Foundations of Computer Science

(a) An ML program makes the following declarations:

```ml
val x = ref 0;

fun f n = (x := !x + 1; n + !x);

fun g n = 
    let val x = ref 0
    in x := !x + 1; n + !x end;
```

Consider evaluating each of the following expressions:

```ml
map f [1,2,3,4];
map g [1,2,3,4];
map ref [5,5,5];
```

What value is returned in each case and how are the references affected? [5 marks]

(b) Code the function `filter` such that `filter p xs` returns the list of those elements of the list `xs` satisfying the predicate `p`. [1 mark]

(c) Use `filter` to express Quicksort. [4 marks]