

COMPUTER SCIENCE TRIPOS Part IB – 2019 – Paper 4

2 Programming in C and C++ (nk480)

- (a) Find at least 2 sources of undefined behaviour in the following program, and write a corrected version of this function. [5 marks]

```
int main(void) {
    char *s = "abcde"; int len = strlen(s);
    for (int i = 0; i <= len; i++)
        s[i] += 1;
    return printf("%s' is %d characters long\n", ++s, strlen(s));
}
```

- (b) Restructure the program below to be more cache-efficient, giving the code and explaining your changes. [5 marks]

```
typedef struct point { double x, y, z; } Point;

int find_max_x_argument(int n, Point *elems) {
    double max = 0; int max_index = 0;
    for (int i = 0; i < n; i++)
        if (max < elems[i].x) { max_index = i; max = elems[i].x; }
    return max_index;
}
```

- (c) The following definition forms part of a legal C++ program:

```
int foo() {
    MyClass x(1,2);
    MyClass y = C(3,4);
    MyClass z = x;
    MyClass t;
    z = x;
    z.f = x.f;
    return z.f;
}
```

- (i) Give a declaration of `MyClass` which enables `foo` to compile and run, noting any methods or constructors in `MyClass` which are invoked when `foo` is called. [Note: Precise C++ syntax is not necessary to obtain full marks.] [4 marks]
- (ii) Having seen your declaration of `MyClass`, a colleague points out some of the lines of `foo` may be redundant. Which are these? [2 marks]
- (iii) Your boss now replaces your declaration of `MyClass`. Not having access to the new declaration, explain, giving reasons, which if any lines of `foo` are now redundant. [4 marks]