

1B11 Exam (+ Resit)

2003

3 Hours

Examiners:

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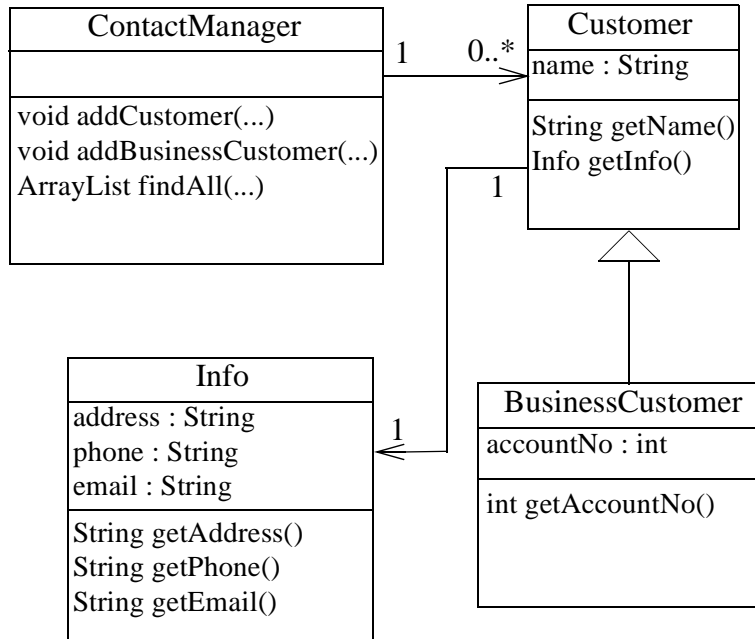
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Answer ALL questions from Part I and THREE questions from Part II

(Note that in all questions, the Java code given in your answers does not have to be syntactically perfect but should, at least, demonstrate how to correctly write the classes and methods.)

Part I

1. Consider the UML class diagram below:



a) Write a Java version of class Info, assuming it has this constructor:
 public Info(String address, String phone, String email)
 and the public methods shown in the diagram.

[4 marks]

b) Write a Java version of class Customer assuming it has this constructor:
 public Customer(String name, Info info)
 and the public methods shown in the diagram.

[4 marks]

c) Write a Java version of class BusinessCustomer assuming it has this constructor:
 public BusinessCustomer(String name, Info info, int accountNo)
 and the public method shown in the diagram.

[5 marks]

[Question 1 cont.]

d) Write a Java version of class `ContactManager` assuming it has this constructor:

```
public ContactManager()
```

and these public methods:

```
public void addCustomer(String name, String address, String phone, String email)
```

```
public void addBusinessCustomer(String name, String address,
```

```
String phone, String email,
```

```
int accountNo)
```

```
public ArrayList findAll(String name)
```

The `findAll` method should find all `Customers` and `BusinessCustomers` with the matching name. Full implementations of all the methods should be provided.

[12 marks]

e) Outline a strategy for testing the classes you have written.

[5 marks]

[Total 30 marks]

2. a) Draw a syntax diagram for the *compound statement*.

Add lookaheads as necessary to aid parsing.

Show how your syntax diagram for the compound statement could be implemented as a Java method.

Explain briefly the role of any other methods or variables that your implementation uses.

[4 marks]

b) The following are simple examples of Java declarations:

```
int i;
```

```
int counter = 0;
```

```
int j = 17, k = 3*j, n;
```

Draw syntax diagrams for declarations such as these. Your answer should not be limited solely to the examples given, but should allow multiple declarations in one declaration statement, with the option of assigning a value.

You may refer without further explanation to a syntax diagram named expression.

Add lookaheads as necessary to aid parsing.

[4 marks]

[Total 8 marks]

3. Consider the expression $2 + 3 * 5 + 4 / 6 * 5$. State the rules that determine how such an expression is evaluated, show how they apply to this example and give the value of the expression.

[7 marks]

End of Part I

Part II Answer THREE questions

4.

- i. Draw syntax diagrams for arithmetic expressions involving addition, subtraction, multiplication, and division, with parenthesised sub-expressions.

Your syntax diagrams should correctly capture the properties of these operators.

Explain the meanings of any tokens that you use.

[5 marks]

- ii. Discuss in general the issues that need to be considered when introducing a new operator or class of operators.

[5 marks]

- iii. Demonstrate these issues by introducing into your syntax diagrams the exponentiation (or power) operator. Assume that an expression such as x^y would be written as `x ** y`.

If you are aware of any problems or deficiencies with your syntax diagram you should discuss them.

You may also offer alternative solutions, and again you should discuss these, pointing out the effect of the differences. It will be possible to gain full marks for an incorrect solution that discusses problems and alternative solutions well.

[8 marks]

[Total 18 marks]

5. a) Write a method that takes an array of int as a parameter and returns the sum of the largest and smallest values stored in the array.

[8 marks]

- b) Write a method that sorts an array of int into ascending order (i.e., smallest value first). The method should return a new array, leaving the original array unchanged. Do not use any sorting methods from the Java class libraries.

[10 marks]

[Total 18 marks]

6. a) Briefly explain each of the following:
overloading, break, this, encapsulation, type, abstraction
[6 marks]
- b) Give the scope and lifetime rules for local, instance, and parameter variables.
[6 marks]
- b) Explain what an object reference is.
[2 marks]
- d) Explain object sharing and its consequences.
[4 marks]
- [Total 18 marks]

7. a) A linked list is constructed from a chain of list elements. Write a list element class in Java.
[6 marks]
- b) Write a method that takes an array of Strings as parameter and returns a chain of list elements with each element holding one string from the parameter array.
[6 marks]
- c) Write a method that takes as parameters a String and a chain of list elements holding Strings, and returns true if the String is found within the chain.
[6 marks]
- [Total 18 marks]

8. a) Consider this method:

```
public int f(int p, int q)
{
    while (p != q)
    {
        while (p > q)
        {
            p = p - q;
        }
        while (p < q)
        {
            q = q - p;
        }
    }
    return p;
}
```

Give the results of the following method calls: f(1,1), f(2,4), f(6,18), f(25,40), f(13,11).

Name the mathematical operation the method calculates.

[9 marks]

b) Consider this recursive method:

```
public void g(int i, int j)
{
    if (i < j)
    {
        i++;
        g(i,j);
        System.out.print(i + " ");
    }
}
```

Write down the output of the following method calls:

g(6,6), g(4,6), g(3,6), g(2,6), g(1,6)

State what algorithm the method implements.

[9 marks]

[Total 18 marks]