# CS615 Quiz 3

**Max marks: 20** **Time: 30 mins**

- *Be brief, complete and stick to what has been asked.*
- *Unless asked for explicitly, you may cite results/proofs covered in class without reproducing them.*
- ***If you need to make any assumptions, state them clearly.***
- ***Do not copy solutions from others. Penalty for offenders: FR grade.***

## 1 Problem

Consider the following function in a C-like (though not exactly C) language.

```
     MyFunc(list_ptr p, list_ptr q)
     local list_ptr t1, list_ptr t2, list_ptr temp;
L0:  t1 := p;
L1:  t2 := q;
L2:  while ((t1 != NULL) && (t2 != NULL)) {
L3:       temp := t1; t1 := t1->next; free(temp);
L4:       temp := t2; t2 := t2->next; free(temp);
L5:    }
L6:  if (t1 == NULL) {
L7:    t3 := t2;
L8:  }
L9:  else {
L10:   t3 := t1;
L11: }
```

Assume that the pre-condition for this function is $\mathsf{acyclic}(p) \star \mathsf{acyclic}(q)$, where the predicate $\mathsf{acyclic}(x)$ is as defined in class:

$$\mathsf{acyclic}(x) \;=\; ((x = NULL) \wedge \mathbf{emp}) \vee (\exists t.\, (x.next \mapsto t) \star \mathsf{acyclic}(t)$$

1. *[10 marks]* Show using Hoare-style reasoning with separation logic that when `MyFunc` terminates, `t3` points to an acyclic list.
2. *[10 marks]* Show using similar reasoning that it is possible for the heap to be empty when `MyFunc` terminates. In other words, show that the post-condition of the function can be satisfied by the empty heap.