

國立臺灣科技大學

八十九學年度碩士班招生考試試題

系所組別：電機工程系丙組、資訊工程研究所

科目：資料結構

P. 1/2

1. Consider a set of five keys as shown below:
 {60, 52, 57, 32, 66}
- (a) i. Draw the binary search tree by scanning these keys from left to right. 3%
- ii. The probabilities of searching for items with keys 60, 52, 57, 32, and 66 are 0.25, 0.25, 0.125, 0.25, and 0.125, respectively.
- A. What is the expected number of key comparisons required for a retrieval? 3%
- B. For the same five keys, draw a binary search tree that gives the minimum average number of key comparisons for a retrieval. 5%
- (b) Suppose the above five items are organized as a *linked list* and *sequential search* method is used. The probabilities of searching for items with keys 60, 52, 57, 32, 59 and 62 are 0.1, 0.25, 0.15, 0.35, 0.1 and 0.05, respectively. (Note that some of the keys searched are not included in the list.)
- i. What is the expected number of key comparisons for a retrieval (including unsuccessful searches)? 3%
- ii. Reorder these keys so that the average number of key comparisons (including unsuccessful searches) for a retrieval is minimized. 4%
2. Analyze the time complexity of the following recursive function `prod` in terms of n . 9%
- ```
int prod(list[], int n)
{
 if (n > 1)
 return prod(list, n - 1) * list[n - 1];
 else
 return list[0];
}
```
3. Given a *circular list* with  $n$  items, what are the time complexities for the following operations?
- (a) Inserting a new item *before* the item pointed to by a given pointer. 3%
- (b) Inserting a new item *after* the item pointed to by a given pointer. 3%
4. (a) What is the fundamental concept behind the AVL trees? 5%
- (b) What is the time complexity for finding the maximum value in a max heap? 3%
5. Array  $a[]$  contains eight integers as shown below: (Note that  $a[0]$  is not used.) We use Heapsort to sort the file.

|        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|
| 30     | 19     | 73     | 12     | 69     | 23     | 64     | 31     |
| $a[1]$ | $a[2]$ | $a[3]$ | $a[4]$ | $a[5]$ | $a[6]$ | $a[7]$ | $a[8]$ |

Show the array  $a[]$  after the complete max heap is constructed, i.e. after phase 1 of Heapsort is done.

9%



## 國立臺灣科技大學

## 八十九學年度碩士班招生考試試題

系所組別：電機工程系丙組、資訊工程研究所

科目：資料結構

P. 3/2

6. What are the minimum and the maximum numbers of nodes in a binary tree with height =  $h$ , where  $h \geq 1$ . 10%

7. Which of the following operations is/are not relevant to the abstract data type "Stack", and why? 20%

- InsertTop (A,S) – Add element A to the top of stack S.
- Pop(S) – Remove S[1], where S is an array of dimension 100.
- Delete(S,i) – Remove the  $i$ th element from stack S.
- CheckTop(S) – Return the top element of Stack S.

8. The preorder list and the postorder list of a binary tree are **cfadbeg** and **adfgebc**, respectively. How many proper descendants does c have? 20%

