國立嘉義大學 113 學年度
資訊工程學系碩士班招生考試試題

科目：資料結構（共 100 分）

一、The Ackermann function *A(x,y)* is defined for integer *x* and *y* by

$$A(x,y) = \begin{cases} y+1 & \text{if } x = 0 \\ A(x-1,1) & \text{if } x > 0 \text{ and } y = 0 \\ A(x-1, A(x,y-1)) & \text{if } x > 0 \text{ and } y > 0 \end{cases}$$

(a) What is the value of *A*(1,1)? (10 Points)
(b) What is the value of *A*(2,2)? (10 Points)

二、(a) What is the minimum height of a binary tree of m-nodes and justify your answer? (5 Points)
(b) What is the maximum height of a binary tree of m-nodes and justify your answer? (5 Points)

三、Draw the 10-entry hash table that results from using the hash function *h(i) = (3i+4) mode 12*, to hash the keys 13, 44, 17, 88, 23, 95, 20, 16, 8 and 67. Assuming the collisions are handled by linear probing. (20 Points)

四、Sorting Algorithm
(a) The following is the problem of sorting records on several keys. Please use the radix sort to sort 10 numbers {269, 184, 57, 587, 4, 53, 508, 263, 309, 482} in the range [0, 999]. (10 Points)
(b) Please analyze the time complexity of the radix sort. Is it possible that the radix sort is faster than the Quick Sort, in which the latter has only comparison and interchange operations permitted on keys, under some restricted conditions? Please describe your opinions. (10 Points)

五、**Stack and Expression:** The following is an infix form of the expression:

(A/B*C+D)+E/(F/(G-H))

Please use the **stack method** to transform it to the postfix one. You must list the contents of the stack as each operator and operand are read. (10 Points)

六、The graph theory

(a) Is the undirected graph G in Figure 1 bipartite? Please explain your answer. (10 Points)

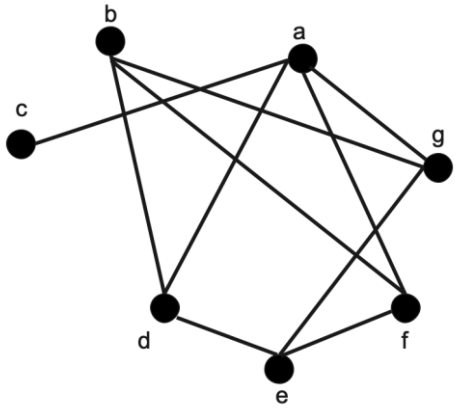

Figure 1: The undirected graph G

(b) The following is an adjacency matrix of the simple graph:

$$A = \begin{array}{c} \\ a \\ b \\ c \\ d \\ e \end{array} \begin{array}{c} \begin{array}{ccccc} a & b & c & d & e \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

Please describe how many different paths of length 4 from vertex *d* to vertex *b*. (10 Points)