112CI02

國立臺北科技大學 112 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. 本試題共五題，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 [12%] [each 2%]

Suppose that the outputs of the following C program are as follows:

2 3 12 21 23 43 65

Please trace the program and fill the blanks with correct statements.

```
01  #include <stdio.h>
02  #include <stdlib.h>
03  typedef struct node {
04      int data;
05      struct node *left;
06      struct node *right;
07  } node_t;
08  typedef node_t * nodep_t;
09
10  nodep_t createNode(int value) {
11      nodep_t p = (nodep_t) malloc(sizeof(node_t));
12      p->data = value;
13      p->left = p->right = _____;                    /* Problem 1-1 */
14      return p;
15  }
16  void build(nodep_t current, nodep_t newNode, int value) {
17      nodep_t parent;
18      while(1) {
19          parent = current;
20          if(value < parent->data) {
21              current = current->left;
22              if(current == NULL) {
23                  _____ = newNode;                   /* Problem 1-2 */
24                  return;
25              }
26          }
27          else {
28              current = current->right;
29              if(current == NULL) {
30                  _____ = newNode;                   /* Problem 1-3 */
31                  return;
32              }
33          }
34      }
35  }
36  nodep_t insert(int value, nodep_t root) {
37      nodep_t current, parent, newNode;
38      newNode = createNode(value);
39      if(root == NULL) {
40          root = newNode;
41      }
42  else {
43          parent = current = _____;                  /* Problem 1-4 */
44          build(current, newNode, value);
45      }
46      return root;
47  }
48  void inorder_traversal(nodep_t root) {
49      if(root != NULL) {
50          inorder_traversal(_____);                  /* Problem 1-5 */
51          printf("%d ",root->data);
52          inorder_traversal(_____);                  /* Problem 1-6*/
53      }
54  }
55  int main() {
56      nodep_t root = NULL;
57      int array[] = {23,12,43,21,65,3,2};
58      for(int i = 0; i < 7; i++)
59          root=insert(array[i], root);
60      inorder_traversal(root);
61      return 0;
62  }
```

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

Please copy the above answer table to your answer sheet.

注意：背面尚有試題

Problem 2 [13%, each 2% except Problem 2-6 which is 3pts]

Please trace the following C program and answer the output of each printf() statement for problems 2-1~2-6.

```
01  #include<stdio.h>
02  #include<stdlib.h>
03  typedef enum {black_ops, top_secret, secret, non_secret} securitylevels;
04  void f1(char *s1, char *s2){
05        for (; *s1!='\0'; s1++);
06        for (; *s2!='\0'; *s1 = *s2, s1++, s2++);
07        *s1 = '\0';
08  }
09
10  securitylevels f2(){
11        return(non_secret- black_ops)/3<secret? black_ops: non_secret;
12  }
13
14  int getValue(int A[][2], int B[][2], int n, int row, int column) {
15        int value = 0;
16        for(int k = 0; k <n; k++) {
17              value = value +A[row][k] * B[k][column];
18        }
19        return value;
20  }
21  void f3(int A[2][2],int B[2][2],int C[2][2], int n){
22        for (int row=0; row<n; row++) {
23              for (int column=0; column<n; column++) {
24                    C[row][column] = getValue(A, B, n, row, column);
25              }
26        }
27  }
28  int f4(int i){
29        int *p=&i,*q=p;
30        return ++(*q);
31  }
32
33  double f5(int a, int b){
34        double t= ((a--)/3+b%4);
35        return t;
36  }
37
38  void f6(int D[], int n){
39        int i=0, m=0;
40        m=n>>4;
41        m=m<<4;
42        for (int i=7; i>=4;i--){
43              D[i] = (m&(1<<i))?1:0 ;
44        }
45  }
```

```
46  int main(){
47        char s1[100]="NTUT", s2[100]="Good";
48        int A[2][2]={{1,2},{2,1}}, B[2][2]={{1,2},{2,3}}, C[2][2], D[10];
49        f1(s1, s2);
50        printf("%s\n", s1);                          /* Problem 2-1 */
51        printf("%d\n",f2());                         /* Problem 2-2 */
52        f3(A, B, C, 2);
53        printf("%d %d\n", C[0][0], C[1][1]);         /* Problem 2-3 */
54        printf("%d\n",f4(20));                       /* Problem 2-4 */
55        printf("%3.2f\n",f5(6, 6));                  /* Problem 2-5 */
56        f6(D, 123);
57        printf("%d%d%d\n", D[1], D[3], D[5]);        /* Problem 2-6 */
58  }
```

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

Please copy the above answer table to your answer sheet.

Problem 3 [25%, each 2%, except 3-1 3%]

(1) Please trace the following Python program and answer the output of each print() statement for problems (3-1)~(3-7).

```
01  def f1(n):
02      X = [i for i in range(1,n) if i%2==0]
03      return (X)
04
05  def f2(S):
06      data = dict()
07      for s in S:
08          if s in data.keys():
09              data[s] = data[s]+1
10          else:
11              data[s]=1
12      return data
13
14  def f3(n):
15      f = lambda m, n: m*n+1
16      X = {i: f(i, i+1) for i in range(1,n) if i%3==0}
17      return (X)
18
19  def f4():
20      scores=[['John', 90, 80],['Bob', 50, 70], ['Mary', 80, 70]]
21      data = filter(lambda x:True if sum(x[1:3])<150 else False, scores)
22      return list(data)
23
24  def f5(s1, s2, m, n):
25      return s1[m:n]+s2[m:n]
26
27  def f6(A, B):
28      return list(map(lambda x , y : x ** y, A, B))
29
30  def f7(data, n):
31      if n==len(data): return[data]
32      elif n==0: return ['']
33      s0 = f7(data[1:], n)
34      s1 = [data[0]+s for s in f7(data[1:], n-1)]
35      return sorted(s0+s1)
36
37
38  print(f1(8)[2])                                  #(Problem 3-1)
39  print(f2('ntut csie')['t'])                      #(Problem 3-2)
40  print(f3(6)[3])                                  #(Problem 3-3)
41  print(f4())                                      #(Problem 3-4)
42  print(f5('ntut','good', 2, 4))                   #(Problem 3-5)
43  print(f6([2,4,6],[3,2,1]))                       #(Problem 3-6)
44  print(f7('abc', 2)[2])                           #(Problem 3-7)
```

(2) Suppose that the outputs of the following Python program are as follows:

```
[[5, 7], [19, 21]]
##
[[5, 7, 9], [19, 21, 23], [33, 35, 37]]
##
[[9, 12], [30, 33]]
##
```

Please trace the program and fill the blanks with correct statements.

```
01  def op(data, x, y, n):
02      sum = 0
03      for i in range(x, x+n):
04          for j in range(y, y+n):
05              sum = sum + _____                    #(Problem 3-8)
06      return sum//_____                            #(Problem 3-9)
07
08  def compress(data, m, n):
09      size = _____                                 #(Problem 3-10)
10      target = []
11      for x in range(size):
12          row = []
13          for y in range(size):
14              row.append(op(data, x*n, y*n, n))
15          target.append(row)
16      return target
17
18  data = [[ 1,  2, 3,  4,  5,  6, 7],
19          [ 8,  9, 10, 11, 12, 13, 14],
20          [15, 16, 17, 18, 19, 20, 21],
21          [22, 23, 24, 25, 26, 27, 28],
22          [29, 30, 31, 32, 33, 34, 35],
23          [36, 37, 38, 39, 40, 41, 42],
24          [43, 44, 45, 46, 47, 48, 49]]
25  print(compress(data, 4, 2), '\n##')
26  print(compress(data, 6, 2), '\n##')
27  print(compress(data, 6, 3), '\n##')
28  # (1+2+8+9)//4=5,
29  # (3+4+10+11)//4=7;
30  # (15+16+22+23)//4=19,
31  # (17+18+24+25)//4=21
32  …
33  # (1+2+3+8+9+10+15+16+17)//9 = 9,
34  # (4+5+6+11+12+13+18+19+20)//9=12,
35  # (22+23+24+29+30+31+36+37+38)//9=30,
36  # (25+26+27+32+33+34+39+40+41)//9=33
```

注意：背面尚有試題

(3) Suppose that the outputs of the following Python program are as follows:

(0, 0) (0, 1) (0, 2) (0, 3)
(1, 0) (1, 1) (1, 2) (1, 3)
(2, 0) (2, 1) (2, 2) (2, 3)
(3, 0) (3, 1) (3, 2) (3, 3)

Please trace the program and fill the blanks with correct statements.

```
01  def printSquare(n):
02      i = 0
03      while i<n*n:
04          print((i____n, i____n), end=' ')        # (Problem 3-11),  (Problem 3-12)
05          i = i + 1
06          if i%n==0:
07              print()
08
09  printSquare(4)
```

Problem	Answer
3-1	
3-2	
3-3	
3-4	
3-5	
3-6	
3-7	
3-8	
3-9	
3-10	
3-11	
3-12	

Please copy the above answer table to your answer sheet.

Problem 4 [25%] [4-1 ~ 4-5, each 3%] [4-6 ~ 4-10, each 2%]

Please trace the following C++ program and answer problems 4-1 ~ 4-5 with the correct statements. Please trace the following C++ program and answer the std::cout outputs of each statement from problems 4-6 ~ 4-10.

```
01  #include <iostream>
02  #include <string>
03  using namespace std;
04  class Animal { /* Abstract Class */
05    public:
06      void makeSound(){ cout << "animal sound" << endl; };
07      virtual void food(){ cout << "water" << endl; }; // virtual function
08      virtual string getColor()_________; // pure virtual function      /* Problem 4-1 */
09  };
10  class Cat: public Animal {
11    private:
12      string color;
13    public:
14      Cat(string co = "white"): color(_________) {};                  /* Problem 4-2 */
15      Cat(const Cat _________a){ // copy constructor                   /* Problem 4-3 */
16          _________ = a.color;                                        /* Problem 4-4 */
17      };
18      void makeSound(){ cout << "cat sound" << endl; };
19      virtual void food() { cout << "mouse" << endl; };
20      virtual string getColor() { return color; };
21      Cat _________ + (Cat &other) {                                  /* Problem 4-5 */
22          return Cat( getColor() + other.getColor());
23      }
24  };
25  int main() {
26    Animal *p1 = new Cat("black");
27    Cat    *p2 = new Cat();
28    Cat    cat = Cat("silver") + *p2;
29    cout << cat.getColor() << endl;                                   /* Problem 4-6 */
30    p1->makeSound();                                                  /* Problem 4-7 */
31    p1->food();                                                       /* Problem 4-8 */
32    p2->makeSound();                                                  /* Problem 4-9 */
33    p2->food();                                                       /* Problem 4-10 */
34  }
```

Problem	Answer
4-1	
4-2	
4-3	
4-4	
...	...
4-9	
4-10	

Please copy the above answer table to your answer sheet.

Problem 5 [25%] [5-1, 5-10~15, each 1%] [5-2~3, 5-6~9, each 2%] [5-4~5, each 3%]

Please trace the following C++ program and answer problems 5-1~5-9 with the correct statements. Then, derive the outputs of the std::cout of each statement from problems 5-10~5-15. Notably, if you believe the answer should be left empty, please fill in "BLANK". Fields mark with same number are ought to have same answer, and, under such condition, points are counted only once. For instance, you will see 5-1 appears twice and the total points of 5-1 is 1.

```
01  #include <vector>
02  #include <iostream>
03  #include <algorithm>
04  #include <string>
05  using namespace std;
06
07  class RedTea{
08  protected:
09      string _name = "Unknown";
10      int _price = 0;
11      double _content = 0;
12  public:
13      RedTea() = default;
14      RedTea(string name, int price, double content) : _name(name), _price(price),
15                                                       _content(content){}
16      _____ ~RedTea(){};                          /* Problem 5-1 */
17      _____ void dilute()                         /* Problem 5-1 */
18                  = _____;                        /* Problem 5-2 */
19      int get_price() const{
20          return _price;
21      }
22      string get_name() const{
23          return _name;
24      }
25      double get_alcohol_content() const{
26          return _content;
27      }
28  };
29
30  class LongIsland : public RedTea {
31  public:
32      LongIsland() = default;
33      LongIsland(string name, int price, double alcohol_content):
34                                          RedTea(name, price, alcohol_content){}
35      ~LongIsland() = default;
36      void dilute() override {
37          this->_content *= 0.7;
38      }
39  };
40
41
```

```
42  class NewBloodyMary;
43  static NewBloodyMary CreateNewBloodyMary(string name, int price,
44                                                      double content);
45  class NewBloodyMary : public RedTea {
46      _____NewBloodyMary CreateNewBloodyMary(string name, int
47                  price, double content);              /* Problem 5-3 */
48  private:
49      NewBloodyMary(string name, int price, double content) :
50                                              RedTea(name, price, content){}
51  public:
52      NewBloodyMary() = default;
53      ~NewBloodyMary() = default;
54      void dilute() override {
55          this->_content *= 0.95;
56      }
57      static NewBloodyMary* CreateNewBloodyMaryPtr(string name, int price,
58                                                          double content) {
59          return new NewBloodyMary(name, price, content);
60      }
61      NewBloodyMary& operator=(const _____){       /* Problem 5-4 */
62          this->_name = other._name;
63          this->_price = other._price;
64          this->_content = other._content;
65          return *this;
66      }
67      NewBloodyMary operator+(const _____){        /* Problem 5-4 */
68          return NewBloodyMary(this->_name, this->_price +
69                  other._price, (this->_content + other._content)/2);
70      }
71  };
72  static NewBloodyMary CreateNewBloodyMary(string n, int p, double c) {
73      return NewBloodyMary(n, p, c);
74  }
75  class Order{
76  private:
77      std::vector<_____> vec;                      /* Problem 5-5 */
78  public:
79      Order() = default;
80      ~Order(){
81          for(int i = 0; i <_____; i++){           /* Problem 5-6 */
82              delete vec[i];
83          }
84      }
85      void append_alcohol(RedTea* alcohol){
86          vec.push_back(alcohol);
87      }
88  int get_total_price(){
89          int total = 0;
90
```

注意：背面尚有試題

```
91          for(int i = 0; i <_____; i++){                    /* Problem 5-6 */
92              total += vec[i]->get_price();
93          }
94          return total;
95      }
96  };
97  int main() {
98      Order order;
99      order.append_alcohol(NewBloodyMary::
100                                 CreateNewBloodyMaryPtr("A", 870, 0.7));
101     order.append_alcohol(new LongIsland("B", 230, 0.7));
102     vector<RedTea*> alcohol_vec = {new LongIsland("C", 77, 0.7),
103         _____CreateNewBloodyMaryPtr("D", 88, 0.8),      /* Problem 5-7 */
104         _____ CreateNewBloodyMaryPtr("E", 12, 0.8)};    /* Problem 5-7 */
105     std::sort(alcohol_vec.begin(), alcohol_vec.end(), [](_____) { /* Problem 5-8 */
106         return a->get_price() < b->get_price();     });
107     NewBloodyMary H = ___("F", 90, 0.8) + ____("G", 10, 0.8); /* Problem 5-9 */
108     cout << alcohol_vec.at(0)->get_price() << endl;          /* Problem 5-10 */
109     cout << alcohol_vec.at(1)->get_price() << endl;          /* Problem 5-11 */
110     cout << order.get_total_price() << endl;                 /* Problem 5-12 */
111     cout << H.get_name() << endl;                            /* Problem 5-13 */
112     cout << H.get_price() << endl;                           /* Problem 5-14 */
113     cout << H.get_alcohol_content() << endl;                 /* Problem 5-15 */
114     return 0;
115 }
```

Problem	Answer
5-1	
5-2	
5-3	
5-4	
5-5	
5-6	
5-7	
5-8	
5-9	
5-10	
5-11	
5-12	
5-13	
5-14	
5-15	

Please copy the above answer table to your answer sheet.