

國立高雄大學九十七學年度轉學招生考試試題

科目：資料結構
 考試時間：80 分鐘

系所：
 資訊工程學系轉三年級
 本科原始成績：100 分

是否使用計算機：否

1. (10%) Determine the frequency counts for all statements in the following program segments.

```

1. i=1;
2. while (i<=n) {
3.     x++;
4.     i++; }
    
```

2. (10%) In the following, we list a matrix multiplication function which computes the matrix $C = A \times B$. Please show the statements (a) and (b).

```

void mult (int A[][max_size], int B[][max_size], int C[][max_size])
{
    int i, j, k;
    for (i=0; i<max_size; i++)
        for (j=0; j< max_size; j++) {
            C[i][j]=0;
            (a) → for (k=0; _____)
            (b) → _____
        }
}
    
```

3. (10%) Given a string $s = \text{baabaabb?}$ and a pattern $\text{pat} = \text{abb?}$ let try to match pattern pat in the string s by using Knuth-Morris-Pratt Algorithm.

Definition: If $p = p_0p_1 \dots p_{n-1}$ is a pattern, then its failure function, f , is defined as

$$f(j) = \begin{cases} \text{largest } k < j \text{ such that } p_0p_1 \dots p_k = p_{j-k}p_{j-k+1} \dots p_j & \text{if such a } k \geq 0 \text{ exists} \\ -1 & \text{otherwise.} \end{cases}$$

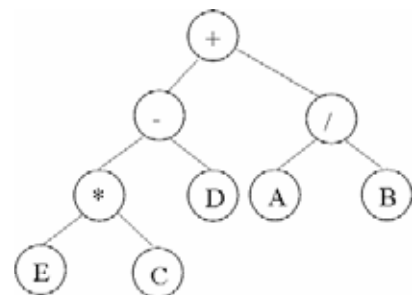
4. (10%) Given a sparse 3? matrix $A = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 \\ 0 & 0 & 0 & 0 \end{bmatrix}$, please use a link list to represent the

matrix A.

5. (10%)

Given the tree in the right figure,

find its (a) postorder traversal (b) level order traversal



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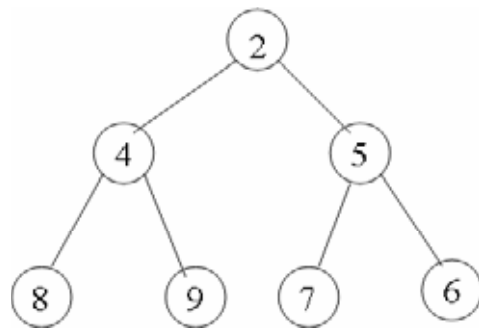
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6. (10%) Find the binary tree which has
inorder sequence: 513968427
preorder sequence: 615934872

7. (10%) Use the following program to find the traversal of the following tree. (only show the output)

```
typedef struct node *tree_pointer;
typedef struct node {
    int data;
    tree_pointer left_child, right_child;
};
void order (tree_pointer ptr)
{
    If (ptr) {
        If (ptr-> data % 2 == 0) {
            order(ptr-> right_child); order(ptr-> left_child);}
        else { order(ptr-> left_child); order(ptr-> right_child);}
        printf("%d\n", ptr->data);
    }
}
```



- 8.(10%) Read a serial of numbers of 9, 6, 5, 2, 10, 7, 8, 3, 4 and 1 in sequence to find:

- (a) max heap tree
- (b) binary search tree

9. (20%)

- (a) Please write a quick-sort program (or algorithm) to sort the array A[1:n].
- (b) Show and explain the time complexities of the quick-sort program in the best case, the average case, and the worst case.
- (c) Apply the quick-sort program to sort A[1:8]=(26, 5, 37, 1, 61, 11, 59, 15) in nondecreasing order. Show the action step by step and identify the number of required comparisons.

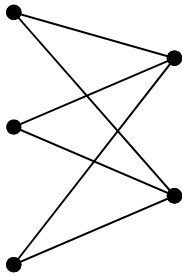
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科目：離散數學
考試時間：80 分鐘

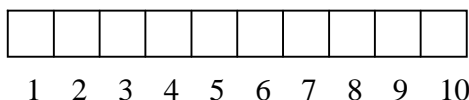
系所：
資訊工程學系轉三年級
本科原始成績：100 分

是否使用計算機：否

1. (a) (3%) What is a Hamilton cycle?
- (b) (4%) Is there a Hamilton cycle in the following graph? If your answer is yes, show it; otherwise, prove there is no Hamilton cycle.
- (c) (3%) What is an Euler trail?
- (d) (4%) Is there an Euler trail in the following graph? If your answer is yes, show it; otherwise, prove there is no Euler trail.
- (e) (3%) Is the following graph planar? If your answer is yes, show it; otherwise, prove it is nonplanar.
- (f) (3%) What is the chromatic number of the following graph? Explain your answer.
- (g) (5%) If five different colors are used to color the vertices such that adjacent vertices have different colors, how many different ways can we color the vertices?



2. (a) (5%) Let R be a partial order on a finite set S . Prove that S has a minimal element with respect to R .
 - (b) (5%) Let R be a total order on a finite set S . Prove that S has a minimal element with respect to R , and the minimal element is unique.
3. (6%) Let n be an odd positive integer. Prove that 12 divides $n^3 + 11n$.
4. There are 5 married couples (husband and wife) to be seated in a row as shown in the following graph.



- (a) (4%) In how many ways can they be seated?
- (b) (4%) If no man be seated beside another man, in how many ways can they be seated?
- (c) (5%) If each couple must be seated together, in how many ways can they be seated?

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- (d) (5%) If no couple is seated together, in how many ways can they be seated?
- (e) (5%) If exactly two men are seated beside their wives, in how many ways can they be seated?
5. (8%) If the 26 letters, A, B, ..., Z are written in a circular array, prove that there must be 5 consecutive consonants.
6. There are ten different presents.
- (a) (4%) If these presents are assigned to 4 people such that each person has at least one present, in how many ways can these 10 presents be assigned?
- (b) (4%) If these presents are packed into 4 same boxes such that each box contains at least one present, in how many ways can these 10 presents be packed?
7. (a) (5%) Write a recurrence relation and initial conditions for the number of ways to group $2n$ people into pairs.
- (b) (5%) Find a formula for (a).
8. (5%) Let a_r be the number of ways of spending r dollars buying balls, if 5 identical black balls (1 dollar each) and 4 identical red balls (3 dollars each) are available. Find the generating function for the sequence $\{a_r\}$.
9. (5%) Determine if the following statement is tautology.
 $(p \rightarrow q) \rightarrow [(p \vee q) \rightarrow q]$