

2 Programming in C and C++ (NK)

- (a) In a C++ program, suppose there is a function with the following prototype.

```
void foo(MyClass x)
```

Suppose that this function is invoked in a call `foo(z)`.

- (i) What does C++ do when `z` is passed as an argument to `foo`?
- (ii) Explain briefly in English how the `MyClass` class can be modified to raise compile-time errors when objects of type `MyClass` are passed as arguments.
- (iii) Why might you want to do this?
- (iv) In response, how should the type of `foo` be declared instead? Give a new function prototype for `foo`.

[3 marks each]

- (b) In C, it is typical for APIs to expose functions which create values (such as `fopen`) and then subsequently delete them (such as `fclose`). For example, a C program might use files with code like:

```
void bar(void) {  
    FILE *fp = fopen("example.txt", "r");  
    baz(fp);  
    fclose(fp);  
}
```

- (i) What makes this style of resource management problematic in C++? Your answer should explain what `baz` could do that creates resource-management hazards. [3 marks]
- (ii) Describe the preferred alternative to handling this kind of resource management issue in modern C++. [2 marks]
- (iii) Define a C++ class which wraps the C file API to support C++ style resource management. You only need to show how to wrap the resource management calls (`fopen` and `fclose`), and may ignore the rest of the file API. [3 marks]