Computational Engineering 2021-12-17

BM40A0202 Foundations of Computer Science

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Exercise 2, Logical circuits and von Neumann's architecture

5 tasks, 1p/task.

1. Task in Moodle.
2. Use the truth table to show how the circuit in Figure 1 works. Be sure to note the effect of the output o on the operation of the circuit.

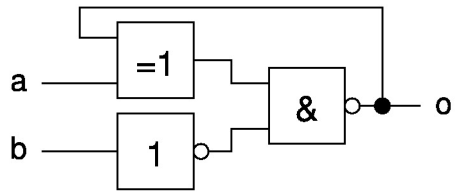

Figure 1: Logical circuit with modern notation

3. Design a logic circuit that implements the truth table of Table 1.

Table 1: Truth table.

a	b	c	Output (o)
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

4. Learn about the computer architecture developed by John von Neumann, a good starting point is to consult the wikipedia article. What else could be a good source to learn about von Neumann architecture? Why would that be a good source? What does "good source" mean?

   How does today's computer compare to the architecture presented by von Neumann? Make a presentation outlining 5 (five) key points (bullet points) about the von Neumann architecture and how it compares to modern computers.

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5. Apply the following algorithm to the numbers $M = 63$ and $N = 71$.

   Step 1. Start with two columns on a page, the left column is labeled **A** and the right column is labeled **B**; and put the value of M under **A** and the value of N under **B**.

   Step 2. Repeat

   (a) calculate a new value for **A** by multiplying the old value in **A** by 2; and

   (b) calculate a new value for **B** by dividing the old value in **B** by 2 and reducing the result by a half if necessary to obtain an integer;

   Until the value in **B** equals one.

   Step 3. Go down the columns crossing out the value in **A** whenever the value in **B** is even.

   Step 4. Add up the remaining values in **A** and "return" the sum.

   What do you get as the "return" value? Test the same algorithm with two binary numbers, e.g. $M = 11101_2$ and $N = 1011_2$.