15-214 - Principles of Software Construction: Objects, Design, and Concurrency
Class Participation Sheet
Hoare Logic, Part 2

Andrew IDs: _____ _____

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Question 1 [Practice]. Consider the following program:

{ N >= 0 }
```
i = 0;
while (i < N) { i = N; }
```
{ i == N }

Which of the following conditions are loop invariants that are sufficient to prove the postcondition? For those that are incorrect, explain why.

A) i = 0

B) i = N

C) N >= 0

D) i <= N

Question 2. For the program above and the invariant *i <= N*, write the steps of the proof. The form of your answer should be three mathematical implications (third is on the last page).

Invariant is initially true:

Invariant is preserved by the loop body:

Invariant and exit condition imply postcondition:

Question 3. For each of the following loops, is the given variant function correct? If not, why not?

A) Loop:
```
n = 256;
while (n > 1) { n = n / 2; }
```

Variant Function: $log_2\, n$

B) Loop:
```
n = 100;
while (n > 0) {
     if (random()) then {n = n + 1; }
          else { n = n – 1; }
}
```

Variant Function: n

C) Loop:
```
n = 0;
while (n < 10) { n = n + 1; }
```

Variant Function: $–n$