Foundations of Algorithms and Machine Learning

(CS60020)

Spring Semester 2017

Assignment 6 Questions

**1.** You are given an undirected graph G having positive weights and N vertices. You start with having a sum of M money. For passing through a vertex i, you must pay S[i] money. If you don't have enough money – you can't pass through that vertex. Find the shortest path from vertex 1 to vertex N, respecting the above conditions; or state that such path doesn't exist. If there exist more than one path having the same length, then output the cheapest one.

You can assume the following:

      $1 < N <= 100$

      $0 <= M <= 100$

      for each i, $0 <= S[i] <= 100$.
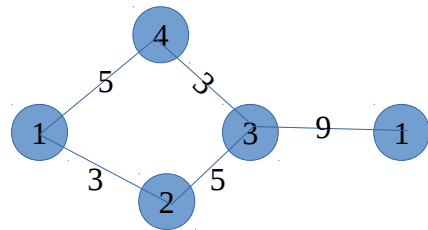
Consider the Example on the right:

The Value on the edge represent weights.

The Value written inside each node is the Money to pay for passing through.

Let us assume M =50

We have to find the shortest path from the leftmost node to the rightmost node.

In this case, two such paths exist, 1-4-3-1 and 1-2-3-1. But the path 1-2-3-1 has a lower cost as compared to the other one. Thus the solution would be the path 1-2-3-1

You should explain your Pseudocode.

2. You are the Dr. Watson, an army doctor who stays with his friend Sherlock Holmes. Since sherlock was busy with saving the world from moriarty, you have have been called upon by a minister in England to investigate a case. In this case, the suspect has jumped from a building with **K** floors. The minister wanted to test your intelligence, so he set's you up with a task. He wanted to know, which floors in the building are safe to jump from, and which will cause death. He hands you **N** Crash Dummies.

The following assumptions can be made:
- A Crash Dummy that survives a fall can be used again.
- A broken Crash Dummy must be discarded.
- The effect of a fall is the same for all Crash Dummies.
- If a Crash Dummy breaks when dropped, then it would break if dropped from a higher floor.
- If a Crash Dummy survives a fall then it would survive a shorter fall.
- It is not ruled out that the first-floor windows break Crash Dummies, nor is it ruled out that the Nth floor do not cause a Crash Dummy to break.

If only one Crash Dummy is available and you wish to be sure of obtaining the right result, the experiment can be carried out in only one way. Drop the Crash Dummy from the first-floor window; if it survives, drop it from the second floor window. Continue upward until it breaks. In the worst case, this method may require N droppings.

The problem is then to tell the minimum number of attempts that must be conducted to give an answer in the **worst case.**

Please write Pseudocode with properly describing the steps.