

國立高雄應用科技大學
106 學年度研究所碩士班招生考試
資訊工程系碩士班
資料結構

試題 共 3 頁，第 1 頁

- 注意：a. 本試題共 10 題，共 100 分
b. 作答時不必抄題
c. 考生作答前請詳閱答案卷之考生注意事項
d. 中英作答皆可

1. (10%)

- (i) Convert the following expression into postfix form (no detail needed).

$$3/(1+2) \times 5 - 8/4$$

- (ii) Then use a stack to evaluate your postfix form (detail needed).

2. (5%) Draw the binary tree whose pre-order sequence is ABDCEGJKFHIL and whose in-order sequence is DBAGKJECHFIL.

3. (10%) Modify the following non-recursive code to a recursive function. Hint: the for-loop calculates the largest integer that can exactly divide both n_1 and n_2 without a remainder. Assume $n_1 \geq n_2$.

```
for (i = 1; i <= n1 && i <= n2; i++) {  
    if (n1 % i == 0 && n2 % i == 0)  
        gcd = i;  
}
```

4. (10%) Show whether the following equalities are correct (Yes or no, with brief explanation):

(i) $7n^2 - 8n = \Theta(n^2)$

(ii) $5n^2 + 1000 = O(n)$

(iii) $\sum_{i=1}^n i^2 = \Theta(n^2)$

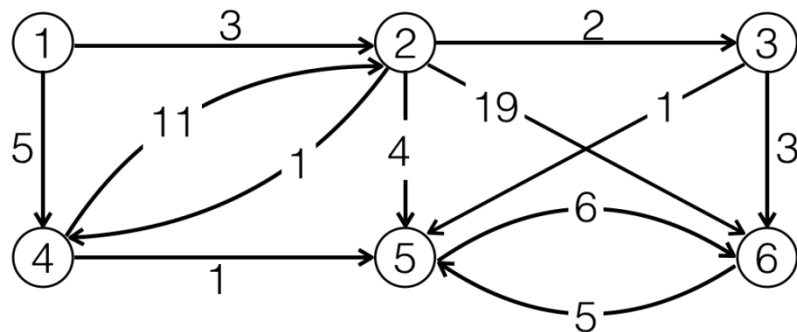
(iv) $10n^3 + 2n^2 = \Omega(n^2)$

5. (10%) A hash table has 11 buckets. Given the following numbers as keys: 2, 10, 34, 83, 54, 7, 61, 42, 76, 19, 59 and a hashing function $h(k) = k \bmod 11$.

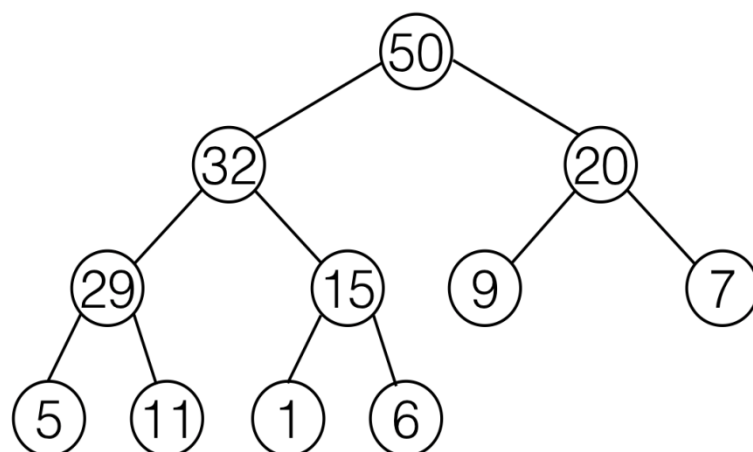
- (i) Use linear probing to handle the overflow (draw the hash table).
- (ii) Use chaining to handle the overflow (draw the hash table).

6. (10%) Construct an AVL tree for the list {6, 7, 9, 4, 3, 5, 8} (detail needed).

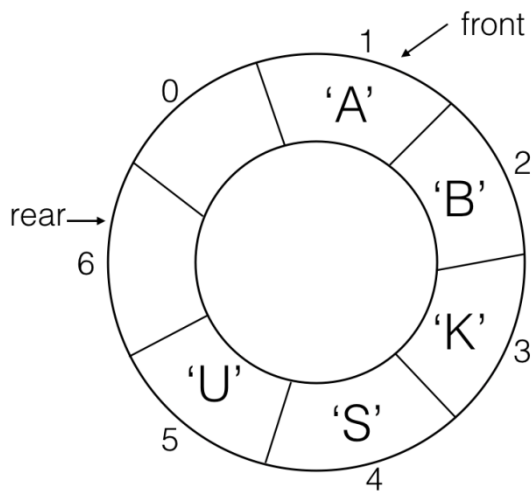
7. (10%) Use the Dijkstra's algorithm to find all the shortest paths with node 1 being the source (detail needed).



8. (5%) Pop (delete) the max from the following max-heap and draw the resulting tree (detail needed).



9. (15%) Assume the current content of a circular queue is as in the following figure. The rear always indicates an empty slot (i.e., only 6 slots are used).



```
void addq (char item) {
    queue[rear] = item;
    rear =(rear+1) % 7;
}

char deleteq( ) {
    value = queue[front]
    front =(front+1) % 7;
    return value;
}
```

- (i) Show how to check whether the queue is full.
- (ii) Show how to check whether the queue is empty.
- (iii) If we want to use all 7 slots, what do we need to do?

10. (15%) In the following directed graph, starts with node A, find

- (i) an order that satisfies bfs order but not topological order
- (ii) an order that satisfies topological order but not bfs order
- (iii) an order that satisfies both bfs order and topological order

