1. Explain why the worst condition for the Quicksort is giving it a list that is sorted in the reverse sort order.
2. Explain how you could sort a list of data and simultaneously keep the data in its original order without creating a copy of the data within a language which does not have pointers. (Hint: DUPLICATION OF DATA IS NOT ALLOWED!!!!)
3. As discussed in class, a digraph is a graph that has a "direction component" on each edge. Explain how an adjacency table can be made that will tell you which nodes are adjacent to each other and what is contained in the node that you will be going to. (Example: You are in Room 1. When you go to Room 9, Room 9 contains a stereo, a case of Diet Dr. Pepper, a couch, the DVD of Animal House, and a wide screen HDTV)
   1. Give each room or node a number. This will correspond to its index in the adjacency and value tables. The adjacency table is a 2-dimensional array with both dimensions of size n, where n is the number of nodes in the graph. Suppose the first dimensional is “from” x and the second dimension is “to” y, where x is node from where you are travelling and y is the node you want to go to. For each node x to each node y, i.e., array[x][y], the element at index (x,y) will indicate the nodes’ connectedness and/or weight e.g., if the cost to travel from Room 1 to Room 9 is $5, array[1][9] will contain the value $5, which indicates both the fact that “x to y” is connected, and that the weight to travel from x to y is $5. In order to store the contents of the nodes, a second array can be constructed using the same corresponding indices for each of the nodes. For each contents[x]. the information for the corresponding node is stored e.g., contents[9] would possibly store a pointer to a container class with a stereo, a case of Diet Dr. Pepper, a couch, the DVD of Animal House, and a widescreen HDTV. (This is a very large container!!)
4. Explain the concept of a "hash of hashes"
5. A weighted graph is one in which each edge has a "cost," either positive or negative, associated with traversing that edge. Negative costs are ones which pay the individual to take that route, and positive costs are ones in which the individual must pay to take that route. Can a digraph be designed with 12 nodes and 18 edges such that the total cost to go from any node to any other node is zero? If so, design the graph. If not, explain why this cannot be done.
6. A river cuts through a small European town. There are five bridges in this town. All bridges are one-way bridges. Draw two digraphs that would allow the bicyclist to ride across all of the bridges once, and only once.
7. Explain how ISBN numbers are actually hashes
8. Explain how UPC Bar Codes are actually hashes
9. The last digit of a credit card number can identify immediately whether or not the remaining digits of the credit card number form a valid number. This hashing algorithm is available to the public via the United States Code concerning banking (or much easier, via the Internet). Create an algorthm such that the nth number of a sequence of m digits, where m > n for all n > 1, will identify if the number is valid or not. (Hint: SKU identification)
10. Explain how to completely sort an array, in place without copying data to another array, via a heap.