CI02

國立臺北科技大學 108 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 [20%, each 2%]

Given the program below in C. Please trace the program and fill the **1-1~1-10** blanks with the printf output of each statement.

```
#include <stdio.h>
#include <string.h>
typedef enum {dog, cat, lion=4, tiger, monkey, hippo, giraffe} animal;

void f1(int a, int b){
   printf("%d\n",!a&&b);                    /*   Problem 1-1    */
   printf("%d\n",~a&b);                     /*   Problem 1-2    */
}

void f2() {
   animal a = cat + hippo;
   printf("%d\n", a);                       /*   Problem 1-3    */
}

void f3(int num) {
   int k;
   k = (num>1 ? (num <=10 ? 100 : 200): 300);
   printf("%d\n", ++k);                     /*   Problem 1-4    */
}

void f4(int num) {
   float f=1.0;
   for(int i=1; i<=num; i++)
      f *= i;
   printf("%.2f\n", f);                     /*   Problem 1-5    */
}

void f5(char *s1, char*s2) {
   char str1[80]="", str2[]="a";  int i=0;
   while(*(s1+i)<=*(s2+i) && strlen(str1)<80){
      i++;
      strncat(str1, str2, 1);
   }
   printf("%s\n", str1);                    /*   Problem 1-6    */
}
```

```
void f6(int x[], int size){
   int sum=0;
   for (int i=0; i<size; i++) {
      switch ((animal) x[i] + 3) {
         case dog: sum+=3;
            break;
         case cat: sum+=3;
            break;
         case lion: sum+=4;
         case tiger: sum+=4;
            break;
         default: sum+=1;
            break;
     }
   }
   printf("%d\n", sum);                     /*   Problem 1-7    */
}

void f7(int a[], int p1, int *p2) {
   a[0] = 5;
   p1= *p2+1;
   *p2 = 1;
}

int f8(int n) {
   if (n < 2)
      return n;
   return f8(n-1) + f8(n-2);
}

int main(int argc, char *argv[]) {
   int  a[]={1,2,3,4};
   char s[2][12]={"problem", "programmer"};

   f1(16,8);
   f2();
   f3(5);
   f4(5);
   f5(s[0], s[1]);
   f6(a, 4);
   f7(a, a[1], &a[2]);
   printf("%d\n", a[0]);                    /*   Problem 1-8    */
   printf("%d\n", a[1]);                    /*   Problem 1-9    */
   printf("%d\n", f8(6));                   /*   Problem 1-10   */
   return 0;
}
```

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

Please copy the above answer table to your answer sheet.

注意：背面尚有試題

Problem 2 [15%, each 3%]

Please trace the following C program and answer problems **2-1~2-5** with the correct statements.

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

typedef struct linkdata {
  _____________ *link;                              // Problem 2-1
    char name[10];
    int data[4][4];
} LinkData;

void f1(int d[][4]) {
   int k, c, r;
   int a[][3] ={{1,1,1},{2,2,2},{1,1,2}};
   int b[][3]={{1,2,3},{2,3,4},{3,4,5}};
   for (r=0; r<3; r++) {   // matrix multiplication
     for (c=0; c<3; c++) {
       _____________;                               // Problem 2-2
       for (k=0; k<3; k++)
          d[c][r] += a[c][k] *_____________;         // Problem 2-3
     }
   }
   printf("%d,%d,%d\n",d[0][0],d[0][1],d[0][2]);  // print out 6,9,12
}

void f2(LinkData **topp, char* s) {
    LinkData *x;
    x = (LinkData *)_____________________________;     // Problem 2-4
    strncpy(x->name,s,10);
    for(int i=0; i<4; i++)
       for(int j=0; j<4; j++)
          x->data[i][j] = i+j;
  _____________= (*topp);                           // Problem 2-5
    (*topp) = x;
}

int main() {
    char *array[]={"dog","lion","hippo","giraffe"};
    LinkData a, *top=NULL;

    f1(a.data);
    for(int i=0;i<4; i++)
       f2(&top, array[i]);
    printf("%s\n", top->link->name);              // print out hippo
    return 0;
}
```

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

Please copy the above answer table to your answer sheet.

Problem 3 [20%, each 2%]

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

```
#include <iostream>
using namespace std;
class Number {
  private:
    int a;
  public:
    Number():a(7){}
    int getA() {return a;}
    int get() {return a;}
    int* getAaddress() {return &a;}
    int setA(int v) {a = v;}
};

class Complex : public Number {
  private:
    int *b;
  public:
    Complex(){
       setA(4);
       b = new int(5);
    }
    Complex(int x, int y){
       setA(x);
       b = new int(y);
    }
    int *getB() {return b;}
    int get() {return b[0];}
    void setB() {b = getAaddress();}
    void setB(int v) {b[0] = v;}

    int getSum() {
      return getA() + *b;
    }

    Complex *foo() {
      return new Complex(6, 7);
    }

    void foo(Complex &c) {
      c = Complex(8, 9);
    }

    Complex foo(Complex *c1, Complex &c2)
    {
      return Complex(c1->getA() +
     c2.getA(),*c1->getB() + *c2.getB());
    }
};
```

```
int main() {
  Complex c1(1, 2);
  cout << c1.getSum() << endl;
  /* Problem 3-1 */

  Complex c2(3, 4);
  c2.setB();
  cout << c2.getSum() << endl;
  /* Problem 3-2 */

  Complex c3;
  cout << c3.getSum() << endl;
  /* Problem 3-3 */

  Complex *p;
  p = c3.foo();
  cout << p->getSum() << endl;
  /* Problem 3-4 */

  Complex c4;
  c3.foo(c4);
  cout << c4.getSum() << endl;
  /* Problem 3-5 */

  Complex c5;
  c5 = c5.foo(&c3, c4);
  cout << c5.getSum() << endl;
  /* Problem 3-6 */

  Number c6;
  c6.setA(5);
  cout << c6.get() << endl;
  /* Problem 3-7 */

  Complex c7;
  c7.setB(6);
  cout << c7.get() << endl;
  /* Problem 3-8 */

  Number *q = new Number();
  cout << q->get() << endl;
  /* Problem 3-9 */

  Number *r = new Complex(8, 9);
  cout << r->get() << endl;
  /* Problem 3-10 */

  return 0;
}
```

Problem	Answer	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 [15%, each 3%]

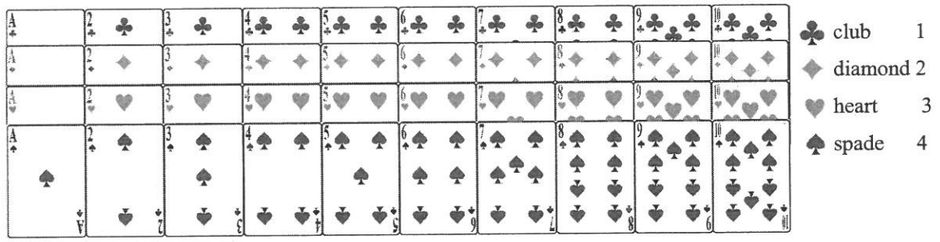
Please trace the following C++ program and answer problems **4-1~4-3** with the correct statements. Please answer the std::cout outputs of each statement from problems **4-4~4-5**.

```
#include <iostream>
using namespace std;
class N {
  public:
    N():np(new int[5]){}
    ________/* Problem 4-1 */ ~N(){
      ________/* Problem 4-2 */ np;
    }
  private:
    int *np;
};
class NChild : public N{
  public:
    NChild():N(),ncp(new int[1000]){
    }
    ~NChild(){
      ________/* Problem 4-3 */ ncp;
    }
  private:
    int * ncp;
};
class Fibonacci : public N {
  public:
    Fibonacci(int n) {
      p = new int[n];
      setFibonacci(n);
    }
    ~Fibonacci() {delete [] p;}
    int sumFibonacci(int n){
      int sum = 0;
      for (int i = 0; i < n; i++)
         sum += p[i];
      return sum;
    }
    void incrementFibonacc(int n) {
      for (int i = 0; i < n; i++)
         p[i] += n;
    }
  private:
    int *dp;
    int *p;

    void setFibonacci(int n) {
      if (n > 2){
        p[0] = 1;
        p[1] = 1;
        for (int i = 2; i < n; i++){
          p[i] = p[i - 1] + p[i - 2];
          //cout << p[i] << endl;
        }
      }
    }
};

int main() {

  for (int i = 0; i < 100; i++) {
    N *p = new NChild;
    delete p;
  }

  Fibonacci f(5);
  cout << f.sumFibonacci(5) << endl;
  /* Problem 4-4 */

  f.incrementFibonacc(2);
  cout << f.sumFibonacci(5) << endl;
  /* Problem 4-5 */

  return 0;
}
```

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

Please copy the above answer table to your answer sheet.

Problem 5 [21%, each 3%]



Consider a Poker game that has two players: "computer" and "human". Suppose that the Poker game uses 40 cards as shown in the above figure. Each card has a suit and a value. The codes for the card suits are: {spade: 4, heart: 3, diamond: 2, club: 1}. The score of one card (CS) is defined as ***CS = value*10 + the code of the card suit***. For example, the score of "spade A" is 1*10+4=14; and the score of "diamond 9" is 9*10+3=93. The game deals 1..*n* cards to each player. A player will win the game if the rank of cards held by the player is larger than that held by the other. The rank of cards held by a player (PR) is defined as $PR = \sum_{i \in player'\ card} CS_i$. For example, if a player holds two cards "spade 9" and "diamond 8", then the rank (SR) of his/her cards is 94+82=176. Please trace the following program and fill the **5-1~5-7** blanks with correct answers.

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

Please copy the above answer table to your answer sheet.

注意：背面尚有試題

```
#include <iostream>
#include <vector>
#include <string>
#include <sstream>
#include <map>
using namespace std;
class Card{
public:
    Card(int value, string suit) {
        this-> value = value;
        this_____________;              //(1)
    }
    int getScore() {
        map<string, int> suitCode   =
        {{"spade",4}, {"heart",3},
         {"diamond", 2}, {"club",1}};
        int score =_____+suitCode[suit]; //(2)
        return score;
    }
private:
    int value;
    string suit;
};
class Player {
public:
    Player(){      }
    int getRank() {
        int rank=0;
        for (int i=0; i<cards.size(); i++){
            rank+=_____________; //(3)
        }
        return rank;
}
  void addCard(Card *card) {
        cards.push_back(card);
  }
private:
    vector<Card*> cards;
};
class PokerGame {
public:
    PokerGame() { }
    void deal(vector <Card*> inCards) {
        init();
        for (int i=0; i<inCards.size(); i+=2){
            human_____________;//(4)
            computer_____________;//(5)
        }
    }
    string play() {
        stringstream ss1, ss2;
        string s1, s2, result;
        ss1<<human->getRank();   ss1>> s1;
        ss2<<computer->getRank(); ss2>> s2;
        result = "Player=" + s1
                + ", Computer=" + s2;
        if (_____________)     //(6)
            result+=", Player Win.\n";
        else if (_____________)     //(7)
            result+=", Computer Win.\n";
        else result+=", Push.\n";
        return result;
    }
private:
    Player *human, *computer;
    void init() {
        human = new Player();
        computer = new Player();
    }
};
void testPokerGame() {
    PokerGame game;
    vector<Card*> inCards1
        = {new Card(5,"spade"),
           new Card(6,"spade")};
    vector<Card*> inCards2
        = {new Card(6,"spade"),
           new Card(5,"spade"),
           new Card(5,"heart"),
           new Card(6,"heart")};
    vector<Card*> inCards3
        = {new Card(9,"spade"),
           new Card(9,"club"),
           new Card(8,"diamond"),
           new Card(8,"heart")};
    game.deal(inCards1);
    cout<<game.play();
    game.deal(inCards2);
    cout<<game.play();
    game.deal(inCards3);
    cout<<game.play();
}
int main(){
    testPokerGame();
    return 0;
}
```

The output is:

Player=54, Computer=64, Computer Win.

Player=117, Computer=117, Push.

Player=176, Computer=174, Player Win.

Problem 6 [9%]

For the program of Problem 5:

(1) (2%) Please briefly describe the reason of the **memory leak problem** in the program.

(2) (2%) Please briefly describe how to fix the memory leak problem.

(3) (5%) Please copy below class diagram and complete the diagram by showing the attributes, operations, and relationships of each class in the program.