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 140 in hexadecimal?

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

Question 3 [2 pt]: (see above) If you add two positive 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 **2's complement** signed integers.

Question 4 [2 pt]: (see above) If the high-order bit of a **2's complement** number is `0`, 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 **2's complement** number is `1`, 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)<<1) + (x ^ y)`

Question 7 [2 pt]: (see above)
`(x<<2) + (x>>1)` and `((x<<3) + x)>>1`

Question 8 [2 pt]: (see above)
`x | (x>>1)` and `x ^ (x>>1)`

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`. If `Q` was `0` before, which of the following will leave it `0`?

Select all that apply by putting 1 or more letters in the box. If none are true, write "none" in the box.

A keeping `clock` at `0`, transition `D` from `0` to `1`
B keeping `clock` at `1`, transition `D` from `1` to `0`
C keeping `D` at `0`, transition `clock` from `0` to `1`
D keeping `D` at `1`, transition `clock` from `1` to `0`

Answer:

Question 10 [2 pt]: Draw a 3-input multiplexer circuit: that is, a set of logic gates with 3 input wires (x_0 through x_2), two selection wires (s_0 and s_1), and one output wire (z) such that $z = x_i$ if $s = i$; it may do anything you wish if $s = 3$.

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] = R[a];
    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 the contents of register 3 into address `0x20`. Answer in hexadecimal bytes, separated by spaces.

Answer: ____________________

Question 13 [2 pt]: If the 32-bit number `0x12345678` is stored in **little-endian** at address `0x20`, what is the value of the byte at address `0x22`? Answer in hexadecimal.

Answer:

Question 14 [2 pt]: If you read the bytes [`fe`, `dc`] as an unsigned **big-endian** 16-bit number, what is that number? Answer in hexadecimal.

Answer:

Question 15 [2 pt]: Which of the following is a reason why we should trust that our computer chips do not contain 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 There's so much code out there, if there was a back door some code would have found it.
B Back doors are hard to build and slow computers down.
C Back doors are created by programmers, not hardware designers.
D Chips are built by the joint efforts of thousands of people. If a back door was added, one of them would have leaked that to the press.

Answer:

Question 16 [2 pt]: Copyrights can protect a description of an ISA, but not the ISA itself. If ISAs are considered to be inventions, patents could protect them, preventing others for using the same ISA (without paying royalties) until the patent expires (typically after 20 years).

Opinions about the patentability of ISAs are varied. Provide one reason for and one reason against the patentability of an ISA. Note that "I want free computers" is not a sufficient reason against…

Pro-patent: ______________________________

____

Anti-patent: ______________________________

____

Pledge:

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

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