15-122: Principles of Imperative Computation

Quiz 1A

Name _____ Andrew ID _____ Section _____

Answer each question in the space provided. You may not reference any additional sources. Write legibly. All answers that are unclear or subject to multiple interpretations will be marked wrong.

1. What is **not** one step in proving total correctness of a function with one loop?

   (a) Prove that the loop invariant and the negation of the loop guard imply the postcondition.
   (b) Prove that the loop terminates.
   (c) Prove that the loop invariant implies the loop guard.
   (d) Prove that the loop invariant is preserved by any iteration of the loop.

   Answer: _____

2. What is the minimum integer that can be represented using **five** bits in "two's complement" representation? Express your answer in decimal notation.

   Answer: _____

3. What is the value of the following C0 expression, expressed **in hexadecimal**:

   ```
   0xAB << 1
   ```

   Answer: _____

4. Consider the following code:

   ```
   /* 1 */ int[] A = alloc_array(int, 5);
   /* 2 */ for (int i = 0; i < 5; i++)
   /* 3 */   A[i] = i;
   ```

   Which of the following is a loop invariant that would allow us, in conjunction with the loop guard on line 2, to conclude that the array access on line 3 is safe?

   ```
   (a) //@loop_invariant i <= 5;
   (b) //@loop_invariant 0 <= i;
   (c) //@loop_invariant i < \length(A);
   (d) No loop invariant will allow us to conclude that it is safe.
   ```

   Answer: _____

5. All of the following expressions in C0 are always true, **except**:

   ```
   (a) x != -x  // mathematical negation
   (b) x != ~x  // bitwise complement
   (c) x == (x & -1)
   (d) x * 4 == x << 2
   ```

   Answer: _____

15-122: Principles of Imperative Computation

Quiz 1B

Name _____ Andrew ID _____ Section _____

Answer each question in the space provided. You may not reference any additional sources. Write legibly. All answers that are unclear or subject to multiple interpretations will be marked wrong.

1. What is **not** one step in proving total correctness of a function with one loop?

   (a) Prove that the loop invariant and the negation of the loop guard imply the postcondition.
   (b) Prove that the loop invariant implies the loop guard.
   (c) Prove that the loop terminates.
   (d) Prove that the loop invariant is preserved by any iteration of the loop.

   Answer: _____

2. What is the maximum integer that can be represented using **five** bits in "two's complement" representation? Express your answer in decimal notation.

   Answer: _____

3. What is the value of the following C0 expression, expressed **in hexadecimal**:

   ```
   0xAB >> 1
   ```

   Answer: _____

4. Consider the following code:

   ```
   /* 1 */ int[] B = alloc_array(int, 6);
   /* 2 */ for (int i = 0; i < 6; i++)
   /* 3 */   B[i] = i;
   ```

   Which of the following is a loop invariant that would allow us, in conjunction with the loop guard on line 2, to conclude that the array access on line 3 is safe?

   ```
   (a) //@loop_invariant i < \length(B);
   (b) //@loop_invariant i <= 6;
   (c) //@loop_invariant 0 <= i;
   (d) No loop invariant will allow us to conclude that it is safe.
   ```

   Answer: _____

5. All of the following expressions in C0 are always true, **except**:

   ```
   (a) x * 4 == x << 2
   (b) x != -x  // mathematical negation
   (c) x != ~x  // bitwise complement
   (d) x == (x & -1)
   ```

   Answer: _____