find the redundancy of the graph below. (5 points)



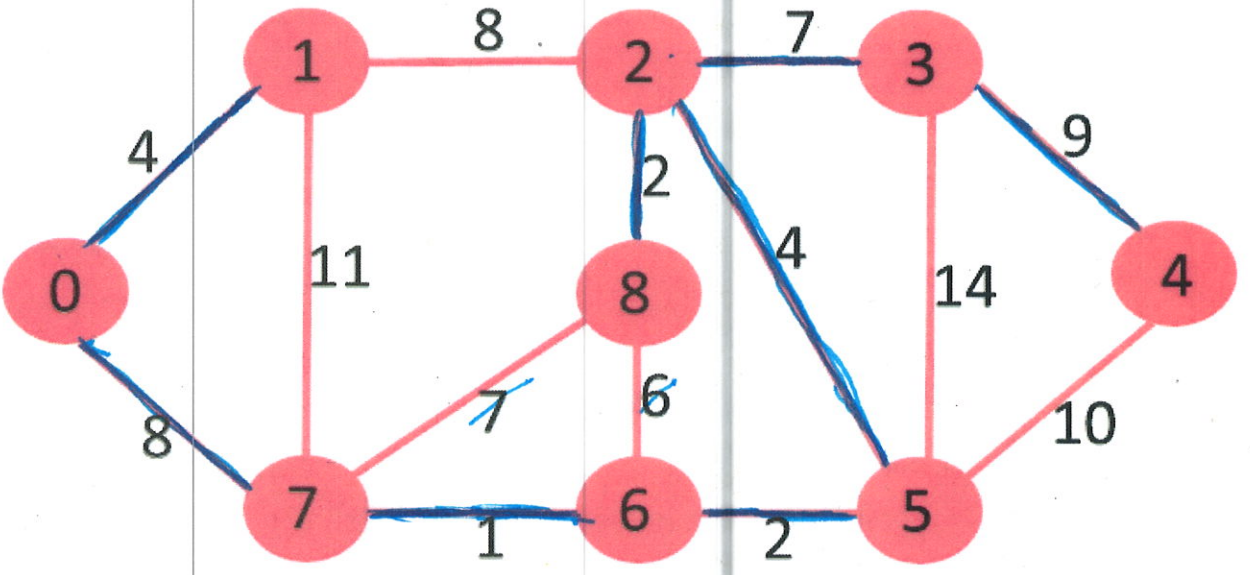
10 vertices
11 edges
redundancy is 2
tree needs 9 edges for 10 vertices
11 - 9 = 2

There are 2 circuits

13. If a tree has 13 vertices, how many edges must it have? (4 points)

12

14. Use Kruskal's Algorithm to find the lowest cost minimum spanning tree. Be sure to state the weight of the final tree. (10 points)




When you get to weight of 8 you can choose either

07 or 12

MST is 37