CS615 Quiz 1

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.***

Consider the following program `P` in a C-like language, in which all variables are of type `int`, and `myFunc` is a function that takes no arguments and returns an integer.

```
L1:  while (myFunc() != 0) {
L2:     if (myFunc() != 0) {
L3:       b := a + 1;
L4:     }
L5:     else {
L6:       b := a - 1;
L7:  } //end-of-while loop
L8:
```

You are told that the pre-condition before entering the `while` loop, i.e at location `L1`, is $\{a = b\}$.

1. *[10 marks]* Suppose `myFunc` is a deterministic function, i.e. it returns the same value every time it is called.

   Give a formula φ in first-order logic such that the Hoare triple $\{a = b\}$ `P` $\{\varphi\}$ evaluates to true. Try to give as strong a formula φ as you can, i.e. your formula should represent as small a set of states at `L8` as you can. Justify why your formula φ is as strong as you can think of for this problem.

2. *[10 marks]* Suppose `myFunc` is a non-deterministic function, i.e. it may return different values on different invocations.

   Give a formula in first-order logic that computes as strong a loop invariant as you can at `L1`, and prove the loop invariance of your formula using Hoare Logic rules.