Instructions

- Complete solutions will include well labeled graphs, good explanation of the process used to implement any algorithms, and complete sentences for any discussion of the answer. Where appropriate, you can draw circuits or number edges directly on the graphs provided.
- You may talk about the assignment with other students in the class, but the work you submit must be your own independent creation. If you have questions talk with me before or after class or during office hours.

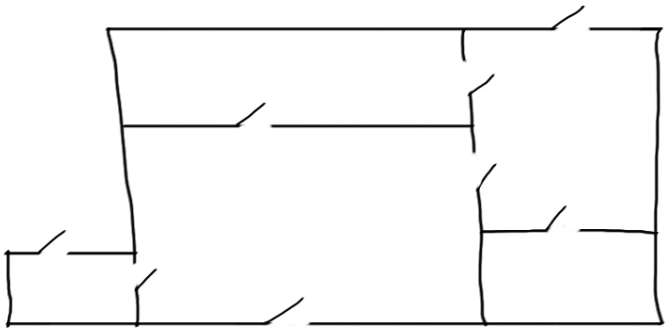
Questions

1. (20 marks) The following represents a house with a variety of rooms and doors, some of which lead outside.

   (a) Can you start in one of the rooms, and walk through every door only once? Explain your answer by constructing a graph of the situation, clearly explaining what the edges and vertices are in terms of the house.

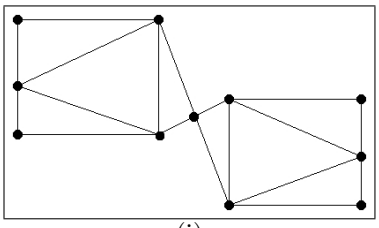
   (b) Can you start in one of the rooms, and walk through every door only once and end back where you started?

   (c) If the answer to (b) is no, what is the least number of doors you would need to add to make the answer to (b) be yes? In which rooms would these extra doors be placed?

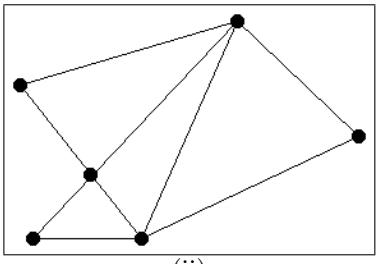


2. (20 marks) You may answer this question directly on this sheet.

   (a) For the following graphs, identify an Euler circuit for the graph by numbering the edges in the order they are traversed.

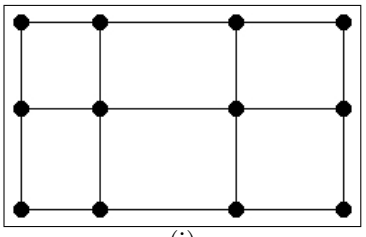


(i)

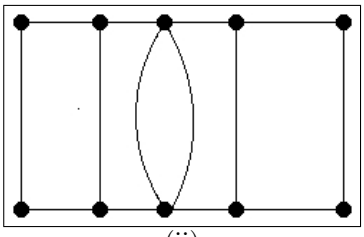


(ii)

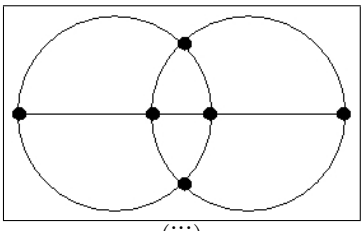
   (b) Determine a most efficient Eulerization of the following graphs.



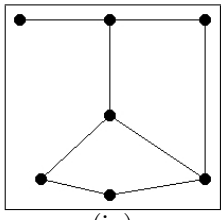
(i)



(ii)



(iii)



(iv)

3. (20 marks) *Kohl's Department Store* has eleven distributions centers.
(source: `http://www.kohlscareers.com/distribution/about/` accessed 1/8/13)

The distances (in miles) between the distribution centers is given in the following table.
(source: `http://www.mapquest.com/` accessed 1/20/10)

	Grain Valley	Corsicana	Findlay	Macon	Mamakating	Menomonee Falls	Middletown	Ottawa	San Bernadino	Winchester	Patterson
Grain Valley, MO	-	567	668	863	1188	579	569	422	1557	996	1839
Corsicana, TX	567	-	1156	850	1633	1076	1150	920	1438	1320	1706
Findlay, OH	668	1156	-	703	561	384	56	332	2239	424	2400
Macon, GA	863	850	703	-	964	908	701	825	2215	651	2480
Mamakating, NY	1188	1633	561	964	-	890	506	838	2742	314	2907
Menomonee Falls, WI	579	1076	384	908	890	-	409	175	2010	751	2174
Middletown, OH	569	1150	56	701	506	409	-	355	2266	369	2423
Ottawa, IL	422	920	332	825	838	175	355	-	1906	700	2073
San Bernardino, CA	1557	1438	2239	2215	2742	2010	2266	1906	-	2568	355
Winchester, VA	996	1320	424	651	314	751	369	700	2568	-	2767
Patterson, CA	1839	1706	2400	2480	2907	2174	2423	2073	355	2767	-

a) How many distinct Hamiltonian circuits are there between the distribution centers? Say you have access to a computer that can calculate one thousand Hamiltonian circuits in a second. How long would it take for your computer to implement a brute force method of determining the optimal Hamiltonian circuit? Is this problem one suitable for solution (by a computer!) using the brute-force algorithm?

b) You are the Executive Secretary to the boss, and need to plan a road trip tour of the eleven distribution centers. Using the nearest neighbor algorithm starting and ending at Ottawa, decide what the tour should look like and the length of the tour.

c) Your boss decides to pay for a flight back from the last city visited to Ottawa, so you only need to find a Hamiltonian path beginning at Ottawa and visiting all the cities. Both nearest neighbour and sorted edges can be modified to find Hamiltonian paths by simply not including the last edge that creates the Hamiltonian circuit. Would it be be better, in general, to use a nearest neighbour algorithm starting at Ottawa or sorted edges algorithm to determine the Hamiltonian path? Justify your choice by referring to the properties of the two algorithms.