※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Let N be the set of nodes, n be the number of nodes, $d(i)$ be the distance label of node i from origin node s, $pred(i)$ be the predecessor of node i, $A(i)$ be the arcs departing from node i and c_{ij} be the cost of arc (i,j) in a graph. The following Dijkstra's algorithm can find the shortest path in a graph. What is the worst-case complexity of the Dijkstra's algorithm? Explain your solution with big O notation (10%). What is the limitation of the Dijkstra's algorithm? (5%)

   Algorithm Dijkstra;
   begin
   　　$S := \emptyset;\ \bar{S} := N;$
   　　$d(i) := \infty$ for each node $i \in N$;
   　　$d(s) := 0$ and $pred(s) := 0$;
   　　while $|S| < n$ **do**
   　　begin
   　　　　let $i \in \bar{S}$ be a node for which $d(i) = min\{d(j) : j \in \bar{S}\}$;
   　　　　$S := S \cup \{i\}$;
   　　　　$\bar{S} := \bar{S} - \{i\}$;
   　　　　for each $(i,j) \in A(i)$ **do**
   　　　　　　if $d(j) > d(i) + c_{ij}$ **then** $d(j) := d(i) + c_{ij}$ and $pred(j) := i$;
   　　end;
   end;

2. What is the difference between deterministic and nondeterministic algorithms? (5%). What is the definition of NP problems? (5%) What is the definition of NP-complete problems (5%)?

3. What are DNS, IMAP, FTP, SSH and Net Neutrality? (20%)

4. Write a program to sort an array of five integer elements in descending order. Note that the integers should be read from users' input. (15%)

5. What is deep learning (an approach to Artificial Intelligence)? (10%) What is the difference between traditional optimization algorithms and optimization algorithms used for training of deep models? (10%).

6. What is vehicular ad-hoc network (VANET)? (8%) What can VANET be used in transportation management? Explain how it can be used to receive full credit. (7%)