

# 國立彰化師範大學109學年度碩士班招生考試試題

系所： 統計資訊研究所(選考丁)

科目： 資料結構

☆☆請在答案紙上作答☆☆

共 5 頁，第 1 頁

一、寫出下列程式碼的執行結果(共 5 題，每題 10 分)

1.

```
#include<stdio.h>
int getMax(int [], int);
void countSort(int [], int, int);
void radixsort(int [], int);
int main(){
    int arr[] = {170, 45, 75, 90, 802, 24, 2, 66}, n, i;
    n = sizeof(arr) / sizeof(arr[0]);
    radixsort(arr, n);
    return 0;
}
int getMax(int arr[], int n){
    int mx = arr[0], i;
    for (i = 1; i < n; i++)
        if (arr[i] > mx)
            mx = arr[i];
    return mx;
}
void countSort(int arr[], int n, int exp){
    int output[n], i, count[10] = {0};
    for (i = 0; i < n; i++)
        count[(arr[i] / exp) % 10]++;
    for (i = 1; i < 10; i++)
        count[i] += count[i - 1];
    for (i = n - 1; i >= 0; i--){
        output[count[(arr[i] / exp) % 10] - 1] = arr[i];
        count[(arr[i] / exp) % 10]--;
    }
    for (i = 0; i < n; i++)
        arr[i] = output[i];
    for (i = 0; i < n; i++)
        printf("%4d", arr[i]);
    printf("\n");
}
void radixsort(int arr[], int n){
    int m = getMax(arr, n), exp;
    for (exp = 1; m / exp > 0; exp *= 10)
        countSort(arr, n, exp);
}
```

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共 5 頁，第 2 頁

2.

```
#include <stdio.h>
void main(){
    int mn = 1, mx = 10, n, i, sum;
    for (n = mn; n <= mx; n++){
        i = 1;
        sum = 0;
        while (i < n){
            if (n % i == 0)
                sum = sum + i;
            i++;
        }
        if (sum == n)
            printf("%d ", n);
    }
    printf("\n");
}
```

3.

```
#include<stdio.h>
#include<string.h>
int LCSuff(char *, char *, int, int);
int main(){
    char X[] = "ABABCACCCBBAC", Y[] = "BCBCAABCCBA";
    int m = strlen(X), n = strlen(Y);
    printf("%d\n", LCSuff(X, Y, m, n));
    return 0;
}

int LCSuff(char *X, char *Y, int m, int n){
    int LCSuff[m + 1][n + 1], result = 0, i, j;
    for (i = 0; i <= m; i++){
        for (j = 0; j <= n; j++){
            if (i == 0 || j == 0)
                LCSuff[i][j] = 0;
            else if (X[i - 1] == Y[j - 1]){
                LCSuff[i][j] = LCSuff[i - 1][j - 1] + 1;
                if (result >= LCSuff[i][j])
                    result = result;
            }
            else
                result = LCSuff[i][j];
        }
    }
    return result;
}
```

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共 5 頁，第 3 頁

4.

```
#include<stdio.h>
#include<math.h>
int sequence[] = {1, 2, 3};
void grayCode(int);
int main() {
    grayCode(3);
    return 0;
}
void grayCode(int N) {
    int i, j, b, grayCode[(int) pow(2, N)], binary[(int) pow(2, N)];
    for (i = 0; i < pow(2, N); i++)
        grayCode[i] = (i >> 1) ^ i;
    for (i = 0; i < pow(2, N); i++) {
        b = 1;
        binary[i] = 0;
        while (grayCode[i] > 0) {
            binary[i] += (grayCode[i] % 2) * b;
            grayCode[i] /= 2;
            b = b * 10;
        }
    }
    for (i = 0; i < pow(2, N); i++) {
        printf("{ ");
        for (j = 0; j < N; j++) {
            if (binary[i] % 10 == 1)
                printf("%d ", sequence[j]);
            binary[i] /= 10;
        }
        printf("}\n");
    }
}
```

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共 5 頁，第 4 頁

5.

```
#include <stdio.h>
int gcd(int, int);
int main(){
    int a = 66, b = 98;
    printf("%2d\n", gcd(a, b));
    return 0;
}
int gcd(int a, int b){
    printf("%2d %2d\n", a, b);
    if (a == 0)
        return b;
    if (b == 0)
        return a;
    if (a == b)
        return a;
    if (a > b)
        return gcd(a % b, b);
    return gcd(a, b % a);
}
```

二、 Please write the code (in C or C++) to create a one-dimensional array dynamically to store  $N$  integers. (5%)

三、 Given the input list (18, 35, 7, 26, 12), please

(a) Construct the max heap tree of this list. (5%)

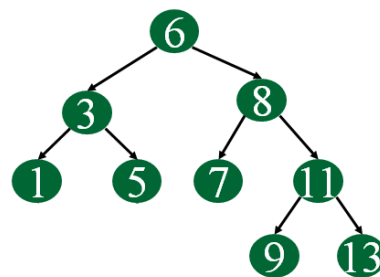
(b) Show the detail steps of heap sort by using the heap tree in (a). (5%)

(c) Briefly analyze the time complexity of heap sort, suppose that there are  $N$  numbers in a list. (5%)

四、

(a) Please briefly explain what is a threaded binary tree? (5%)

(b) Please draw the threaded binary tree of the following binary tree. (5%)



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五、Given the following graph, please write its

- (a) Adjacency matrix. (5%)
- (b) One-dimension array representation. (5%)
- (c) Obtain a minimum spanning tree with Kruskal's algorithm. (5%)
- (d) What kinds of data structure are appropriate to maintain the edges for Kruskal's algorithm? (5%)

