類組：電機類　科目：資料結構(3002)　　共 2 頁 第 1 頁

※請在答案卷內作答

一 (10%) Given a set S, explain the definition of "equivalence relation" over S.

二 (10%) Convert an infix expression (B-A)*D+(C-F)/G+F to a postfix expression by using a stack. Your answer should include step-by-step status of input, stack, and output.

三 (10%) Construct a generalized list for a given polynomial $\left((x^9+3x^6)y+5x^6y^3\right)z^2+\left((x^5+2x^4)y^3+5y\right)z$ with the node data structure: (* means pointer)

variable/down*/coefficient	exponent	next*

參考用

四 (10%) Provide a design of circular queue based on array implementation with size N. Note that the circular queue can contain at most N items.

五 (10%) There are three towers and 64 disks of different diameters placed on the first tower. The disks are in order of decreasing diameter as one scans up the tower. Monks were reputedly supposed to move the disk from tower 1 to tower 3 obeying the rules:

(i) Only one disk can be moved at any time.
(ii) No disk can be placed on top of a disk with a smaller diameter.

Write a non-recursive algorithm that prints out the sequence of moves needed to accomplish this task by using stack data structure.

六 (10%) Given a list L of length n.

(一) (2%) What is the time complexity of searching an element in L using linear search?

(二) (2%) What is the time complexity of searching an element in sorted L using binary search?

(三) (6%) When does it make sense to perform a comparison-based sorting on L first then binary searches? Assume we do k searches.

七 (10%) Answer the following questions about a certain type of data structures.

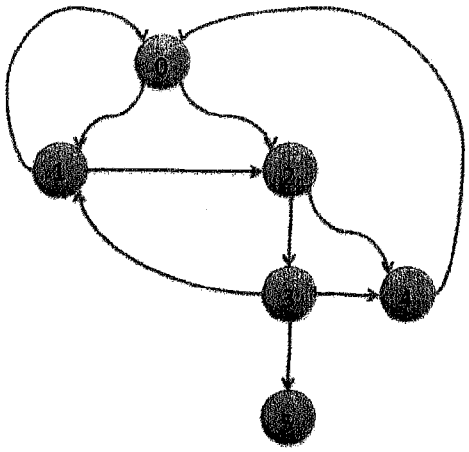
(一) (2%) Which data structure is often used to capture relationships among entities?

(二) (4%) Entities are represented as _____ and relationships are represented as _____.

(三) (4%) Depending on whether or not the relationships are symmetric, the data structure can be divided into two subtypes _____ and _____.

注意:背面有試題

八 (10%) What is the adjacency list of the following graph?



九 (10%) Answer the following question.

(一) (4%) Why do binary search trees have to be balanced?

(二) (6%) Make a comparison of the **findMax**, **find**, and **insert** operations between binary search trees and max-heaps.

十 (10%) Given the following single-pair shortest-path algorithm by depth-first search,

Single-pair shortest-path

1. Choose the smallest unvisited child of the start node
2. Choose the smallest unvisited child of that node and so on
3. Going deeper and deeper until it either reaches the goal node or a node with no children
4. The search then backtracks, returning to the most recent node with children that it has not yet visited
5. When all paths have been explored, choose the shortest path from the start to the goal

What is the shortest path from node 0 to node 5 of the graph of Problem 八 by this algorithm? Write down each step in detail. Assume that all edges have the same weight one on the graph. Hint: the first four steps of the algorithm should be 0, 0→1, 0→1→2, and 0→1→2→3.