

# COMPUTER SCIENCE TRIPOS Part IB – 2016 – Paper 3

## 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:

```
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?

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

[4 marks]