**CONFIDENTIAL**

# UNIVERSITI TEKNOLOGI MALAYSIA

## FINAL EXAMINATION

## PAPER I (THEORY)

## SEMESTER I 2017/2018

| | | |
|---|---|---|
| **SUBJECT CODE** | **:** | **SCSJ1023** |
| **SUBJECT NAME** | **:** | **PROGRAMMING TECHNIQUE II** |
| **TIME** | **:** | **XX:XX – XX:XX (1 HOUR 30 MINUTES)** |
| **DATE/DAY** | **:** | |
| **VENUES** | **:** | |

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**INSTRUCTIONS TO THE STUDENTS:**

This test book consists of 4 Structured Questions:

| | |
|---|---|
| Question 1 | 40 Marks |
| Question 2 | 40 Marks |
| Question 3 | 20 Marks |
| **TOTAL** | **100 Marks** |

**ANSWER ALL QUESTIONS IN THIS BOOKLET IN THE SPACES PROVIDED.**

***Additional answer sheets will be given upon request.***

| | |
|---|---|
| **Name** | |
| **Matric. Number** | |
| **Year / Course** | |
| **Section** | |
| **Lecturer's Name** | |

*(This question booklet consists of 12 pages including this page.)*

**Question 1** **[40 marks]**

Consider the following **`Program 1`** and answer questions (i) and (ii).

```
 1  // Program 1
 2  #include <iostream>
 3  using namespace std;
 4
 5  class Instructor
 6  {
 7    private:
 8      string instructorName;
 9      string officeNum;
10
11    public:
12      Instructor(string n, string o)
13      { set(n, o); }
14
15      void set (string n, string o)
16      { instructorName = n;
17        officeNum = o; }
18
19      void print() const
20      { cout << endl << "Instructor name: " << instructorName
21             << endl;
22        cout << "Office number: " << officeNum << endl; }
23  };
24
25  class TextBook
26  {
27      private:
28        string title;
29        string author;
30
31      public:
32        TextBook(string t, string a)
33        { set(t, a); }
34
35         void set(string t, string a)
36         { title = t;
37           author = a; }
38
39         void print() const
40         { cout << endl << "Title: " << title << endl;
41           cout << "Author: " << author << endl; }
42  };
43
44
45
46
47
48
49
50
51
```

```
 52 class Exam
 53 {
 54   private:
 55     string examName;
 56     string date;
 57
 58   public:
 59
 60     Exam()
 61     { set("", ""); }
 62
 63     Exam(string n, string d)
 64     { set(n, d); }
 65
 66     void set (string n, string d)
 67     { examName = n;
 68       date = d; }
 69
 70     void print() const
 71     { cout << endl << "Exam name: " << examName << endl;
 72       cout << "Date: " << date << endl; }
 73 };
 74
 75
 76 class Course
 77 {
 78   private:
 79     string courseCode;
 80     string courseName;
 81     Instructor *instructor;
 82     TextBook *textbook;
 83     Exam exam;
 84
 85   public:
 86     Course(string n, string d, string cc, string cn,
 87            Instructor *I, TextBook *T): exam(n, d)
 88     { courseCode = cc;
 89       courseName = cn;
 90       instructor = I;
 91       textbook = T; }
 92
 93     void print() const
 94     { cout << endl << "Course code: " << courseCode << endl;
 95       cout << "Course name: " << courseName;
 96       instructor->print();
 97       textbook->print();
 98       exam.print(); }
 99 };
100
101
102
103
104
105
106
```

```
class Department
{ private:
    string depName;
    Instructor *instructor;

  public:
    Department(string n, Instructor *I)
    { depName = n;
      instructor = I; }

    void print() const
    { cout << endl << "Department name: " << depName;
      instructor->set("Amir Hamzah", "N28-301");
      instructor->print(); }
};


int main()
{
  Instructor *myInstructor = new Instructor("Noraminah Hassan",
                                            "N28A-512");

  TextBook *myText = new TextBook("Introduction to C++",
                      "Daniel Liang");

  Department myDepart("Software Engineering", myInstructor);

  Exam myExam("Final Exam", "05 January 2018");

  Course myCourse("Test 1", "07 November 2017",
                  "SCSJ1023","Programming Technique II",
                  myInstructor, myText);

  myCourse.print();
  cout << endl;

  myDepart.print();
  cout << endl;

  myText->set("Starting Out with C++", "Gaddis");
  myInstructor->print();
  cout << endl;

  myText->print();
  cout << endl;

  myExam.print();
  cout << endl;

  return 0;
}
```

(i) Based on **`Program 1`**, draw the UML diagram showing all the classes and the relationship between them. (23 marks)

(ii) What is the output of **`Program 1`** as printed by each of the following lines. State your answer in the right column of the table below.

| Line | Output |
|---|---|
| `140` | (8 marks) |
| `143` | (3 marks) |
| `147` | (2 marks) |
| `150` | (2 marks) |
| `153` | (2 marks) |

**Question 2** **[40 marks]**

Given **`Program 2`** as shown below. Answer questions (i), (ii) and (iii).

```
 1  // Program 2
 2
 3  #include <iostream>
 4  using namespace std;
 5
 6  class A
 7  {
 8    private:
 9      int a1;
10
11    protected:
12      int a2;
13
14    public:
15      int a3;
16
17      A(int a = 25, int b = 15, int c = 55) {
18        a1 = a; a2 = b; a3 = c;
19        cout << "Class A with a1 = " << a1 << ", a2 = "
20             << a2 << ", a3 = " << a3 << endl;
21      }
22
23      void print() {
24         cout << "Print from class A" << endl;
25      }
26
27      ~A() {
28        cout << "Class A object destroyed with a1 = "
29             << a1 << ", a2 = " << a2 << ", a3 = "
30             << a3 << endl;
31      }
32  }; //End of class A
33
34  class B: protected A
35  {
36    private:
37      int b1;
38
39    public:
40      B(int a = 0, int b = 0, int c = 0, int d = 0):
41      A(a, b, c) {
42        b1 = d;
43        cout << "Class B with b1 = " << b1 << endl;
44      }
45
46      void print() {
47         cout << "Print from class B" << endl;
48      }
49
50
```

```
51      ~B() {
52        cout << "Class B object destroyed with b1 = "
53             << b1 << endl;
54      }
55  }; //End of class B
56
57  class C: private B
58  {
59    private:
60      int c1;
61
62    protected:
63      int c2;
64
65    public:
66      C(): B() {
67        c1 = 44; c2 = 88;
68        cout << "Class C with c1 = " << c1 << ", c2 = "
69               << c2 << endl;
70      }
71
72      void print() {
73        B::print();
74          cout << "Print from class C" << endl;
75          A::print();
76      }
77
78      ~C() {
79        cout << "Class C object destroyed with c1 = "
80             << c1 << ", c2 = " << c2 << endl;
81      }
82  }; //End of class C
83
84  int main()
85  {
86      B object1(2,4,6), object2;
87      C object3;
88      A object4(10);
89
90      object1.print();
91      object3.print();
92
93      return 0;
94  }
```

(i) What will the following lines print onto the screen when the **`Program 2`** runs? State your answer by completing the following table:

| Line | Output |
|---|---|
| `86` | (6 marks) |
| `87` | (4.5 marks) |
| `88` | (2 marks) |
| `90` | (0.5 mark) |
| `91` | (1.5 marks) |
| `93-94` | (12.5 marks) |

(ii) Based on the objects created in the **`main`** function of **`Program 2`** (lines 86 to 88), determine the member variables that each object owns. Write (**Yes**) in the corresponding blank cells, if the object own or has a copy of the variable; and write (**No**) if otherwise. State your answer by completing the following table:

(5 marks)

| | **Member Variables** | | | | | |
|---|---|---|---|---|---|---|
| **Object** | **a1** | **a2** | **a3** | **b1** | **c1** | **c2** |
| **object1** | | | | | | |
| **Object2** | | | | | | |
| **Object3** | | | | | | |

(iii) With reference to the same member variables in (ii), determine whether they are accessible inside the methods and by the object listed below. Write (**Yes**) in the corresponding blank cells, if it is accessible; and write (**No**) if otherwise. State your answer by completing the following table: (8 marks)

| | **Member Variables** | | | | | |
|---|---|---|---|---|---|---|
| **Object/ Method** | **a1** | **a2** | **a3** | **b1** | **c1** | **c2** |
| **object4** | | | | | | |
| **void A::print()** | | | | | | |
| **void B::print()** | | | | | | |
| **void C::print()** | | | | | | |

**Question 3** **[20 marks]**

Given **`Program 3`** as shown below.

```
 1  //Program 3
 2
 3  #include <iostream>
 4  using namespace std;
 5
 6  class FinalA
 7  {
 8    public:
 9      void display() {
10        cout << "Final Exam PT2, Good Luck!!\n"; }
11
12      virtual void display(int a) {
13        cout << "Final Exam PT2, I get " << a << endl; }
14
15      virtual void display(char a) {
16        cout << "Final Exam PT2, I get " << a << endl; }
17  };
18
19  class FinalB: public FinalA
20  {
21    public:
22      virtual void display() {
23        cout << "Answer Part A PT2, Good Luck!!"; }
24
25       void display(int a) {
26        cout << "Part A PT2, I get " << a << endl; }
27  };
28
29  class FinalC: public FinalB
30  {
31    public:
32      void display() {
33        cout << "Answer Part B PT2, Good Luck!!"; }
34
35       void display(char a) {
36        cout << "Part B PT2, I get " << a << endl; }
37  };
38
39  int main()
40  {
41      // The code will be inserted here
42      // The Code will be inserted here
43
44      return 0;
45  }
```

Determine the output of the program if each of the following code segment is inserted into the program at line 41 and 42. Note that, each question below is independent. Note also that, the ASCII code for the letter 'A' is 65. State your answer in the right column of the table below.

(20 marks)

| No | Code to be inserted at Line 41 and 42 | Output |
|---|---|---|
| a) | `FinalA *obj = new FinalC();`<br>`obj->display('A');` | |
| b) | `FinalA *obj = new FinalB();`<br>`obj->display('A');` | |
| c) | `FinalB *obj = new FinalC();`<br>`obj->display('A');` | |
| d) | `FinalC *obj = new FinalC();`<br>`obj->display('A');` | |
| e) | `FinalB *obj = new FinalC();`<br>`obj->display();` | |
| f) | `FinalA *obj = new FinalB();`<br>`obj->display();` | |
| g) | `FinalA *obj = new FinalC();`<br>`obj->display();` | |
| h) | `FinalA *obj = new FinalB();`<br>`obj->display(85);` | |
| i) | `FinalA *obj = new FinalC();`<br>`obj->display(85);` | |
| j) | `FinalB *obj = new FinalC();`<br>`obj-> display(85);` | |