1 Programming in C and C++ (AVSM)

(a) Explain the difference between 'x' and "x" when used as constants in C. Describe the memory representation of both values. [4 marks]

(b) Consider the following C program:

```c
void swap(int x, int y) {
    int temp = x;
    x = y;
    y = temp;
}

int main(int argc, char **argv) {
    int x = 0;
    int y = 1;
    swap(x, y);
    assert(x == 1);
    return 0;
}
```

Briefly explain the role of the assert statement and why this program will trigger an assert failure when executed. Supply two modified versions of the program that alter the swap function definition and, if necessary, its calls, to avoid this assert failure. One version should be in C, and the other should use C++ language features. [4 marks]

(c) Describe the address-space layout (highlighting four areas of memory) of a typical compiled x86 C program, and how each of these areas are used by C constructs. [8 marks]

(d) Briefly explain what undefined behaviour is in the C standard. Under what circumstance(s) would calling the following C function result in undefined behaviour?

```c
int32_t divide(int32_t a, int32_t b) {
    return a / b;
}
```

[4 marks]