

YOUR NAME: _____

RCS ID: _____

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Principles of Software Quiz 2

Feb. 6, 2019

10 points total

Question 1. A Hoare triple is still true if we replace the precondition with a weaker condition (2 points)

- (a) true
- (b) false

Question 2. There may exist two different strongest postconditions $P1$ and $P2$ for a given segment of Java code. (By “different” we mean that $P1$ and $P2$ are different Boolean functions, not just two different ways of writing the same logical formula.) (2 points)

- (a) true
- (b) false

Question 3. Consider the loop in `prodN()`. `prodN()` requires $n > 0$ and returns the product of the integers 1 through n . For example, `prodN(5)` = 120. (6 points)

```
// precondition: n > 0
int prodN(int n) {
    int k = 2;
    int prod = 1;
    // LI: prod = 1 * 2 * ... * (k - 1) && k <= (n + 1)
    while (k <= n) {
        prod = prod * k;
        k = k + 1;
    }
    return prod;
}
// postcondition: prod = 1 * 2 * ... * n
```

- (a) Given the loop invariant $prod == 1 * 2 * \dots * (k - 1) \ \&\& \ k \leq (n + 1)$, show that the loop invariant is true for the base case before the loop executes. (2 points)

- (b) Use induction to show that the loop invariant holds for the general case. That is, assume it holds after some iteration m and show that it holds after iteration $m + 1$. (2 points)

- (c) Show that at exit, the loop invariant and the exit condition imply the postcondition. (2 points)