## COMPUTER SCIENCE TRIPOS Part IA – 2024 – Paper 1

## 4 Object-Oriented Programming (rkh23)

A university manages its students using a program that has a class Student with subclasses FirstYear, SecondYear, and ThirdYear for year-specific state and behaviour. The program has a List<Student> that contains all Students.

- (a) Should Student be a class, an abstract class or an interface? Explain your answer. [2 marks]
- (b) Write a Comparator that can be used to sort the List<Student> by year group and then by name, both ascending, and show how it would be used. You should assume the existence of a String getName() method within Student.

[4 marks]

(c) At the end of each year, the third year students graduate and must be removed. This is done by passing the list to the following method:

```
void removeThirdYears(List<Student> students) {
   for (Student student : students) {
      try {
      ThirdYear thirdyear =(ThirdYear) student;
      students.remove(thirdyear);
   }
   catch(ClassCastException cce) { }
  }
}
```

- (i) What will happen when the call to remove() is made? Explain why and fix the code.[4 marks]
- (ii) Comment on this use of exceptions and propose an alternative that does not rely on them.[3 marks]

Full marks required correct use of an iterator or equivalent. Copying the list did not earn the mark for the solution.

- (d) Also at the end of the academic year, the first and second year students move up a year.
  - (i) Explain why this class design makes this problematic. [3 marks]
  - (*ii*) Propose an alternative design and explain in detail how it addresses the problems you identified in (d)(i). [4 marks]