COA1 Exam 1 – Fall 2018

Name: _____ Computing ID: _____

Letters go in the boxes unless otherwise specified (e.g., for **C** 8 write "C" not "8").
Write Letters clearly: if we are unsure of what you wrote you will get a zero on that problem.
Bubble and Pledge the exam or you will lose points.
Single-select by default: Multiple select are all clearly marked; answer them by putting 1 or more letters in the box, or writing "none" if none should be selected.
Mark clarifications: If you need to clarify an answer, do so, and also add a ⋆ to the top right corner of your answer box.

. . . . . .

Question 1 [2 pt]: What is 0xC2 in decimal?

Answer:

Information for questions 2–5
The following assume 8-bit 2's-complement numbers. For each number, bit 0 is the low-order bit, bit 7 is the high-order bit.

Question 2 [2 pt]: (see above) Complete the following sum, showing your work (carry bits, etc)

```
  0 0 0 1 1 1 0 0
+ 0 0 1 1 1 1 1 0
-----------------
```

Question 3 [2 pt]: (see above) If you add two negative numbers, you have experienced overflow if

A the carry resulting from adding bit 7 is 0
B the carry resulting from adding bit 7 is 1
C the result is negative
D the result is positive

Answer:

Information for questions 4–5
The following ask about **biassed** signed integers.

Question 4 [2 pt]: (see above) If the high-order bit of a **biassed** number is `1`, then the value it represents is

A `< 0`
B `<= 0`
C `== 0`
D `!= 0`
E `>= 0`
F `> 0`

Answer:

Question 5 [2 pt]: (see above) If the high-order bit of a **biassed** number is `0`, then the value it represents is

A `< 0`
B `<= 0`
C `== 0`
D `!= 0`
E `>= 0`
F `> 0`

Answer:

Information for questions 6–11
Each question gives two expressions of 32-bit two's-compliment integers `x` and `y`. If the two are equivalent for all `x` and `y`, write "same"; otherwise, write an example `x` (and `y` if used in the expressions) for which the two are different.
———— add example

Question 6 [2 pt]: (see above)
`x + y` and `~((-x) + (~y))` *(note that's two ~ and one -)*

Question 7 [2 pt]: (see above)
`x + x + x` and `(x<<1) + x`

Question 8 [2 pt]: (see above)
`!x` and `1 & ~((x>>16) | (x>>8) | (x>>4) | (x>>2) | (x>>1) | x)`

Question 9 [2 pt]: The register type we discussed in class (the positive-edge-triggered D flip-flop) has inputs `D` and `clock` and output `Q`. What signals need to be provided to `D` and `clock` to change `Q` from `1` to `0`? Assume `D`, `clock`, and `Q` are all `1` before your description is used.

Answer: _____

_____

Question 10 [2 pt]: Draw a 4-bit decrement circuit: that is, a set of logic gates with 4 input wires (x_0 though x_3) and four output wires (z_0 through z_3) such that the output is numerically 1 less than the input ($z = x + -1$).

Information for questions 11–12

Suppose we extended the ISA simulator you wrote in Lab 04 and PA 03 with the following code:

```
if (reserved == 1 && icode == 1) {
    M[oldPC + 1] = M[oldPC + 2];
    return oldPC + ____;
}
```

Question 11 [2 pt]: (see above) What number should be placed in the `return` statement where the code above has `____`?

Answer:

Question 12 [2 pt]: (see above) Using the new instruction, write a program that moves a value from address `0x12` to address `0x34`. Answer in hexadecimal bytes, separated by spaces.

Answer: _____

Information for questions 13–14
Suppose we extended the ISA simulator you wrote in Lab 04 and PA 03 with the following code:

```
if (reserved == 1 && icode == 2) {
    R[a] = M[M[oldPC + 1] + R[b]];
    return oldPC + ____;
}
```

Question 13 [2 pt]: (see above) What number should be placed in the `return` statement where the code above has `____`?

Answer:

Question 14 [2 pt]: (see above) Suppose there is an array of bytes starting at address `0x40`. Using the new instruction, write a program that reads into R_3 the byte at index R_0 of that array. Answer in hexadecimal bytes, separated by spaces.

Answer: _____

Question 15 [2 pt]: If the 32-bit number `0x12345678` is stored in **big-endian** at address `0x20`, what is the value of the byte at address `0x22`? Answer in hexadecimal.

Answer:

Question 16 [2 pt]: If you read the bytes [`ba`, `98`] as an unsigned **little-endian** 16-bit number, what is that number? Answer in hexadecimal.

Answer:

Question 17 [2 pt]: Which of the following are true statements about back doors? **Select all that apply** by putting 1 or more letters in the box. If none are true, write "none" in the box.

A They can allow others to control your computer without your knowledge.
B They can be added to a large project by one or two people with relatively little work.
C They can be hidden in a way that makes them very hard to find.
D They can be added in hardware.
E They can be added in compilers.
F They can be added in software.

Answer:

Information for questions 18–19
We discussed in class about patenting an ISA. These questions are about that and related ideas.

Question 18 [2 pt]: (see above) Why would copyrighting an ISA not be sufficient intellectual property protection to prevent clone products being created?

Answer: _____

_____

Question 19 [2 pt]: (see above) Many people consider patents an important way to fuel invention and share knowledge. Why?

Answer: _____

_____

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Pledge:

On my honor as a student, I have neither given nor received aid on this exam.

_____
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