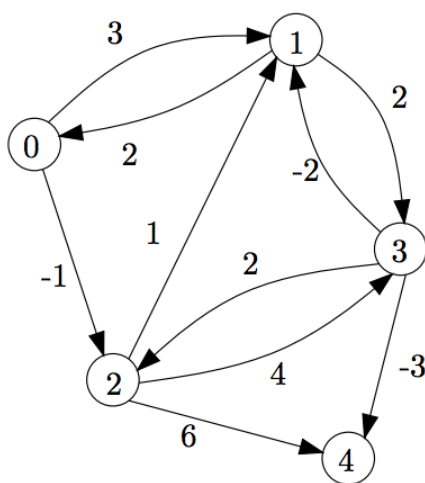


長庚大學 111 學年度第二學期資工所博士班演算法資格考

1. Please write down your student ID and name on the answer sheet.
2. Please indicate the number of each your answer that is relative to the problem.
3. Any form of cheating will lead to fail.

Please select five problems to answer. Total score of this exam is 100. Maximum deduction of 20 points for each problem that your answer.

1. Please explain the time complexity of depth-first search (DFS) algorithm and breadth first search (BFS) algorithm *in detail* (especially the differences between the adjacency matrix and list used to present the graph)
2. (A) Prove that if G is an undirected connected graph, then each of its edges is either in the depth-first search tree or is a back edge. (B) Prove that in a breadth-first search of a directed graph, there are no forward edges.
3. Solve the all-pairs shortest path problem on the following weighted, directed graph using Floyd-Warshall algorithm. Please show the matrices of distance D and predecessor matrices Π in each iteration of the loop.



4. What is the time complexity of Greedy based solution of Activity Selection Problem? Please explain your answer in detail.
5. What is the best performance of a sorting algorithm only using the comparison and interchange? Please explain your answer.
6. Consider a modification of the rod-cutting problem in which, in addition to a price p_i for each rod, each cut incurs a fixed cost of c . The revenue associated with a solution is now the sum of prices of the pieces minus the cost of making the cut.
 - (A) Give a dynamic-programming algorithm to solve this modified problem, including the mathematical expression for the maximum revenue and the pseudocode.
 - (B) Express your answer as an array of maximum revenue $R[1.. 10]$ with $c=1$.
 - (C) Describe a series of cuts that given the maximum revenue for a 10-inch rod.

Length i	1	2	3	4	5	6	7	8	9	10
Price p_i	2	5	6	8	11	12	15	18	19	20