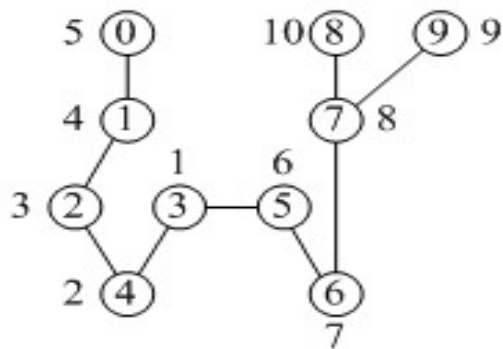
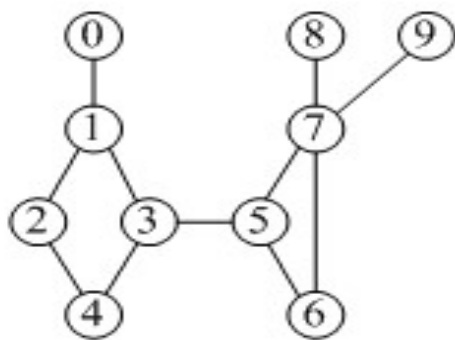


國立嘉義大學 112 學年度
資訊工程學系碩士班招生考試試題

科目：資料結構（共五題，共 100 分）

1. Draw binary search trees of height 2 and 6, respectively, on the set of keys $\{1, 2, 3, 4, 5, 6, 7\}$. (20%)
2. Every file added to IPFS (InterPlanetary File System, 星際檔案系統) is given a unique address derived from a hash value of the file's content.
 - a. What is a hash function? (10%)
 - b. What is a one-way hash function used mostly for generating digital signatures? (10%)
3. Write the postfix and prefix forms of “ $(A+B)*C+D/(E+A*C)+F$ ”. (10%)
4. The following figure shown in right-hand side is a depth first spanning tree DFS(3), which the source vertex is the vertex 3, for the following left connected graph G , and the numbers outside the vertices are depth first number (dfn) of the vertex.



- a. Write out the low values of each vertex for the depth first spanning tree with root = 3 based on the equation

$$\text{low}(u) = \min\{\text{dfn}(u), \min\{\text{low}(w) | w \text{ is a child of } u\}, \min\{\text{dfn}(w) | (u, w) \text{ is a back edge}\}\}. \text{ (10\%)}$$
 - b. Give the rule to determine whether a vertex is an articulation point or not in a graph. (5%)
 - c. Show the articulation points of the graph G . (5%)
 - d. Is G a biconnected graph? (5%)
5. KMP algorithm is a rapid method to perform pattern matching operation. First, we need to define a failure function for a pattern. The following definition is used to determine the failure function:

$$f(j) = \begin{matrix} \text{largest } i < j \text{ such that } p_0 p_1 \dots p_i = p_{j-i} p_{j-i+1} \dots p_j & \text{if such an } i \geq 0 \text{ exists} \\ -1 & \text{otherwise} \end{matrix}$$

- a. Suppose that we have a pattern shown below, to give the failure function of the pattern for each character. (15%)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| a | b | a | b | b | a | b | a | b | a | b |
|---|---|---|---|---|---|---|---|---|---|---|

- b. Suppose that the lengths of the string and pattern are m and n . Give the time complexity of performing the KMP algorithm to accomplish a pattern matching. (10%)