

PART A - STRUCTURED QUESTIONS

[75 marks]

Part A consists of **FIVE (5)** structured questions. The marks for each part of the question is as indicated.

Question 1

[22 marks]

- a) Write a class declaration named **Inventory** that has **itemNumber** (which contains the id number of a product) and **numOfItem** (which contains the quantity on hand of the corresponding product) as private data members. The default constructor to the **Inventory** class initializes the **itemNumber** and **numOfItem** member to 0. Add an overloaded constructor to the **Inventory** class. This constructor should accept two arguments and design its value to the **itemNumber** and **numOfItem** member variables. Write three public inline member functions named **getId** (this member function puts the value of **id** into the private data member **itemNumber**), **getAmount** (this member function puts the value of **num** into the private data member **numOfItem**), and **display** (this member function displays the value of the object to the screen). (14 marks)
- b) Write a C++ statement that defines an array of 10 objects of the **Inventory** class in Question (a), name this object as **products**. (1 mark)
- c) Write C++ statements that will read inventory numbers and number of items from the keyboard (inputs will be entered by the user) into the array of objects represented by the array you defined in Question (b). There should be calls to both **getId** and **getAmount** member functions. (5 marks)
- d) Write C++ statements to print out the values (**itemNumber** and **numOfItem**) for each object in the array that you defined in Question (b). This should be done by calling the member function **display** within a loop. (2 marks)

Question 2

[13 marks]

Given Program 1 as follows; please answers Question 2 parts (a) to (g).

```

1  #include <iostream>
2  #include "Stock.h"
3  using namespace std;
4
5  class Book
6  {
7      private:
8          static int numBook = 0;
9          static double pricePay = 0;
10         double price; //Book's price
11
12     public:
13         Book(double);
14         double getPrice()
15         { return price; }
16         int getNumBook()
17         { return numBook; }
18         double getPricePay()
19         { return pricePay; }
20
21         /*(b)Insert static inline member function named
22            totPrice to calculate the total price of books. */
23
24         //(f)Declare the addStock friend function here.
25     };
26
27     Book::Book(double b)
28     {
29         numBook++;
30         price = b;
31     }
32
33     //Insert new statement(s) if necessary.
34
35     int main()
36     {
37         double price;
38         cout << "Enter your book price: RM";
39         cin >> price;
40         //(c)Call the totPrice member function
41
42         Book obj1(50.5);
43         Book obj2(21.0);
44         /*(d)Use the obj1 and obj2 object to call the totPrice
45            member function */
46
47         cout << "Total book that you have purchased: " <<
48         obj1.getNumBook() << endl;
49         cout << "Total price that you need to pay: RM" <<
50         obj2.getPricePay() << endl;

```

```

51
52      //(g)Define obj3 and initialize with obj1's values.
53      Return 0;
54  }

```

Program 1

- a) Identify the error(s) in the class book declaration and correct it, by modifying the statement(s) in the class book declaration and inserting new statement(s) as indicated in Program 1. Provide your answers by completing the following table: (4 marks)

Line	A Corrected/ New Statement

- b) At line 21, write a **static** inline member function named **totPrice** to calculate the total price of books. (2 marks)
- c) At line 40, write a statement to call the **totPrice** member function before any instances of the **Book** class is created. (1 mark)
- d) At line 44, write statements to call the **totPrice** member function by using the objects of the **Book** class created in line 42 and 43. (2 marks)
- e) Assuming the error(s) is fixed in Question (a), and the function and statements in Question (b) to (d) have successfully been written. Based on the input given, what is the output of the program? (2 marks)
- Input:** Enter your book price: RM50.00
- f) At line 24, write a friend function declaration named **addStock** that belongs to the **Stock** class. Notice the function takes two arguments, a double and an integer values; and does not return any value. (1 mark)
- g) At line 52, define an object named **obj3** and initialize it to the values stored in **obj1**.

(1 mark)

Question 3**[14 marks]**

Given Program 2 below. Please answer Question 3 parts (a) to (d).

```

1  #include <iostream>
2  using namespace std;
3
4  class Line
5  {
6      public:
7          Line(int p)
8          {
9              cout << "Normal constructor allocating ptr" << endl;
10             ptr = new int;
11             *ptr = p;
12         }
13
14         //(a) Define a copy constructor
15         //(b) Define a destructor
16         //(c) Define an overloaded operator for the operator +
17
18         int getPtr(){ return *ptr; }
19         void setPtr(int p){ *ptr = p; }
20
21     private:
22         int *ptr;
23 };
24
25 int main()
26 {   Line obj1(10);
27     Line obj2 = obj1;
28     obj2.setPtr(15);
29     cout << obj1.getPtr() << endl;
30     cout << obj2 + obj1 << endl;
31     obj1.~Line();
32
33     return 0;   }
34

```

Program 2

- a) At line 14, define a copy constructor that copies the value of pointer **ptr** from other **Line** and display the message "**Copy constructor allocating ptr**". (4 marks)
- b) At line 16, define a destructor to release a memory and display the message "**Freeing memory!**". (3 marks)
- c) At line 18, define an overloaded operator for the operator + such that when two lines, *e.g.* **y** and **z**, are added, the result that will be returned is the sum of the pointer **ptr** of both

lines. For example, if the values of pointer **y.ptr** and pointer **z.ptr** are 5 and 3, respectively, the result will be returned for the operation **y + z** is 8. (2 marks)

- d) Assuming all the definitions in Question 3 (a) to (c) have successfully been written, what is the output of the program? (5 marks)

Question 4

[10 marks]

Given Program 3 as follows. Please answer Question 4 parts (a) and (b).

```

1  #include <iostream>
2  using namespace std;
3
4  class classA
5  {
6      int val1;
7      string val2;
8
9      public:
10     classA(int val1, string val2)
11     { this->val1 = val1;
12       this->val2 = val2; }
13
14     int getValue() { return val1 * 100; }
15     string getStringA() { return val2; }
16 };
17
18 class classC
19 {
20     string value1;
21     string value2;
22
23     public:
24     classC(string value1, string value2)
25     { this->value1 = value1;
26       this->value2 = value2; }
27
28     string getStringC() { return value1 + ' ' + value2; }
29 };
30
31 class classB
32 {
33     string valA;
34     int valB;
35     classA *valC;
36     classC valD;
37
38     public:
39     classB(string valA, int valB, classA *C): valD("Good",

```

```

40     "Luck")
41     { this->valA = valA;
42       this->valB = valB;
43       valC = C; }
44
45     void print()
46     { cout << "In class A: " << valC->getStringA()
47         << " " << valC->getValue() << endl
48         << "In class C: " << valD.getStringC() << endl
49         << "In class B: " << valA << " " << valB * 100; }
50 };
51
52 int main()
53 {
54     classA *obj1 = new classA(50, "My target");
55     classB obj2("For You", 10, obj1);
56     obj2.print();
57
58     return 0;
59 }

```

Program 3

- a) Based on Program 3 above, draw the UML class diagram that shows the relationship among classes. (7 marks)
- b) What is the output of this program? (3 marks)

Question 5**[16 marks]**

Given three classes named **Fruit**, **Apple** and **Banana** respectively, and some objects of these classes as shown in Program 4:

```

1  #include <iostream>
2  using namespace std;
3
4  class Fruit
5  {
6      private:
7          double weight;
8
9      public:
10         double gst;
11         Fruit()
12         {
13             weight = 0;
14             cout << "A fruit object has been created but "
15                 << "not yet weighed." << endl;
16         }
17
18         Fruit (double w, double g)

```

```

19     {
20         weight = w;
21         gst = g;
22         cout << "Fruit object weighing " << weight
23             << " kilos and tax " << g << "%." << endl;
24     }
25
26     void printFruit() { }
27 }; //class Fruit
28
29 class Apple : protected Fruit
30 {
31     private:
32         double pricePerKilo;
33
34     protected:
35         double kilo;
36
37     public:
38         Apple() : Fruit(2.5,10.0)
39         {
40             pricePerKilo = 0;
41             kilo = 0;
42             cout << "Apples with price and kilogram weight "
43                 << "(2.5, 10) accordingly." << endl;
44         }
45
46         Apple(double p, double k)
47         {
48             pricePerKilo = p;
49             kilo = k;
50             cout << "Apples valued at RM" << pricePerKilo
51                 << " per kilo weighing " << kilo
52                 << " kilos." << endl;
53         }
54
55         void printApple() { }
56 }; //class Apple
57
58
59 class Banana : private Apple
60 {
61     public:
62         Banana(double pr) : Apple(pr, pr)
63         {
64             cout << "Banana priced at RM" << pr
65                 << " per kilo." << endl;
66         }
67
68         void printBanana() { }
69 }; //class Banana
70
71
72 int main()
73 {
74     Fruit fruit(100,15);

```

75	Apple epal;
76	Banana pisang(3);
77	
78	return 0;
79	}

Program 4

- a) What will the lines 74 to 76 print onto the screen when the program runs? State your answer by completing the following table: (6 marks)

Line	Statement	Output
74	Fruit fruit(100,15);	
75	Apple epal;	
76	Banana pisang(3);	

- b) Based on the objects created in the main function of the program (line 74 to 76), determine the member variables that each object owns. Write (**Own**) 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: (4 marks)

	Member Variables			
Object	weight	gst	kilo	pricePerKilo
fruit				
epal				
pisang				

- c) With reference to the same member variables in (a), determine whether they are accessible inside the methods and by the object listed below. Write (**Accessible**) in the corresponding blank cells, if it is accessible; and write (**No**) if otherwise. State your answer by completing the following table: (6 marks)

	Member Variables			
Method/ Object	weight	gst	kilo	pricePerKilo
printFruit()				
printApple()				
printBanana()				

fruit			
-------	--	--	--

PART B - PROGRAMMING QUESTION**[25 marks]**

Part B consists of **ONE (1)** question only.

Question

Suppose you are developing a program that a rental house manager can use to manage his rental houses. The rental houses include two types of houses: bungalow and apartment houses. Regardless of the type, the manager keeps the following data about each house:

- Location
- Number of room
- Rental rate

Each type of house has these general characteristics, plus its own specialized characteristics. For a bungalow, the manager keeps the following additional data:

- Land size

And, for an apartment, the manager keeps the following additional data:

- Floor level

Write a **House** base class to hold all the general data about a house, and then write derived classes for each specific type of house that inherits from the **House** class. Every class should have the following:

- A default constructor that assigns empty strings (""), 0 to integer member variables and 0.0 to double member variables.
- A constructor that accepts the required values as arguments and assigns them to all member variables.
- Appropriate accessor functions to get the values stored in the object's member variables.

Be sure to separate the driver, header and implementation files where applicable.

In the main function:

- Create a **Bungalow** object that is located at Pontian, Johor with 6 bedrooms, 300 square feet land size with monthly rental rate at RM1200.

- b) Create an **Apartment** object that is located at Taman Daya, Johor Bahru with 3 bedrooms, at level 2 with monthly rental rate at RM800.
- c) Display the information of the houses for rent as shown in the Figure 1. *Note:* Information in the bold fonts are obtained from the accessor functions.

We have a bungalow located at **Pontian, Johor** with **6** bedrooms
300 square feet land size. Monthly rental rate: RM**1200.00**

We have an apartment located at **Taman Daya, Johor Bahru** at
level **2** with **3** bedrooms. Monthly rental rate: RM**800.00**

Figure 1: Example of output