

國立中正大學
110 學年度碩士班招生考試
試題

[第 3 節]

科目名稱	計算機概論(含程式設計)
系所組別	資訊工程學系-乙組

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

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科目名稱：計算機概論(含程式設計)

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系所組別：資訊工程學系-乙組

- (10%) Carefully examine the following sentences and give your answer, true (T) or false (F), for each sentence. Two points are given for each correct answer, whereas **three points are deducted** for each incorrect answer. Therefore, please **do not guess at the answer** if you are unsure since **the expected value is negative**. Note that the deduction for incorrect responses only affects the 10 points of this question.
 - Data movement is not required for inserting a node to a linked list.
 - The maximum number of nodes in a binary tree of depth 10 is 1023.
 - Every binary tree can be uniquely defined by its pre-order and post-order sequences.
 - A bi-connected graph is a connected graph that has two articulation points.
 - Design patterns are formalized to make changes propagate throughout the code.
- (5%) The Fibonacci numbers are defined as: $f_0 = 1$, $f_1 = 1$, and $f_i = f_{i-1} + f_{i-2}$ for $i \geq 2$. Please fill in the blanks (a), (b), (c), (d), (e) of the both recursive and iterative C functions below. Note that you are not allowed to create new variables in the blanks.

```
unsigned int recursive_fib(unsigned int i) {  
    if ( ____ (a) ____ ) return i;  
    return ____ (b) ____;  
}
```

```
unsigned int iterative_fib(unsigned int i) {  
    unsigned int fib, fib1, fib2, count;  
    if ( ____ (a) ____ ) return i;  
    fib1 = 0;  
    fib2 = 1;  
    ____ (c) ____;  
    for (count = 3; count <= i; count ++ ) {  
        ____ (d) ____;  
        ____ (e) ____;  
        ____ (c) ____;  
    }  
    return fib;  
}
```

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系所組別：資訊工程學系-乙組

3. (10%) Given the following numbers: 75, 51, 80, 64, 10, 41, 92, 8, please answer the following questions.

(a) (7%) Please sort these numbers in increasing order with the following quicksort function, where the swap function is used to swap two numbers. Note that the first number in each sublist is always selected as the pivot, and you must show necessary steps such that the use of the quicksort function can be recognized.

(b) (3%) Assume that the numbers are input sequentially. Please construct a binary search tree without rotations.

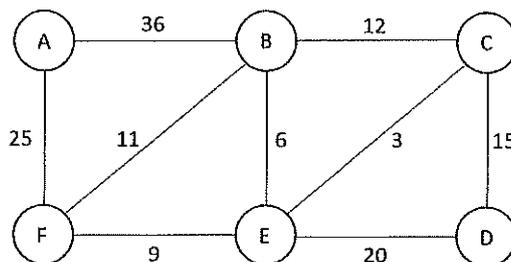
```
void quicksort(int a[], int left, int right)
{
    int pivot, i, j;
    if (left < right) {
        i = left;
        j = right+1;
        pivot = a[left];
        do {
            do i++; while (a[i] < pivot);
            do j--; while (a[j] > pivot);
            if (i < j) swap(&a[i], &a[j]);
        } while (i < j);
        swap(&a[left], &a[j]);
        quicksort (a, left, j-1);
        quicksort (a, j+1, right);
    }
}
```

4. (25%) Consider the following undirected graph. Please answer the following questions.

(a) (5%) Please write down the sequences of edges selected by Kruskal's algorithm.

(b) (5%) Please write down the sequences of edges selected by Prim's algorithm (start from vertex A).

(c) (15%) Let G denote a given undirected graph with positive edge weights such as the following graph. Please prove that if each edge in G has a *distinct* weight, then there will be only one *unique* minimum cost spanning tree in G by contradiction.



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系所組別：資訊工程學系-乙組

5. (12%)
- (a) (3%) What is 2021_8 (Octal) in base 10?
 - (b) (3%) What is 1100010101000011_2 (Binary) in base 16?
 - (c) (6%) Use 8-bit two's complement binary representation to represent 123_{10} (Decimal) and -113_{10} (Decimal).
6. (8%) Explain the following terms.
- (a) (4%) Task-level parallelism
 - (b) (4%) Data-level parallelism
7. (10%)
- (a) (5%) What is SIMD instruction?
 - (b) (5%) For programming, please describe three approaches that can leverage SIMD instructions.
8. (8%) Python is a popular programming language. Basically, it is executed by using an interpreter.
- (a) (4%) Please explain the execution flow that an interpreter executes a program.
 - (b) (4%) What are the differences between interpreters and compilers.
9. (12%) Assume that the following program is executed on a little-endian machine. Write down the output of the following C program.

```
#include <stdio.h>
#include <stdlib.h>

int main(void)
{
    int *ptr;
    char *ptrc;
    short *ptrs;

    ptr = (int*) malloc(sizeof(int)*4);
    *ptr = 0x123;
    ptr[1] = 0x7F;
    *(ptr+2) = 20;
    ptrc = (char*) ptr;
    ptrs = (short*) ptrc;

    printf("%d\n", ptrc[1]);
    printf("%d\n", ptr[0]);
    printf("%d\n", *(ptrc+4));
    printf("%d\n", ptr[2]/6);
    printf("%d\n", ptrc[8]%6);
    printf("%d\n", ptrs[0]);
    free(ptr);
    return 0;
}
```

