CMPSCI 145
SPRING 2020
REVIEW SHEET FOR MIDTERM EXAM #1
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This is a reminder that exam #1 will be in-class on Friday, February 28TH. The exam is open-book, open notes. Anything on paper is OK to bring in. We will cover from the beginning of the semester up through floating-point representations, but we will not cover any later topic.

From the on-line version of the textbook ***Representing, Storing, and Retrieving Information*** (the password is my last name, all lower case) chapters 1-5 are fair game for the exam:

Chapter 1 – Introduction
Chapter 2 – Analog Mechanical Techniques
Chapter 3 – Digital Mechanical Techniques
Chapter 4 – Electrical and Electronic Devices
Chapter 5 – Integer Representations
Chapter 6 – Real Number Representations

From the ***Computer Science Companion***, please review the following pages:

26: Accuracy vs. Precision
36: Converting between Base 10 and Another Base
37: Converting between Base 2 and Base 2^N
38: Base Conversion Table
39: Table of Powers of Two
40: Bits and Bytes
~~41: Bytes: Hex to Decimal and Decimal to Hex~~
74: Integers
75: Number Wheel for Signed and Unsigned Bytes
76: Unsigned and Two's Complement Signed Bytes
77: Relationships Between Various Signed Representations
78: Binary Addition
79: Binary Subtraction
79-83: Closure Plots
84: BCD and XS3 Representations
85: Gray Code
86-89: Floating Point
94: Truth Tables
96: Simple Primitive Gates
97-100: Adders
~~104: Simple Set-Reset Flip-Flops~~
~~105: D Flip-Flop~~
~~106: Asynchronous Binary Counter, Divide by 10 Counter~~
114: Ohm's Law
116: Resistor Networks
117-118: Simple Switched Logic Circuits, Relay Circuits
163: 7-Segment Displays

Although I do not think you will need a calculator, *simple* calculators are allowed. No graphing calculators, no calculators that have built-in base conversion functions, and no cell phone calculators, please. ***No other electronics permitted*** (no cell phones, computers, PDAs, iPods, iPads, etc.). If you took notes on a laptop, you will need to print them out to use them for the exam. I will try very hard to make the exam short enough to do in the 50-minute class time, but when you get the exam please go through it once to identify the easy problems and get them out of the way quickly. If you run short on time, I do not want you to have a bunch of easy problems left unanswered.

I know that there is a lot of material here, and obviously I cannot ask detailed questions about each topic, but here are the high spots. I'll try to ask representative questions from each topic group and still bring it in under 50 minutes expected completion time. Feel free to email me with questions over the next few days; if there are topics I feel to be of benefit to the entire group I'll write them up and send them out in an email broadcast.

What is the difference between an analog device and a digital device? What general characteristics of each type lead you to decide whether a particular device is analog or digital? How can you perform computations with gears, sticks, fluids, marbles, etc., and what kinds of computations can you perform? For example, I might give you a gear train and ask how fast each gear rotates relative to the driven gear.

How does a change in representation (such as changing a linear scale to a logarithmic scale) alter the types of calculations that can be performed? How can you use analog functional elements (e.g., resistor voltage dividers, amplifiers, ENIAC devices, etc.) to solve some computation? For example, I may give a resistor divider and ask what the output voltage is relative to the input voltage.

What advantages do analog devices have over digital devices? What advantages do digital devices have over analog devices? How are digital functional elements (gates) similar to and different from analog functional elements?

What are the functional differences between AND, OR, NAND, NOR, XOR, and NOT gates? How can you use digital functional elements to create a circuit to solve some computation? ~~How do punched paper devices store their information? What is a bit?~~

How do you use 9's and 10's complement arithmetic to perform subtraction using a machine capable only of addition? (RE: Comptometer.) How do you convert between decimal (base 10) and simple binary? For example, I may give you an addition or subtraction problem and ask for the result.

How do you represent integers in binary? Know the difference between unsigned binary integers and sign & magnitude, one's complement, and two's complement signed binary integers. I should be able to give you a binary number and then have you derive for me the different decimal interpretations (unsigned, sign & magnitude, 1's comp, 2's comp, BCD, XS3) for that number~~, as well as the equivalent hexadecimal coding~~. As with the 9's and 10's complement, I may give you an addition or subtraction problem in binary (2's comp) and ask if there is a signed or unsigned overflow. What are the advantages seen with each representation? What are the disadvantages?

Finally, I intend to give you a short-answer question about choices of representations that are not covered in the book. In particular, the question will be of the form "Representation X is used in situation Y. Why? What advantages or disadvantages does this representation exhibit?" In a question like this, I will expect you to think about the given representation, what the alternatives might be, and come up with an answer of no more than three or four sentences outlining your conclusions. I don't want a long involved answer.