

## 國立臺灣科技大學 108 年度產業碩士專班招生(秋)試題

班 別：AI 跨域應用  
科 目：物件導向程式設計

(總分為 100 分)

不得使用計算器

1. (5%) Given the following functions and variables from the `ctime` library

```
#include <ctime>
```

- A. `clock_t` is a clock type and alias of a fundamental arithmetic type which is capable of representing *clock tick* counts. It is equivalent to `long`.
- B. `CLOCKS_PER_SEC` is a macro expanding to an expression representing the number of *clock ticks* per second.
- C. `clock_t clock (void);` This returns the number of clock ticks elapsed since an epoch related to the particular program execution. While being on failure, the function returns a value of -1.

Please finish the following program to print out "Hello, how are you today" every second, and to print out "Hello, you look happy" every two seconds. (Suppose the program runs for an infinitely)

```
#include <iostream>
#include <ctime>
int main(int argc, char** argv)
{
...
}
```

Ans:

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2. (10%) Give two input matrices, A and B, and one output matrix and their corresponding sizes of NAX, NAY, NBX, NBY, NCX, and NCY (NAX: rows of matrix a, NAY: cols of matrix a, etc...). Please implement the following matrix multiplication code and return true if the multiplication success and false if the multiplication cannot be done.

```
bool Multiplication (double **A, double **B, double **C,  
int NAX, int NAY, int NBX, int NBY, int NCX, int NCY){  
...  
}
```

Ans:

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3. (10%) Numerically,  $\pi$  can be implemented with the following manner:

$$\pi = 4 * (1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \frac{1}{13} \dots)$$

$$\text{Level 1} = 4, \text{Level 2} = 4 * \left(1 - \frac{1}{3}\right), \text{Level 3} = 4 * \left(1 - \frac{1}{3} + \frac{1}{5}\right), \text{etc ...}$$

Please finish the following function using the recursive mechanism

```
double PI(int level){
```

```
...
```

```
}
```

Ans:

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4. (10%) Please write down the output of the following program.

```
#include <iostream>
using namespace std;
class Foo1 {
public:
    void show() {
        cout << "Foo1's show" << endl;
    }
};
class Foo2 : public Foo1 {
public:
    void show() {
        cout << "Foo2's show" << endl;
    }
};
void showFooByPtr(Foo1 *foo) {
    foo->show();
}
void showFooByRef(Foo1 &foo) {
    foo.show();
}
int main() {
    Foo1 f1;
    Foo2 f2;
    showFooByPtr(&f1);
    showFooByPtr(&f2);
    cout << endl;
    showFooByRef(f1);
    showFooByRef(f2);
    cout << endl;
    f1.show();
    f2.show();
    return 0;
}
```

Ans:

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5. The following shows a program

```
#include <iostream>
using namespace std;
class Foo1 {
public:
    int value = 0;
    Foo1(int value){
        value = value;
    }
    virtual void show() {
        cout << value << endl;
    }
};

int main() {
    Foo1 ff(20);
    ff.show();
    return 0;
}
```

a. (3%) Please write out the output of the program.

Ans:

b. (3%) Actually, the programmer wants ff.value to be initialized as 20. According to the output, whether its value is 20?

Ans:

c. (4%) If the answer to b is no, what is the problem and how do we modify it?

Ans:

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6. (10%) Please finish the following program to put all prime numbers in the range of 1 to N in the front of the array of A and return the total number of prime numbers in this range.

```
int FindPrimeNumbers(int** A, int N)
{
...
}
```

Ans:

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7.

a. (5%) Please simply describe the definition of call-by-value and call-by-reference.

Ans:

b. (5%) One of the applications for call-by-reference lies in memory management to have a function to allocate the memory to instance a class object. Please define and declare the function of CreateFoo() which allocates and creates an instance of Foo, passes back to the programmer using the pass-in parameter, and return true for successful operation and false while failing. So that the following code can work properly.

```
#include <iostream>
using namespace std;
class Foo {
public:
    int value = 20;
    void show() {
        cout << value << endl;
    }
};
/*( Definition and declaration of CreateFoo() )*/
int main()
{
    Foo f;
    CreateFoo(&f);
    f->show();
    Return 0;
}
```

Ans:

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8. Stacks are commonly used in programming.

a. (5%) Please simply describe the characteristics of a stack and give an example of its usage in various functions and programs.

Ans:

b. (10%) Please implement the `push()` and `pop()` function in the following class.

```
class IStack{
private:
    int* container = NULL;
    int size = 0;
    int head = 0;
public:
    IStack(void){
        container = new int [10];
        size = 10;
        head = 0;
    }
    ~IStack(void){
        if(container) delete [] container;
        size = 0;
        head = 0;
    }
    void push(int A){

    }
    int pop(void){

    }
};
```

Ans:



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9. (10%)The following program is a zoo-related class definition. Please draw a class diagram of the program.

```
#include <iostream>
#include <string>
using namespace std;
class Hasleg {
    int LegNumber;
    int OutPutLegNumber();
};
class CanSwim {
    float swimmingSpeed;
    void swim();
};
class Animal {
    string name;
    bool alive;
};
class Mammal : public Animal{
    void Lactation(Mammal child);
};
class Dog :public Mammal , Hasleg {
    void Bark();
};
class Dolphin : public Animal , CanSwim {
    void DoTrick();
};
class Zoo {
public:
    string name;
    Animal* animals;
    int AnimalNumber;
    void AddAnimal(Animal animal);
};
```

Ans:

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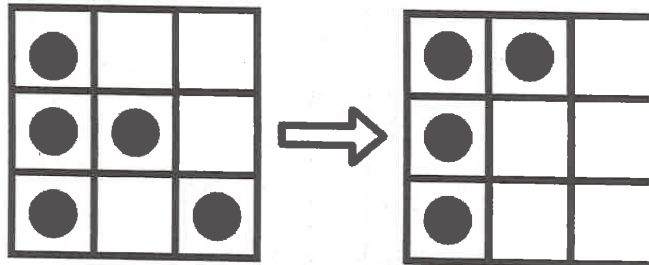
(總分為 100 分)

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10. (10%) “Game of Life” is a data simulation program. There are only two possible values, **true** and **false**. Additionally, there are a 2D array to record the current state of the system. The value of each element for the next state depends on its values and the value of its 8-th neighboring elements in the current state as follows.

Rules:

- Any true element with fewer than two true neighboring elements changes to false in the next state.
- Any true element with two or three true neighboring elements stays true in the next state
- Any true element with more than three true neighboring elements becomes false in the next state.
- Any false element with exactly three true neighboring elements becomes true in the next state.



The present state and next state in 3 x 3 space

Please write a “Game of Life” program, which can specify the length and width of the 2D array by the user. The initial state of the 2D array element needs to be randomly assigned. Output the result after 10 step;

Ans: