3 Programming in C and C++ (AM)

(*a*) Write a C function `revbits()` which takes a single 8-bit `char` parameter and returns a `char` result by reversing the order of the bits in the `char`.   [4 marks]

(*b*) Write a C function `revbytes()` taking two parameters and returning no result. The first parameter is a pointer to memory containing n contiguous bytes (each of type `char`), and the second is the number of bytes. The function should have the side effect of reversing the order of the bits in the n contiguous bytes, seen as a bitstring of length $8n$. For example, the first bit of the first `char` should be swapped with last bit of the last `char`.   [6 marks]

(*c*) You have been assigned the following seemingly working C code, which processes files controlling the behaviour of a system. You observe that, after obtaining several `ERR_MALFORMED` errors, subsequent calls to `fopen` fail due to too many files being open:

```
int process_file(char *name)
{   FILE *p = fopen(name, "r");
    if (p == NULL) return ERR_NOTFOUND;
    while (...)
    {   ...
        if (...) return ERR_MALFORMED;
        process_one_option();
        ...
    }
    fclose(p);
    return SUCCESS;
}
```

(*i*) Explain how to fix the program using facilities in C.   [2 marks]

(*ii*) Now suppose the function above was part of a system written in C++ (but still using the C file-processing commands such as `fopen` and `fclose`), and that `process_one_option()` might raise one or more exceptions. Using a class with a destructor, show how to fix the "too many files open" bug above.   [8 marks]