You will submit your solution to this assignment to the Curator System (as `HW04`). Your solution must be either a plain text file (e.g., NotePad) or a <u>typed</u> MS Word document; submissions in other formats will not be graded.

Credit will only be given if you show relevant work.

1. [25 points] Apply Dijkstra's SSAD algorithm to find the shortest distance from vertex 0 to every other vertex in the graph shown in Figure 1 below. For uniformity, when choosing which node to visit next, take them in increasing numeric order. You must show supporting work in the form of a table; see the course website for an acceptable format. You do not need to list the paths in your answer, just the minimum distances.

   Note: the example in the course notes shows an undirected graph, but the algorithm applies to directed graphs as well, and in the obvious manner.
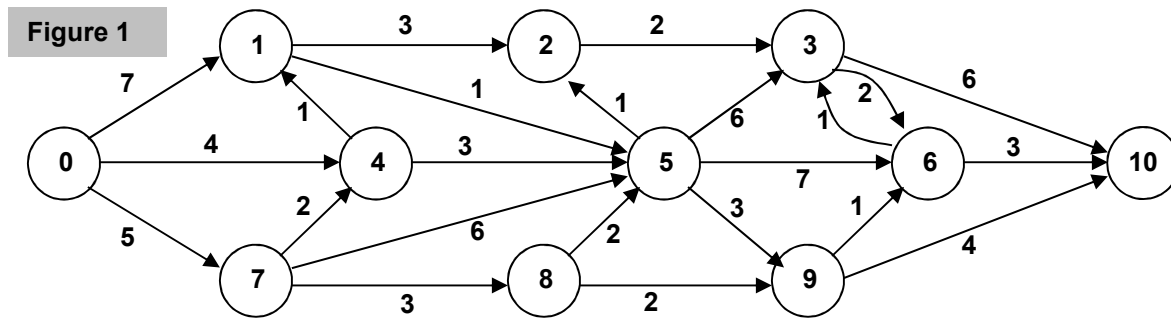
2. [25 points] Using a depth-first traversal, find a topological ordering of the nodes in the graph shown in Figure 2 below. For uniformity, when choosing which node to visit next, take them in increasing numeric order. You must show supporting work; see the course website for an acceptable format.
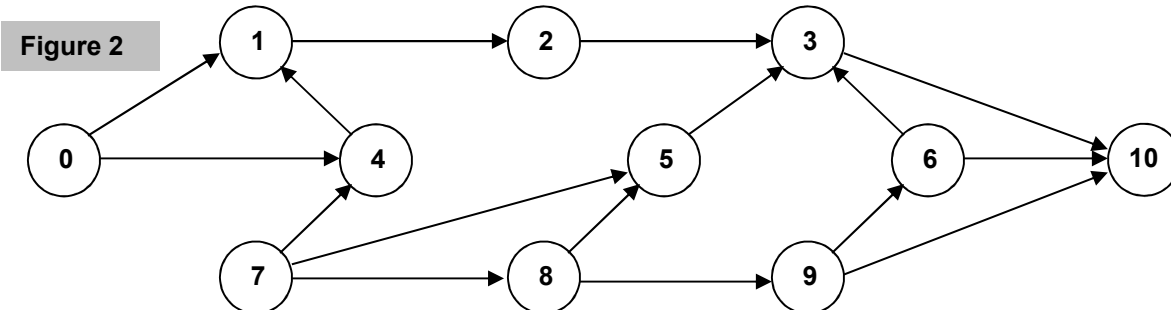
3. [25 points] Many operations can be performed faster on sorted data than on unsorted data. For each of the following operations, <u>explain</u> whether it could be performed faster if the data values were sorted (do not take the cost of the sorting into account).

   a) Checking whether a set of strings contains two words that are an anagrams of each other (e.g., *plum* and *lump*)
   b) Finding a value in a set of integers that is the sum of two values in the set.
   c) Determining if any string in a set of strings has a specific string as a substring.
   d) Determining if any string in a set of strings is the prefix of another sting in the set.
   e) Determining if a given integer divides any integer in a set of integers.

4. [25 points] Implement a Java method that takes an array of 0's and 1's and sorts it into ascending order in $\Theta(N)$ operations. Your answer should conform to the following interface:

```
void sortBits(int A[])
```