國立臺北科技大學 109 學年度碩士班招生考試

系所組別：2300 資訊工程系碩士班

第二節　程式設計　試題

注意事項：

1. 本試題共六題，共 100 分。

2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。

3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

Problem 1 [14%, each 2%]

Please trace the following C program and answer the output of each printf() statement for problems 1-1~1-7.

```c
#include <stdio.h>
#include <string.h>

typedef enum {apple, banana, orange, pineapple, mango} fruit;

int f1(int a, int b) {
    if ((a == b) || (a > b))
        return a&b;
    else if ((a != b) && (a < b))
        return a^b;
    else
        return a|b;
}

int f2() {
    int x[] = {1, 2, 3};
    int n, a=0;
    n = sizeof(x)/sizeof(x[0]);
    for (int i=0; i<n; i++)
        for (int j=0; j<n; j++)
            a += x[i]*x[j];
    return a;
}

fruit f3() {
    return (banana+pineapple)/2 > orange? apple : mango;
}

int f4(int m, int n) {
    if (n == 0)
        return m;
    else
        return f4(n, m%n);
}
int f5(int num) {
    int sum=0;
```

```c
    for (int i=num; i>1; i--) {
        if (i%2 == 0)
            continue;
        sum += i;
    }
    return sum;
}

float f6(float x) {
    float y=10.02;
    do {
        y -= x;
        x--;
    } while(x>1.0);
    return y;
}

int f7(char* s) {
    int t=0;
    for (int i=0; i<strlen(s); i++) {
        switch (s[i]) {
            case 'a': t += 1;
            case 'n': t += 2;
                break;
            case 'g': t += 3;
                break;
            default: t += 1;
                break;
        }
    }
    return t;
}

int main(int argc, char *argv[]) {
    printf("%d\n", f1(3,2));        /*    Problem 1-1    */
    printf("%d\n", f2());           /*    Problem 1-2    */
    printf("%d\n", f3());           /*    Problem 1-3    */
    printf("%d\n", f4(18, 24));     /*    Problem 1-4    */
    printf("%d\n", f5(5));          /*    Problem 1-5    */
    printf("%3.1f\n", f6(3.5));     /*    Problem 1-6    */
    printf("%d\n", f7("language")); /*    Problem 1-7    */
    return 0;
}
```

Problem	Answer
1-1	
1-2	
1-3	
1-4	
1-5	
1-6	
1-7	

Please copy the above answer table to your answer sheet.

注意：背面尚有試題

Problem 2 [21%, each 3%]

Please trace the following C program, fill the blanks **2-1~2-5** with correct answers, and give the output of each printf() statement for problems **2-6~2-7**.

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

#define  NUM_OF_STUDENT 5

typedef struct {
    char id[10];
    int score;
} STUDENT;

void copy_string(char *target, char *source) {
    while (*source) {
        *target = _Problem 2-1_;
        source++;
        target++;
    }
    *target = '\0';
}

void sawp1(STUDENT s1, STUDENT s2) {
    STUDENT temp;
    temp = s1;
    s1 = s2;
    s2 = temp;
}

void sawp2(STUDENT *s1, STUDENT *s2) {
    STUDENT temp;
    temp = *s1;
    *s1 = *s2;
    *s2 = temp;
}

void foo(STUDENT *students) {
    for (int i=0; i<NUM_OF_STUDENT; i++)
      for (int j=i+1; j <NUM_OF_STUDENT; j++)
        if (students[i].score > students[j].score)
            sawp1(_____Problem 2-2_____);
}

void bar(STUDENT *students) {
    for (int i=0; i<NUM_OF_STUDENT; i++)
      for (int j=i+1; j <NUM_OF_STUDENT; j++)
        if (students[i].score < students[j].score)
            sawp2(_____Problem 2-3_____);
}

int main() {
    char *ids[NUM_OF_STUDENT]={"t001", "t002", "t003", "t004", "t005"};
    int scores[NUM_OF_STUDENT]={85, 70, 95, 60, 75};
    STUDENT *students;

    students = (STUDENT *) malloc(_Problem 2-4_ * sizeof(STUDENT));
```

```c
// initialize each student's id and score
for(int i=0;i<NUM_OF_STUDENT; i++) {
    copy_string(students[i].id, ids[i]);
    (_Problem 2-5_)->score = scores[i];
}

foo(students);
printf("%s\n", students[0].id);        /*    Problem 2-6    */
bar(students);
printf("%s\n", students[0].id);        /*    Problem 2-7    */
return 0;
}
```

Problem	Answer
2-1	
2-2	
2-3	
2-4	
2-5	
2-6	
2-7	

Please copy the above answer table to your answer sheet.

Problem 3 [30%, each 3%]

Please trace the following C++ program and answer the std::cout output of each statement for problems **3-1~3-10**.

```cpp
#include <iostream>
using namespace std;

class B {
  private:
    int a;
  public:
    void f();
    virtual void g();
    ~B();
    int get() {
      return a;
    }
    void set(int v) {
      a = v;
    }
};

B::~B() {
    cout << "66" << endl;
}

void B::f() {
    cout << "11" << endl;
}
```

```
void B::g() {
   cout << "22" << endl;
}

class D : public B {
   private:
      int b;
   public:
      void f();
      void g();
      ~D();
      D() {
         set(1);  b = 2;
      }
      int getA() {
         return get();
      }
      int getB() {
         return b;
      }
};

D::~D() {
   cout << "99" << endl;
}

void D::f() {
   cout << "33" << endl;
}

void D::g() {
   cout << "44" << endl;
}

void f(B& p) {
   p.f();
}

void g(B& p) {
   p.g();
}

int main() {
   B b;
   D d;
   b.f();            /* Problem 3-1 */
   d.f();            /* Problem 3-2 */
   f(d);             /* Problem 3-3 */
   g(d);             /* Problem 3-4 */

   B *b1, *b2;
   b1 = new B;
   b2 = new D;
   b1->f();          /* Problem 3-5 */
   b2->f();          /* Problem 3-6 */
   b1->g();          /* Problem 3-7 */
   b2->g();          /* Problem 3-8 */

   delete b1;        /* Problem 3-9 */
   delete b2;        /* Problem 3-10 */
}
```

背面尚有試題

Problem	Answer
3-1	
3-2	
3-3	
3-4	
3-5	
3-6	
3-7	
3-8	
3-9	
3-10	

Please copy the above answer table to your answer sheet

Problem 4 [5%, each 1%]

Please trace the following C++ program and fill the blanks with correct answers for problems **4-1~4-5**.

```
#include <iostream>
using namespace std;

class Figure {
   public:
      Figure(){}
      /* Problem 4-1 */ void draw(){}
};

class Line: public Figure {
   public:
      Line(){}
      void draw();
};

void Line::draw() {
   cout << "draw like a line..." << endl;
}

class Circle: public Figure {
   public:
      Circle(){}
      void draw();
};

void Circle::draw() {
   cout << "draw like a circle..." << endl;
}

int main() {
   Figure *p1 = /* Problem 4-2 */ Line();
   Figure *p2 = /* Problem 4-3 */ Circle();
   p1/* Problem 4-4 */draw(); // call Line::draw()
   p2/* Problem 4-5 */draw(); // call Circle::draw()
   return 0;
}
```

注意：背面尚有試題

Problem	Answer
4-1	
4-2	
4-3	
4-4	
4-5	

Please copy the above answer table to your answer sheet

Problem 5 [24%, each 3%]

Please trace the following C++ program, fill the blanks **5-1~5-2** with correct answers, and give the std::cout output of each statement for problems **5-3~5-8**.

```cpp
#include <iostream>
#include <string>
#include <cmath>

using namespace std;

class Base {
    protected:
        string value;
        int base;
    public:
        void set(string s, int b){
            value=s;
            base=b;
        };
        virtual void name (){
            cout<< "BaseName"<<endl;
        }
        virtual _____  /*Problem 5-1*/
        void app(){
            cout<<"APP"<<endl;
        }

};

class Binary: public Base {
    public:
        void name(){
            cout<<"Binary"<<endl;
        }
        int transferToDecimal(){
            int decimal=0, p=0;
            for (int i=value.size()-1; i>=0; i--){
                decimal+=(value[i]-'0')*pow(base,p);
                p++;
            }
            return decimal;
        }
};

class Octal: public Base {
    private:
        string value;
```

```cpp
        int base;
    public:
        void name(){cout<<"Octal"<<endl;}
        int transferToDecimal(){
            int decimal=0, p=0;
            for (int i=value.size()-1; i>=0; i--){
                decimal+= (value[i]-'0')*pow(base,p);
                p++;
            }
            return decimal;
        }
        Octal(){
            value="744";
            base=8;
        }
        void app(){
            cout<<"Unix Command"<<endl;
        }
};

class Hexadecimal: public Base {
    public:
        void name(){
            cout<<"Hexadecimal"<<endl;
        }
        int transferToDecimal(){
            int decimal=0, p=0;
            for (int i=value.size()-1; i>=0; i--){
                if(value[i]>='A' && value[i]<='E'){
                    decimal+=_____*pow(base,p);  /*Problem 5-2*/
                }else{
                    decimal+=(value[i]-'0')*pow(base,p);
                }
                p++;
            }
            return decimal;
        }
        void app(){
            cout<<"MAC Address"<<endl;
        }
};

int main(){
    Binary binary;
    Octal octal;
    Hexadecimal hexadecimal;
    Binary *ptr_base1 = &binary;
    Octal *ptr_base2 = &octal;
    Base *ptr_base3 = &hexadecimal;
    ptr_base1->set("0111101",2);
    cout<<ptr_base2->transferToDecimal()<<endl;  /*Problem 5-3*/
    ptr_base2->name();                           /*Problem 5-4*/
    ptr_base2->app();                            /*Problem 5-5*/
    ptr_base3->set("A9C",16);
    cout<<ptr_base3->transferToDecimal()<<endl;  /*Problem 5-6*/
    ptr_base3->name();                           /*Problem 5-7*/
    ptr_base3->app();                            /*Problem 5-8*/
}
```

Problem	Answer
5-1	
5-2	
5-3	
5-4	
5-5	
5-6	
5-7	
5-8	

Please copy the above answer table to your answer sheet.

Problem 6 [6%, each 1%]

Consider the following incomplete UML class diagram for Problem 5, please copy the diagram to your answer sheet and complete the class diagram. Please show the missing attributes and methods with proper visibilities in the classes and the missing inheritance relationships between the classes.
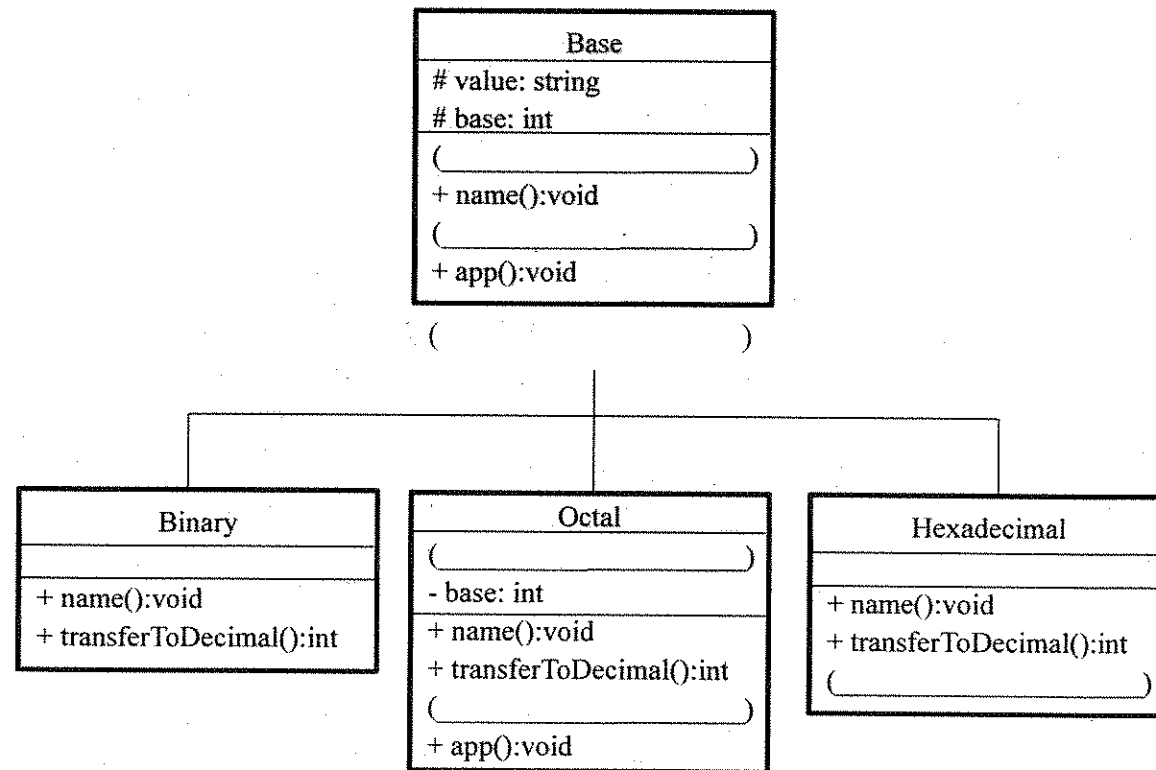
Please copy the above class diagram to your answer sheet.