EE2-12

IMPERIAL COLLEGE LONDON

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING
EXAMINATIONS 2014

EIE PART II: MEng, Beng and ACGI

Corrected Copy

**SOFTWARE ENGINEERING 2**

Wednesday, 11 June 2:00 pm

Time allowed: 2:00 hours

**There are THREE questions on this paper.**

**Answer ALL questions.**
**Q1 carries 40% of the marks. Questions 2 and 3 carry equal marks (30% each).**

**Any special instructions for invigilators and information for candidates are on page 1.**

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| Examiners responsible | First Marker(s) : | M. Cattafi |
| | Second Marker(s) : | J.V. Pitt |

# SOFTWARE ENGINEERING 2: OBJECT ORIENTED SOFTWARE ENGINEERING

1. This is a general question about Object Oriented Software Engineering.

a) Compare and contrast how software complexity is handled in Structured Programming and Object Oriented Programming.

[ 9 ]

b) Explain the OOP concept of *encapsulation*. Illustrate your answer with an example in C++ code.

[ 8 ]

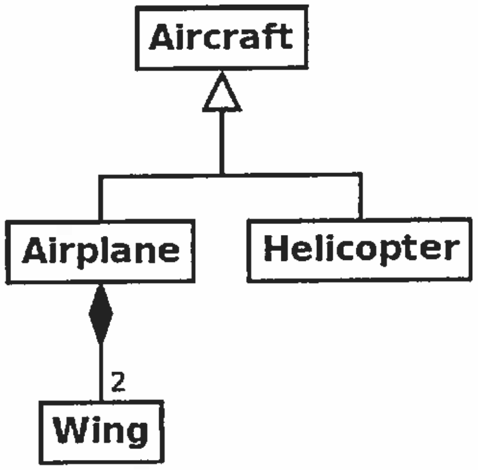

Figure 1.1 An UML diagram

c) Describe in words the software architecture represented in the UML class diagram in Fig. 1.1. What kind of problem domain could it model and what kind of software application?

[ 7 ]

d) Compare and contrast the OOP concepts of *inheritance* and *composition* also expanding on the examples and the context of Fig. 1.1.

[ 9 ]

e) Write C++ declarations for all the classes in the UML diagram in Fig. 1.1. The declarations can be kept to the essential skeleton (e.g. constructors can be omitted) but all the elements related to available information (including relationships) should be included.

[ 7 ]

2. This question deals with C++ references and features enabling or preventing value updates.

a) Consider the following code snippet. Would it compile (why or why not)? Would it (be likely to) cause runtime errors (why or why not)? Trace (if possible and meaningful) how the value of the variables would change.

```
int n = 10;
int& nr;
nr = n;
```

[ 6 ]

b) Consider the following code snippet. Would it compile (why or why not)? Would it be likely to cause runtime errors (why or why not)? Trace (if possible and meaningful) how the value of the variables would change.

```
int n = 10;
int& nr = n;
int n2 = 3;
nr = n2;
n2 = 2;
```

[ 6 ]

c) When and why are function parameters in C++ declared `const`, usually? Illustrate your answer with an example in code including the implementation of such a function.

[ 8 ]

d) When and why are member functions declared `const` in C++ (by placing the keyword after the parentheses enclosing the parameters)? Illustrate your answer with an example in C++ code including such a declaration (in its appropriate context) and a call of the function in relevant circumstances.

[ 10 ]

3. Consider memory management in C++ and Java.

a) Consider the following function. Would it compile (why or why not)? Would it be likely to cause runtime errors (why or why not)? If the function is not correct, propose and comment a correct alternative (keeping the function declaration unaltered).

```
int* make_it_double(int n){
    int m = 2 * n;
    return &m;
}
```

[ 10 ]

b) What are memory leaks? How do they occur? What needs to be done in order to avoid them? Illustrate your answer with an example in C++ code of a situation with a memory leak and of how it can be fixed.

[ 12 ]

c) Explain how Java differs from (standard) C++ in terms of memory management also mentioning related advantages and disadvantages.

[ 8 ]