Functional electronic circuits

Laboratory work 3 «Design of control path functional blocks»

1. Develop the device that performs the arithmetic operation according to the variant. The control unit should be implemented as FSM. The size of operands is 32 bit.
2. Develop a testbench of the device and test the device.
3. Calculate the calculation time if clock frequency is 100MHz.
4. Draw the interface of your block and FSM according to the control logic.
5. Put results in the report. The report should consist:
   5.1. Student Name and Student ID
   5.2. The picture with FSM and table of transition
   5.3. The timing diagram with simulation results
   5.4. Code of the testbench and the device.
6. Upload the report by this form: https://forms.yandex.ru/u/6279e3f58fd3854abe62b5d0/

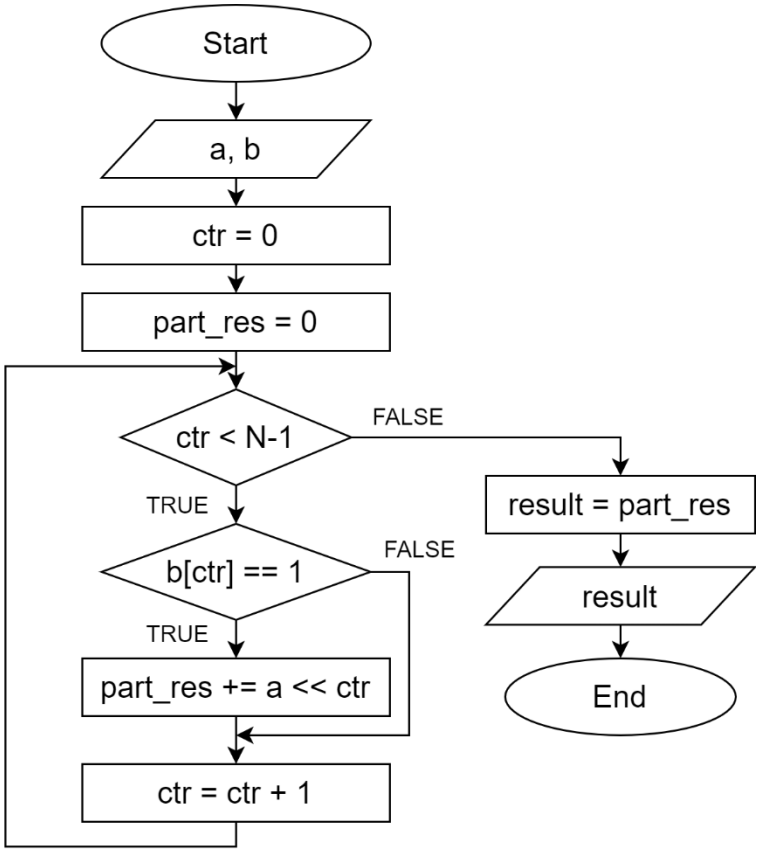
Variants

Variant	Function	Constraints
1	$y = a^2 + \sqrt[3]{b}$	Number of adders: 1 Number of multipliers: 2
2	$y = a^3 + \sqrt[2]{b}$	Number of adders: 2 Number of multipliers: 1
3	$y = \sqrt{a^2 + b^2}$	Number of adders: 1 Number of multipliers: 2
4	$y = \sqrt{a + \sqrt[3]{b}}$	Number of adders: 2 Number of multipliers: 1
5	$y = 3a + 2 \cdot \sqrt[3]{b}$	Number of adders: 1 Number of multipliers: 2
6	$y = a \cdot b + a^3$	Number of adders: 2 Number of multipliers: 1
7	$y = a \cdot \sqrt{b}$	Number of adders: 1 Number of multipliers: 2
8	$y = a \cdot \sqrt[3]{b}$	Number of adders: 2 Number of multipliers: 1
9	$y = \sqrt[3]{a} + \sqrt{b}$	Number of adders: 1 Number of multipliers: 2
10	$y = \sqrt[3]{a + \sqrt[2]{b}}$	Number of adders: 2 Number of multipliers: 1

Appendix. Arithmetic algorithms

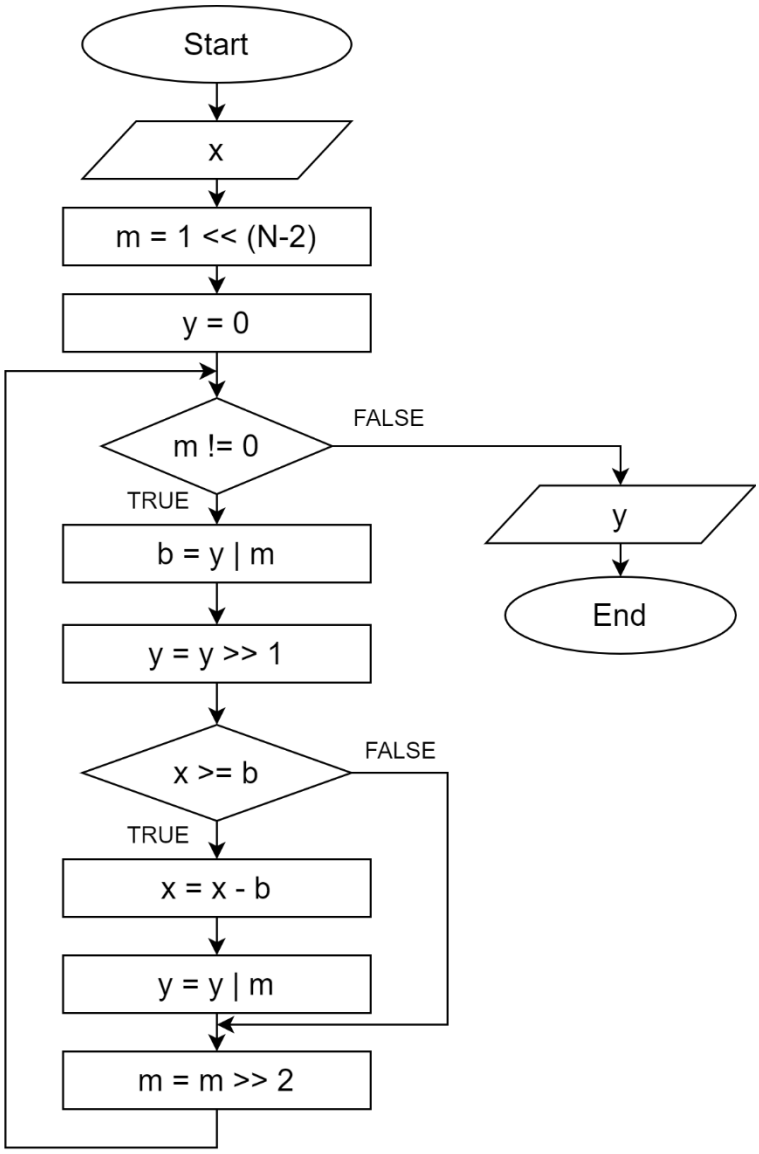
Multiplication

N – size of operands. For example, N = 32 for 32 bit operands.



Square root

N – size of operands. For example, N = 32 for 32 bit operands.



Cubic root

N – size of operands. For example, N = 32 for 32 bit operands.