113 C102

國立臺北科技大學 113 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 [10%] [each 2%]

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

    ID: 112590011, GPA: 3.95
    ID: 112590025, GPA: 3.80
    ID: 112590001, GPA: 3.75

Please trace the program and fill the blanks problems 1-1~1-5 with correct statements.

```
01  #include <stdio.h>
02  #include <stdlib.h>
03  typedef struct Student {
04      int studentID;
05      double GPA;
06      _____;                              /*Problem1-1*/
07  } Student_t;
08  void printStudentInfo(Student_t *current) {
09      while (current != NULL) {
10          printf(" ID: %d, GPA: %.2f \n", current->studentID, current->GPA);
11          current = current->next;
12      }
13  }
14  Student_t* addStudent(Student_t* head, int studentID, double GPA) {
15      Student_t* newStudent = (Student_t*)malloc(sizeof(Student_t));
16      if (_____) {                        /*Problem1-2*/
17          printf("Memory allocation failed.\n");
18          exit(EXIT_FAILURE);
19      }
20      newStudent->studentID = studentID;
21      newStudent->GPA = GPA;
22      _____;                              /*Problem 1-3 */
23      return newStudent;
24  }
25  void freeList(Student_t* head) {
26      Student_t* current;
27      while (head != NULL) {
28          _____;                          /*Problem 1-4 */
29          free(current);
30          head = head->next;
31      }
32  }
33  void main() {
34      _____;                              /*Problem 1-5 */
35      head = addStudent(head, 112590001, 3.75);
36      head = addStudent(head, 112590025, 3.80);
37      head = addStudent(head, 112590011, 3.95);
38      printStudentInfo(head);
39      freeList(head);              // Free memory
40  }
```

注意：背面尚有試題

Problem 2 [15%] [each 3%]

Please trace the following C program and answer the output of each printf() statement for problems 2-1~2-5.

```
01  #include <stdio.h>
02  float f1(int a, int b){
03      return (float) b/a + b%a;
04  }
05  int f2(){
06    enum MONTH {Jan, Feb=2, Mar, Apr, May, Jun=9, Jul};
07    return (Jun/Apr+May%3+Jan*Jul);
08  }
09  int f3(int x, int y){
10      int t= x < y ? x : y;
11      return (t<<y);
12  }
13  int f4() {
14      int sum=0, myArray[5] = {1, 2, 3, 4, 5};
15      int *ptr = myArray;
16      for (int i = 0; i < 5; ++i, ++ptr)
17          sum += *ptr;
18      return sum;
19  }
20  int f5() {
21      int sum=0, A[3][3] = {{1,1,1},{2,1,2},{2,1,2}};
22      int B[3][3] = {{1,1,1},{2,2,2},{1,1,1}};
23      int C[3][3] = {{0,0,0},{0,0,0},{0,0,0}};
24      for (int index = 0; index < 9; ++index) {
25          int i = index / 3;
26          int j = index % 3;
27          for (int k = 0; k < 3; ++k)
28              C[i][j] += A[i][k] * B[k][j];
29      }
30      for (int i = 0; i < 3; ++i) {
31          for (int j = 0; j < 3; ++j)
32              sum += C[i][j];
33      }
34      return sum;
35  }
36  void main(void) {
37      printf("%3.2f\n", f1(2,3));     /* problem 2-1*/
38      printf("%d\n", f2());           /* problem 2-2*/
39      printf("%d\n", f3(3,4));        /* problem 2-3*/
40      printf("%d\n", f4());           /* problem 2-4*/
41      printf("%d\n", f5());           /* problem 2-5*/
42  }
```

Problem 3 [25%] [3-1 ~ 3-7, each 3%] [3-8, 2%] [3-9, 3-10, each 1%]

(1) Please trace the following Python program and answer the output of Line 15, 16, and 22, 33, and 41.

```
01  def check(x, data: dict, label: dict):
02      if len(x)==0: return
03      for key, value in label.items():
04          if x[0] in value and x[0] in label['num']:
05              data['num'] += int(x[0]) + 1
06          elif x[0] in value: data[key] += 2
07      return check(x[1:], data, label)
08
09  def countSymbol():
10      num = [str(i) for i in range(1,10)]
11      special, alpha = ['~', '!', '@', '#', '$', '%'], ['a', 'b', 'c', 'd']
12      data = {'num':0, 'special': 0, 'alpha':0}
13      label = {'num':num, 'special': special, 'alpha':alpha}
14      check('_5f2xe3r!1^c#', data, label)
15      for key in data.keys(): print(key, end=' ')    # problem 3-1
16      for value in data.values(): print(value, end=' ')  # problem 3-2
17
18  def countWord(sentence):
19      words = sentence.split()
20      data = {w: words.count(w) for w in set(words) }
21      info = sorted(data.items(), key=lambda d:d[1])
22      for i in info: print(i, end=' ')               # problem 3-3
23
24  def isOk(num: int)->bool:
25      if num<=0: return False
26      elif num == 1: return True
27      else: return isOk(num-2)
28
29  def printNum(m:int, n: int):
30      mySum = 0
31      for i in range(m, n):
32          if isOk(i): mySum += i
33      print(mySum)                                    # problem 3-4
34
35  def compute(n: int):
36      data = [[1, 2, 3], [4, 5, 6], [7, 8, 9]]
37      target =[[0, 0, 0], [0, 0, 0], [0, 0, 0]]
38      for row in range(3):
39          for col in range(3):
40              target[row][col] = data[col][row]
41      print(target[n][n], target[n+1][n-1])           # problem 3-5
42
43  countSymbol()
44  countWord('this is a book this is a cook')
45  printNum(5,10)
46  compute(1)
```

(2) Please trace the following Python program and answer the output of Line 07. And how to modify the code of line 06 – [0, 1], so the outputs are: 1 1 21. (# **problem 3-7**)

```
01   def h(data, n):
02       if data[n]==0:
03           data[n] = h(data, n-1) +h(data, n-2)
04       return data[n]
05
06   data = [0, 1] + [0 for i in range(20)]
07   print(h(data, 0), h(data, 1), h(data, 7))          # problem 3-6
```

(3) Suppose that the Input/Outputs of the "test()" Python program are as follows:

Inputs	Outputs
[[1, 0, 3, 4, 5],	[1, 2, 3, 4, 5]
[5, 4, 0, 2, 1],	[5, 4, 3, 2, 1]
[2, 3, 5, 0, 4],	[2, 3, 5, 1, 4]
[4, 3, 1, 5, 0],	[4, 3, 1, 5, 2]
[0, 1, 4, 2, 5],	[3, 1, 4, 2, 5]
[1, 2, 3, 4, 5]]	[1, 2, 3, 4, 5]

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

```
01   def needNumByIndex(data:list)->(int, int):
02       if data.count(0)_____ : return 0, 0          # problem 3-8
03       for i in range(1, len(data) _____1):           # problem 3-9
04           if data.count(i)==0:
05               return _____, data.index(0)            # problem 3-10
06       return 0, 0
07
08   def test03(data):
09       for d in data:
10           num, index = needNumByIndex(d)
11           if num != 0: d[index] = num
12           print(d, end=' ')
13   # count() returns the number of times the specified element appears in the list.
14   # index() is used to get the position of a given element in a list.
15   # [0 for i in range(3)] == [0, 1, 2]
```

Problem 4 [25%] [4-1 ~ 4-2, each 2%] [4-3 ~ 4-9, each 3%]

Please trace the following C++ program and answer problems 4-1 ~ 4-2 with the correct statements. Please trace the following C++ program and answer the cout outputs of each statement from problems 4-3 ~ 4-9.

```
01   #include <iostream>
02   #include <string>
03   using namespace std;
04   class Shape { /* Abstract Class */
05       protected:
06           string c; // color
07           int w; // weight
08       public:
09           string getC(){ return "white"; };
10           virtual int getW(){ return 0; }; // virtual function
11           virtual int getV()_____; // pure virtual function      /* Problem 4-1 */
12   };
13   class Cube: public Shape {
14       private:
15           int s; // side
16       public:
17           Cube(string v1, int v2, int v3): s(v3) { setC(v1); setW(v2); };
18           void setC(string v){ c = v; };
19           void setW(int v){ w = v; };
20           int getS(){ return s; };
21           string getC(){ return c; };
22           string getC(Cube *o){ return c + o->getC(); }; // function overloading
23           virtual int getW(){ return w; }; // virtual function
24           virtual int getV(){ return s * s * s; };
25           Cube operator + (Cube _____o) {   // operator overloading      /* Problem 4-2 */
26               return Cube( getC()+o.getC(), getW()+o.getW(), getS()+o.getS() );
27           }
28   };
29   int main() {
30       Shape    *p1 = new Cube("cyan", 1, 2);
31       Cube     *p2 = new Cube("blue", 3, 4);
32       Cube   cube = Cube("red", 5, 6) + *p2;
33       cout << p1->getC() << endl;              /* Problem 4-3 */
34       cout << p1->getW() << endl;              /* Problem 4-4 */
35       cout << p2->getC() << endl;              /* Problem 4-5 */
36       cout << p2->getW() << endl;              /* Problem 4-6 */
37       cout << cube.getC() << endl;             /* Problem 4-7 */
38       cout << cube.getC(p2) << endl;           /* Problem 4-8 */
39       cout << cube.getV() << endl;             /* Problem 4-9 */
40   }
```

Problem 5 [25%] [5-1 ~ 5-7, each 3%] [(3), 4%]

EBicycle and UBicycle are vehicles available for rent. The rental price for a UBicycle is calculated as rent "hour*rent Price". For an EBicycle, an additional battery charging fee is added to this calculation.

(1) Assume the output of test01() is: 100, 175. Please trace the following C++ program and answer problems 5-1 ~ 5-5 with correct statements.

(2) Provide the outputs of the cout statements for problems 5-6 and 5-7.

(3) If the comment lines 80~84 are removed, identify the errors and explain the reasons for these errors in test03().

```
01  #include <vector>
02  #include <iostream>
03  #include <string>
04  using namespace std;
05  class Vehicle {
06  private:
07      int rentPrice;
08  protected:
09      int GetRentPrice() const { return this->rentPrice;     }
10      void SetRentPrice(int _rentPrice){
11          if(_rentPrice < 0) throw string("not be negative");
12          this->rentPrice = _rentPrice;
13      }
14  public:
15      Vehicle(int _rentPrice){ SetRentPrice(_rentPrice);    }
16      virtual int Rent(int hour) = 0;
17      virtual ~Vehicle() {}
18  };
19  class UBicycle final: public Vehicle {
20  public:
21      UBicycle(int rentPrice):Vehicle (rentPrice){}
22      UBicycle& operator = (const UBicycle& bicycle){
23          this->SetRentPrice(bicycle.GetRentPrice());
24          return *this;
25      }
26      int Rent(int hour) override { return GetRentPrice() * hour; }
27      ~UBicycle() {}
28  };
29  class EBicycle final: public Vehicle {
30  private:
31      int battery;
32  public:
33      EBicycle(int rentPrice, int battery): Vehicle(rentPrice){
34          this->battery = battery;
35      }
36      ~EBicycle() {}
37      EBicycle& operator = (const EBicycle& bicycle){
38          this->SetRentPrice(bicycle.GetRentPrice());
39          return *this;
40      }
41      int GetChargeFee() { return battery * _____; }       / *Problem 5-1*/
42      int Rent(int hour) override {
43          return GetRentPrice() * hour + _____;         /*Problem 5-2*/
44      }
45  };
46  class ParkingSystem {
47  private:
48      vector<Vehicle*> _____;                            /*Problem 5-3*/
49  public:
50      ParkingSystem(vector<Vehicle*> &vehicles){this->vehicles = vehicles;    }
51      ~ParkingSystem() {};
52      int _____{                                    /*Problem 5-4*/
53          int total = 0;
54          for(int i = 0; i < vehicles.size(); i++)
55              total += vehicles[i]_____;                 /*Problem 5-5*/
56          return total;
57      }
58  };
59  void test01(){
60      EBicycle* eBi1 = new EBicycle(10, 5);
61      UBicycle* uBi1 = new UBicycle(5);
62      vector<Vehicle*> vehicles = {eBi1, uBi1};
63      ParkingSystem parkingSystem(vehicles);
64      cout << parkingSystem.GetTotalRentPrice(5) << ", ";
65      cout << parkingSystem.GetTotalRentPrice(10) << endl;
66      delete eBi1, uBi1;
67  }
68  void test02(){
69      EBicycle* eBi1 = new EBicycle(15, 5);
70      UBicycle* uBi1 = new UBicycle(10);
71      UBicycle   uBi2 = *uBi1;
72      vector<Vehicle*> vehicles = {eBi1, uBi1, &uBi2};
73      ParkingSystem parkingSystem(vehicles);
74      cout << parkingSystem.GetTotalRentPrice(5) << endl;     /*Problem 5-6*/
75      try { UBicycle* uBi2 = new UBicycle(-5); }
76      catch (string e) { cout<<e<<endl; }                     /*Problem 5-7*/
77      delete eBi1, uBi1;
78  }
79  void test03() {
80      //Vehicle* eBi1 = new EBicycle(15, 5);
81      //Vehicle* uBi1 = new UBicycle(10);
82      //Vehicle* veh1 = new Vehicle(10);
83      //cout << eBi1.GetChargeFee() << endl;
84      //cout << uBi1->GetRentPrice() << endl;
85  }
86  int main() {     test01();      test02();       test03();    }
```