

國立高雄大學九十五學年度轉學招生考試試題

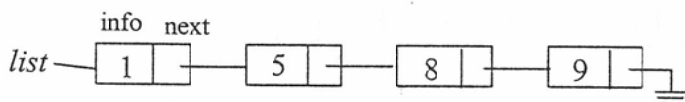
科目：資料結構
 考試時間：90 分鐘

系所：資訊工程學系三年級
 本科原始成績：滿分 100 分

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 否
 使用計算機

- Consider the integer sequence: 1 2 3 4
 - Explain how to permute this sequence into 2 3 1 4 with a stack and its operations, **push** and **pop**. (5%)
 - What permutations of 1 2 3 4 can not be obtained using the above method? (5%)
 - For a general integer sequence: 1 2 3 ... n , how many possible permutations can be obtained using the method in (1)? (5%)

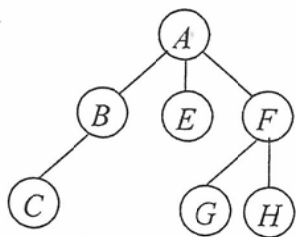
- Consider the following linked list.



- Write the steps to insert an element 2 after the node that pointed by *list*. (5%)
 - Write the steps to reverse the list. (10%)
- Draw the expression trees for the following expressions, and show the result of traversing the tree in (a) preorder, (b) inorder, and (c) postorder. (15%)

$$(\log x!) + (\log y) * (m \% n)$$

- Can a ternary tree be represented in a one-dimensional array? If not, explain why; if yes, illustrate the corresponding array for the following ternary tree, and show the method for accessing the parent and children of each node. (15%)



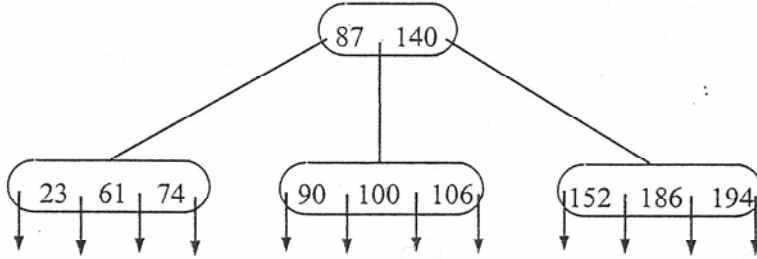
- Complete the following summary table for comparing various sorting methods. (15%)

Sorting method	Worst case time	Average case time	Extra space
Binary tree sort			
Bubble sort	$O(n^2)$	$O(n^2)$	$O(1)$
Heapsort			
Insertion sort			
Merge sort			
Quick sort			

6. Consider the following B-tree of order 4 (10%)

1) What is the resulting B-tree after inserting an element with key 102?

2) What is the resulting B-tree if continue inserting an element with key 196?



7. Consider a sequence of keys to be inserted in the order 14, 29, 34, 28, 42, 39, 84, 38. Answer the following questions related to hash (15%)

1) If the hash function is $h(key) = key \% 10$ and standard coalesced hashing (hash with chaining) is used when hash collision occurs, what is the resulting table? (Assume the table contains two fields, key and $next$, and the available empty position is search from 0)

2) If the hash function is $h(key) = key \% 10$ and quadratic rehash is used when hash collision occurs, i.e., the rehash function is

$$rh(key, j) = rh(h(key) + j^2) \% 10,$$

where j denotes the j -th collision, what is the resulting table?

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使用計算機

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 否

1. There are four kinds of different color balls in a bag, ten green, ten red, ten blue, and ten white. How many different selections do we have when ten balls are drawn from the bag? (7 points)
2. A coin is tossed 15 times yielding 10 heads and 5 tails. In how many ways could this have happened so that there were no consecutive tails? (7 points)
3. Let p, q, r denote primitive statements. Write the contrapositive, converse, and inverse of $p \rightarrow \neg q \wedge r$ (7 points)
4. Let $A = \{1, 2, 3, \dots, 10\}$. How many subsets of A contain exactly three odd integers? (7 points)
5. For $n \in \mathbb{Z}^+$, prove that $6 \mid (n^3 + 11n)$. (7 points)
6. Let $A = \{1, 3, 5, 7, 9, 11, 13, 15\}$. If five numbers are selected from A , prove that two of them must have the sum 16. (7 points)
7. How many subsets $A = \{a, b, c, d\} \subseteq \mathbb{Z}^+$, where $a, b, c, d > 1$, satisfy the property $a \times b \times c \times d = 2 \times 3 \times 5 \times 7 \times 11 \times 13 \times 17$? (7 points)
8. Let $A = \{1, 2, 3, 4, 5\} \times \{1, 2, 3, 4, 5\}$. Define R on A by $(x_1, y_1) R (x_2, y_2)$, if $x_1 + y_1 = x_2 + y_2$. Verify that R is an equivalence relation on A . (7 points)
9. Determine how many $n \in \mathbb{Z}^+$ satisfy $n \leq 100$ and are not divisible by 2, 3, 5, or 6. (7 points)
10. Find the coefficient of x^{33} in $f(x) = (1 + x^3 + x^6 + x^9 + x^{12})^8$. (7 points)
11. How many 5-digit telephone numbers use only the digits 1, 2, 3, and 4, with each digit appearing at least twice or not at all? (7 points)
12. Solve the recurrence relation: $a_{n+1} - a_n = 3n^2 + 5n + 3$, $n \geq 0$, $a_0 = 3$. (7 points)
13. If $G = (V, E)$ is a connected graph with $|E| = 11$ and $\deg(v) \geq 3$ for all $v \in V$, what is the maximum value for $|V|$? (7 points)
14. a) Determine the chromatic polynomials for the following graph. (5 points)
b) If five colors are available, in how many ways can the vertices be properly colored? (4 points)

