DIGITAL DESIGN ASSIGNMENT REPORT

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PROBLEM STATEMENT

Design an automated system for a garment factory that cuts an incoming steady stream of cloth into fixed lengths. The length is preset by the user. The user can also enter a pattern of lengths, upto 3 in a row. The machine should be able to cut those pieces in the same fashion.

OUR ASSUMPTIONS

- The cloth cutter works on a falling edge. i.e. The machine cuts cloth instantaneously whenever the transition of 0 to 1 happens in the output signal

- The time delay because of the circuit components are neglected except for the delay because of the clock as frequency of the clock is very slow compared to the propagation delay due to circuit.

- Frequency of Clock = x (m/s)/ 1(m)

  Where x is the speed of the incoming cloth.

- We are assuming that user is entering all the inputs for selected no. of patterns.

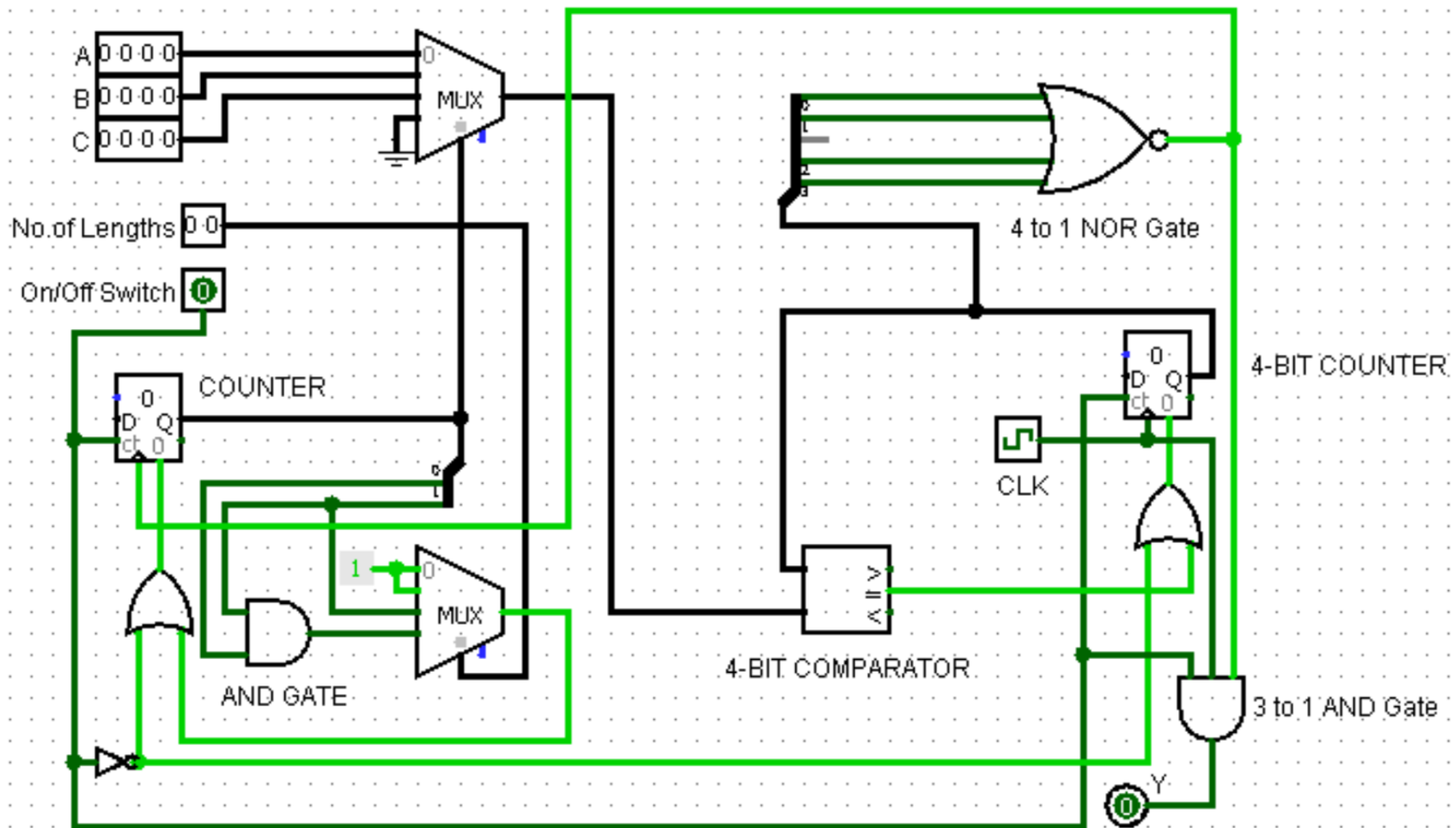 i.e. if no. of pattern=1 then A is not 0

     if no. of pattern=2 then A, and B are not 0

     if no. of pattern=3 then A,B, and C are not 0

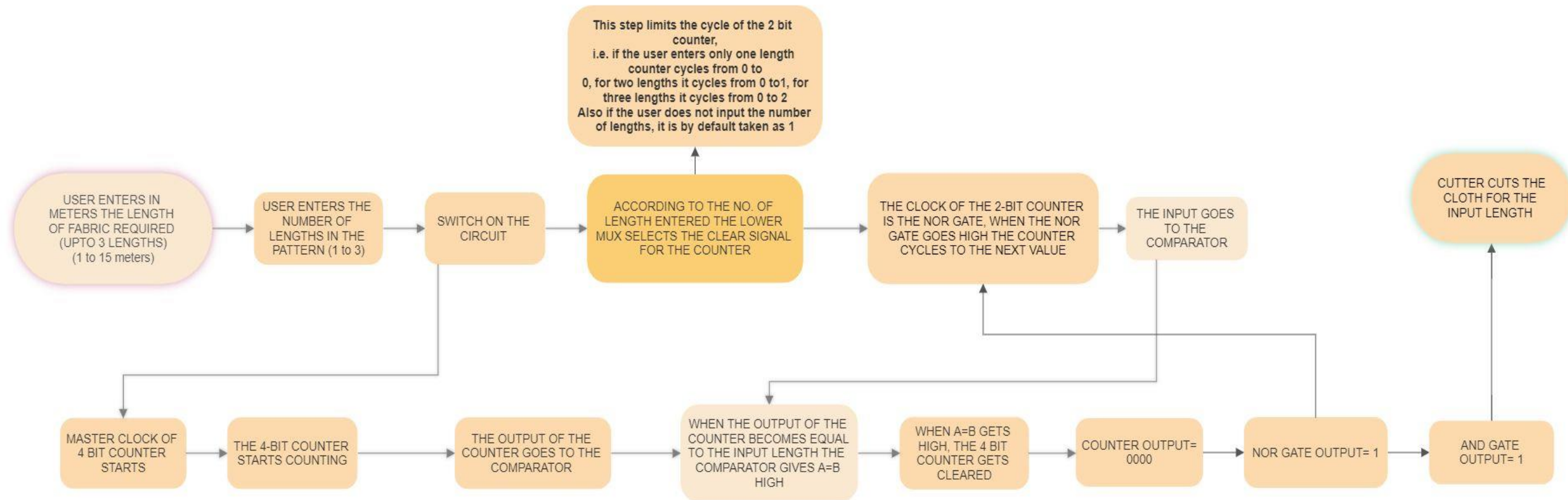   if no. of pattern=4 then A,B,C, and D are not 0

- The circuit would be "switched on" only when the inputs has been entered.
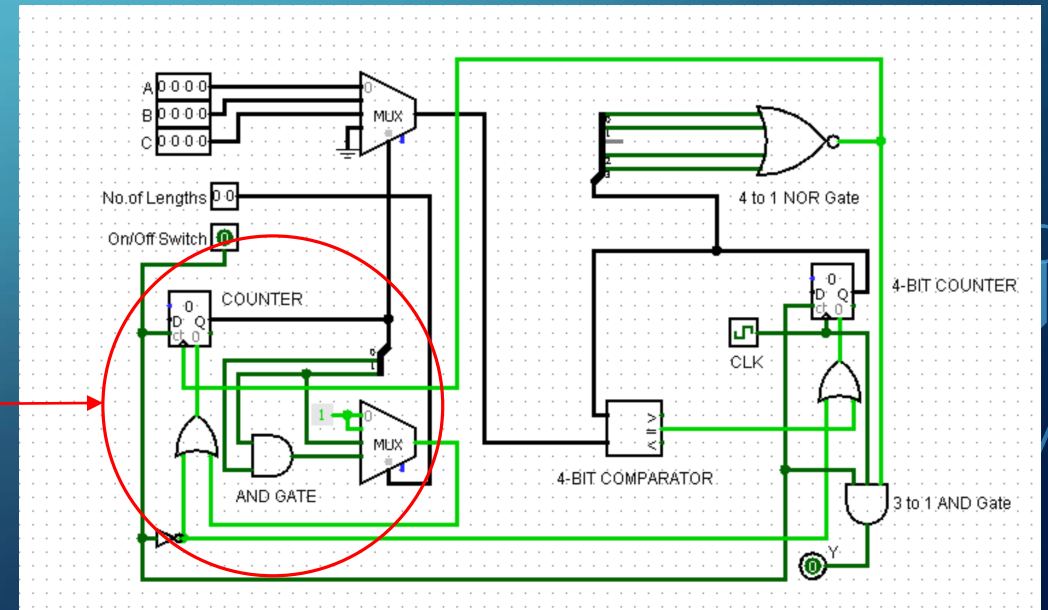
# OUR SOLUTION

GARMENT FACTORY

METHODOLOGY : SELECTING INPUTS

- This part of the circuit takes the number of lengths as the input.

- The Counter is designed to select the value from the input pins that needs to be cut.

- By using the combination of an AND Gate and a multiplexer, we make sure that the counter follows the set pattern.
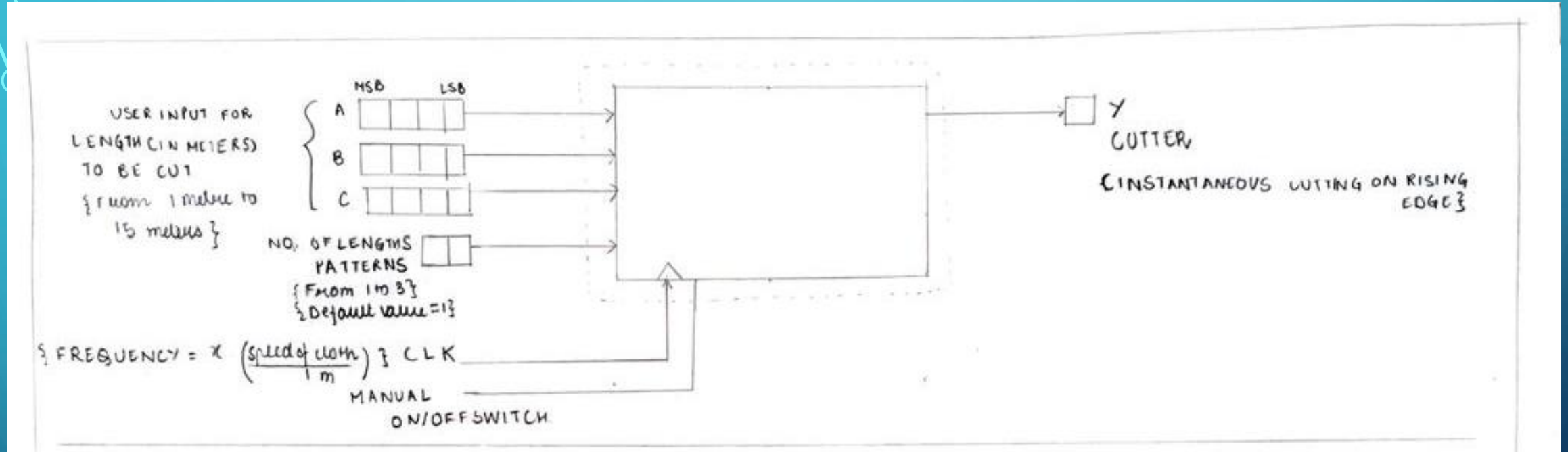
METHODOLOGY : THE CUTTER

- The second counter is used to measure the timing signals (the frequency is set according to the speed of cloth).

- We use a 4-bit binary counter for the same.

- This makes sure that the length that is input by the user is cut – the counter counts until the length matches, and then the cutter cuts and counter resets.
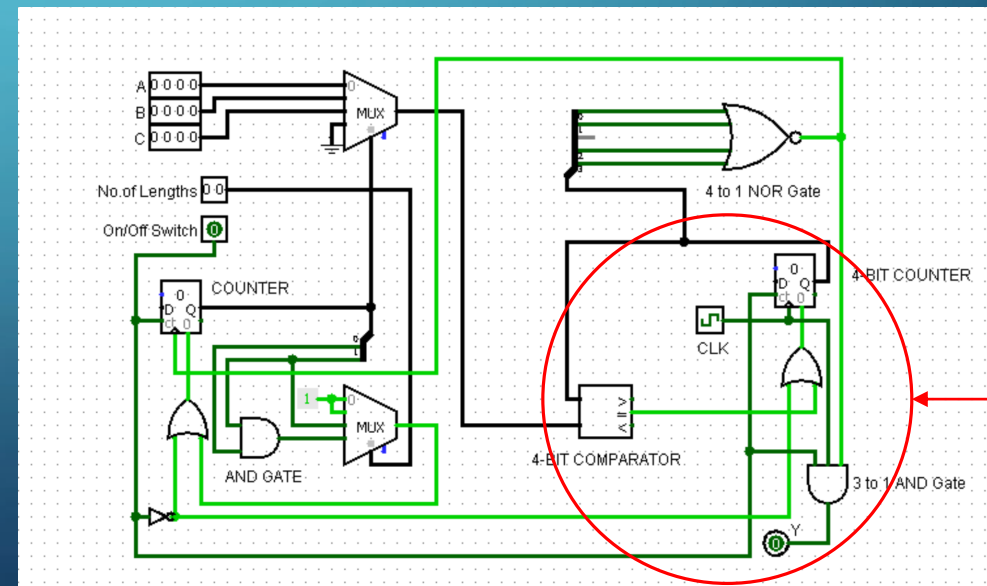
TOP LEVEL BLOCK DIAGRAM

INPUTS 1, 2, 3 are the lengths that need to be input from the user, and the number of lengths need to be defined.

The on/off switch starts in sync with the clock.
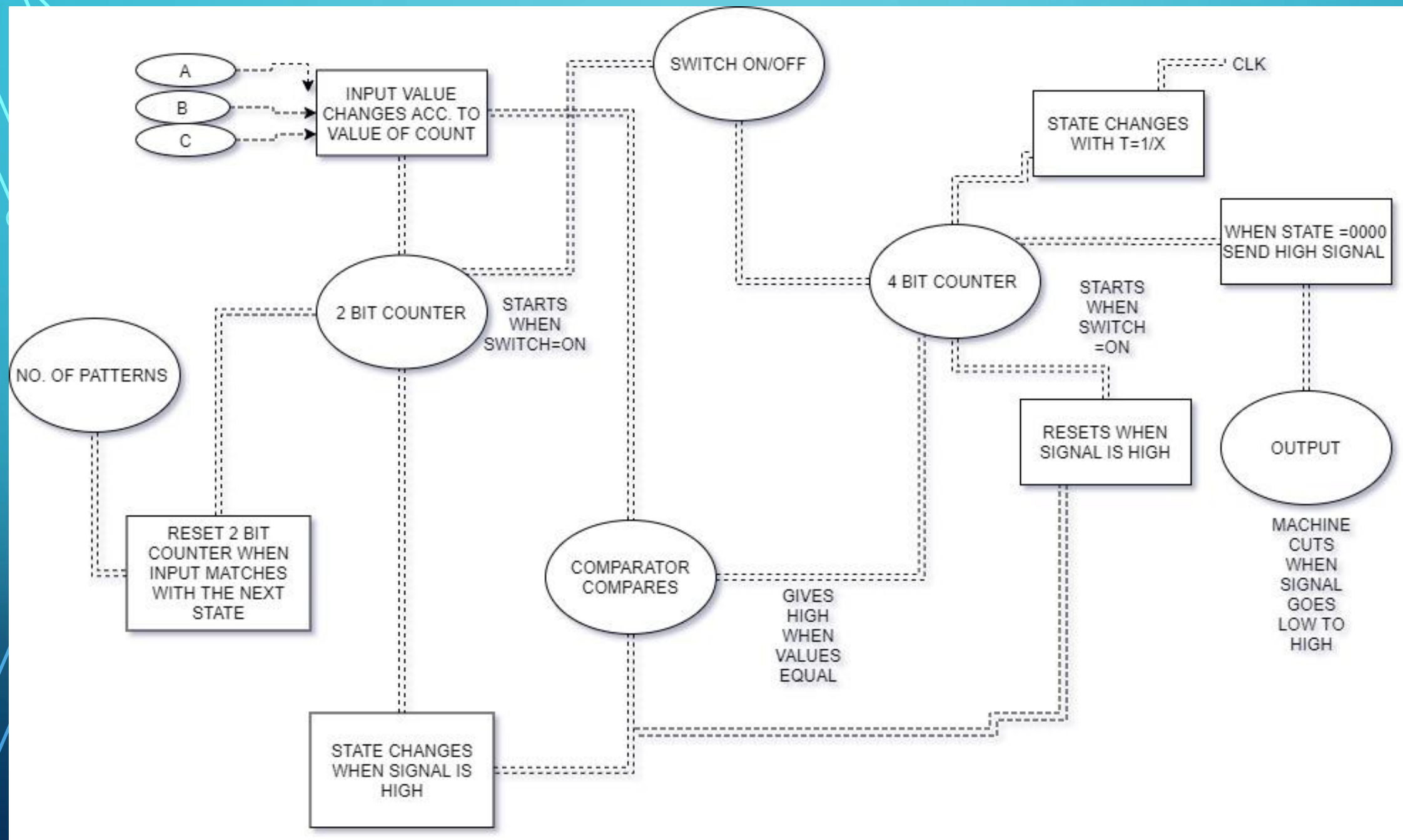
STATE DIAGRAM
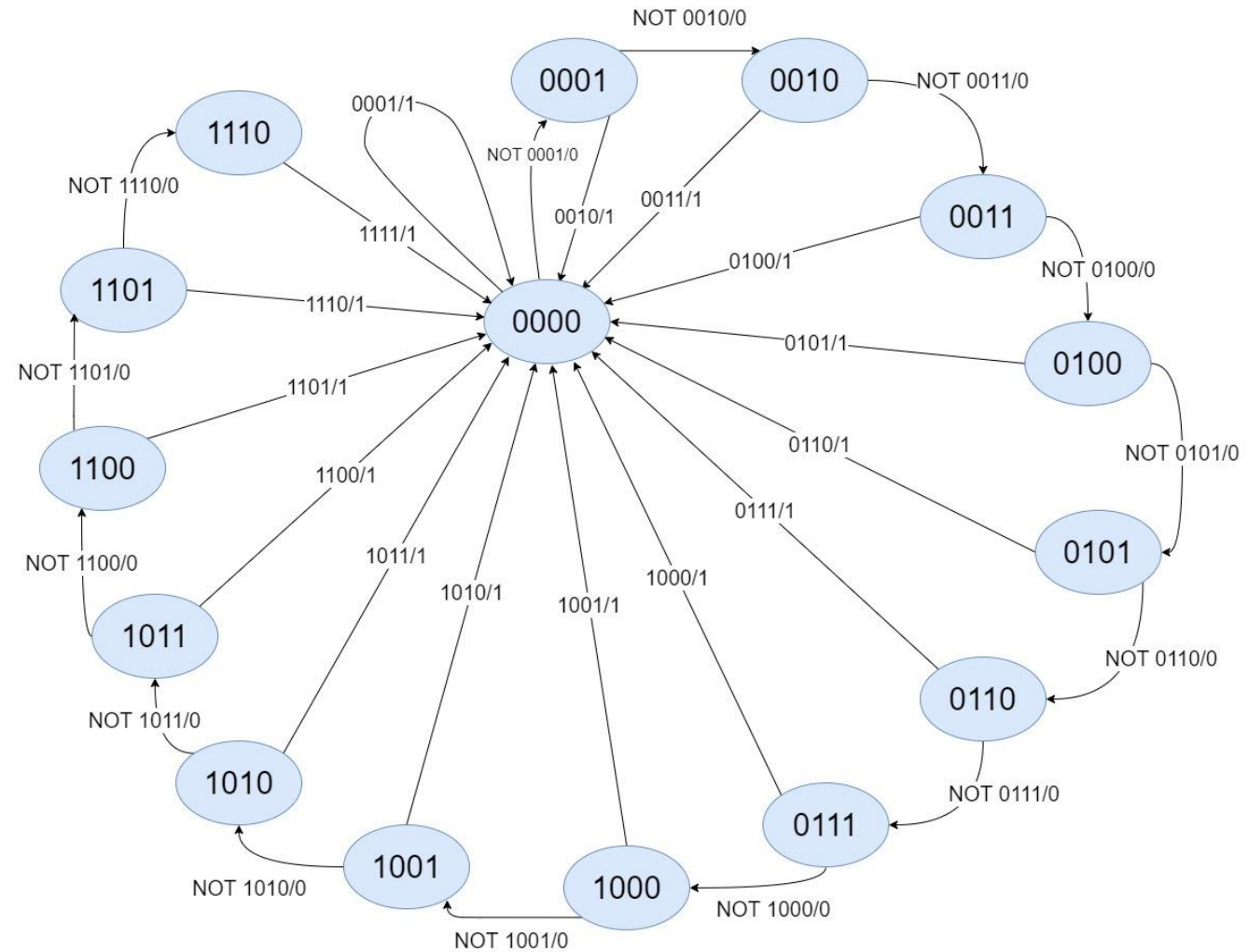
1. Each and every state transition occours after time period of 1 clock cycle.
2. The machine will cut every time when the state transists to [0000] as the output value become 1 at [0000]

FPGA IMPLEMENTATION

- We have prepared a module file for the FPGA chip implementation.
- The module for the same is attached separately.

SAMPLE INPUT-OUTPUT COMBINATION

11 is input to indicate that 3 patterns have to be cut

Machine works only while the switch is in 'On' state

1 time period corresponds to 1 meter of cloth

Cutter Cuts after 3 metres of cloth is fed.

Cutter Cuts after 2 metres of cloth is fed.

Cutter Cuts after 4 metres of cloth is fed.

The first pattern is circulated automatically in the circuit

On/Off Switch	No.of Patterns	A	B	C	Clock(550,260)	Y
1	11	3	2	4	0	0
1	11	3	2	4	1	0
1	11	3	2	4	0	0
1	11	3	2	4	1	0
1	11	3	2	4	0	0
1	11	3	2	4	1	1
1	11	3	2	4	0	0
1	11	3	2	4	1	0
1	11	3	2	4	0	0
1	11	3	2	4	1	1
1	11	3	2	4	0	0
1	11	3	2	4	1	0
1	11	3	2	4	0	0
1	11	3	2	4	1	0
1	11	3	2	4	0	0
1	11	3	2	4	1	0
1	11	3	2	4	0	0
1	11	3	2	4	1	1
1	11	3	2	4	0	0
1	11	3	2	4	1	0
1	11	3	2	4	0	0
1	11	3	2	4	1	0
1	11	3	2	4	0	0
1	11	3	2	4	1	1
1	11	3	2	4	0	0
1	11	3	2	4	1	0
1	11	3	2	4	0	0
1	11	3	2	4	1	1
1	11	3	2	4	0	0
1	11	3	2	4	1	0
1	11	3	2	4	0	0
1	11	3	2	4	1	0
1	11	3	2	4	0	0
1	11	3	2	4	1	0
1	11	3	2	4	0	0
1	11	3	2	4	1	1

EXTRA FUNCTIONALITY

i.   Data bits of the Additional circuit has been extended easily (by just increasing the bit length of the components already used).

ii.   After a power cut, when the power comes back the Additional circuit resumes its work from exactly where it stopped before the power cut.

iii.   A Reset button has been given to reset the circuit so that when new input is given no cloth is wasted, also in case of any hardware malfunction the circuit can be reset to start fresh without any additional wastage.

iv.   An important feature is introduced to the Additional circuit which gives out pre-set quantity of the cloth.

v.   For example if the user pre-sets no. of pieces = 50 and choses three lengths say 5m, 15m and 25m. The machine will give 50 slices of 5m cloth and another 50 slices of 15m cloth and another 50 slices of 25m cloth.

vi.   A cloth count enable is given. The user will enable the cloth count when he requires a specific quantity of cloth and then enter the "no. of pieces". When switched on then the machine will give the specified amount of cloth and then stop automatically.

vii.   The user will disable the cloth count when he does not need a specific quantity of cloth and needs bulk of cloth of same sizes. The user can ignore the "no. of pieces". When switched on the machine will keep on cutting the cloth unless switched off.

Circuit shown on next slide

PIN OUT DIAGRAM

(FOR THE BASIC CIRCUIT)
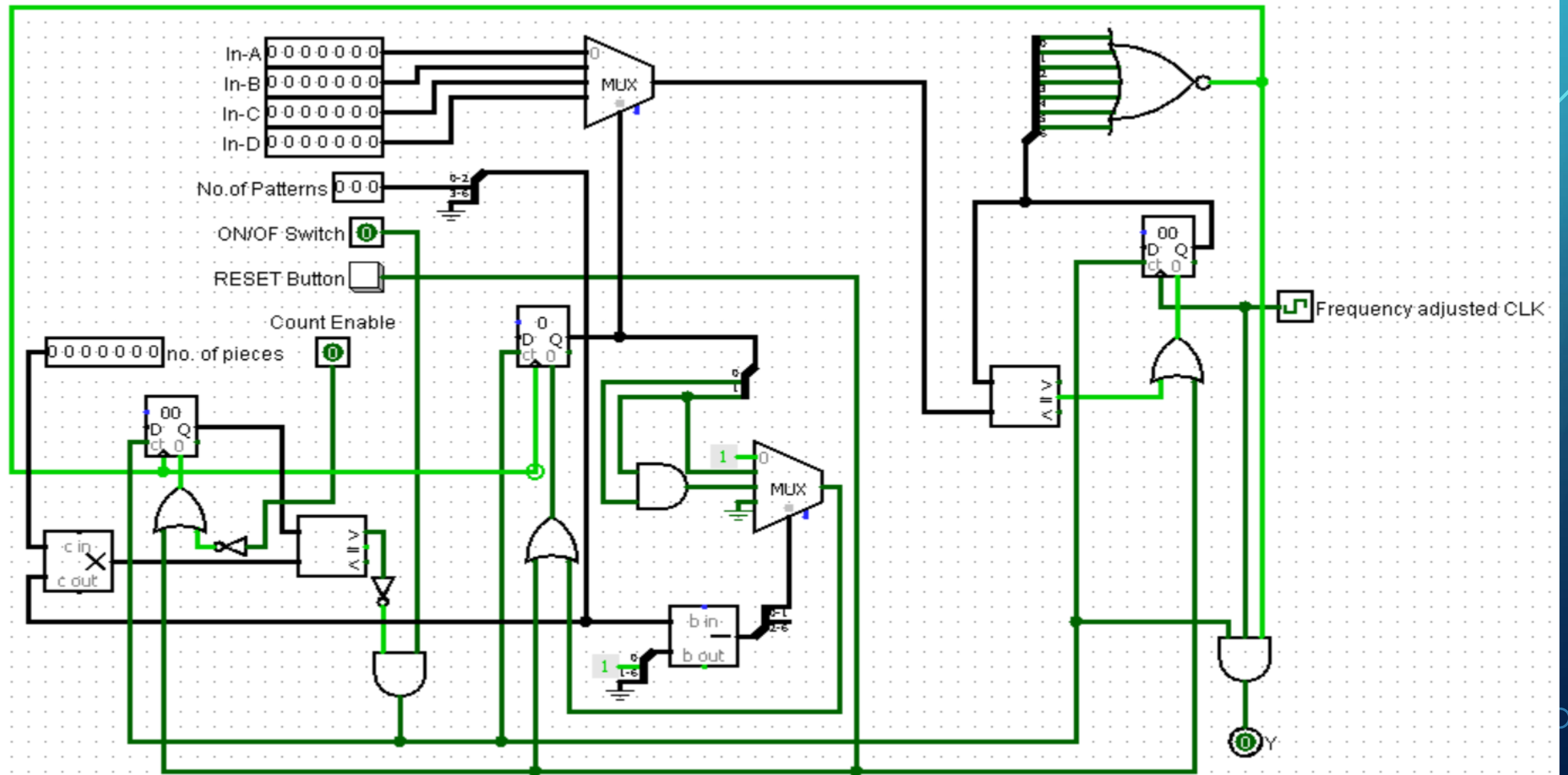
(ALSO ATTACHED SEPARATELY)
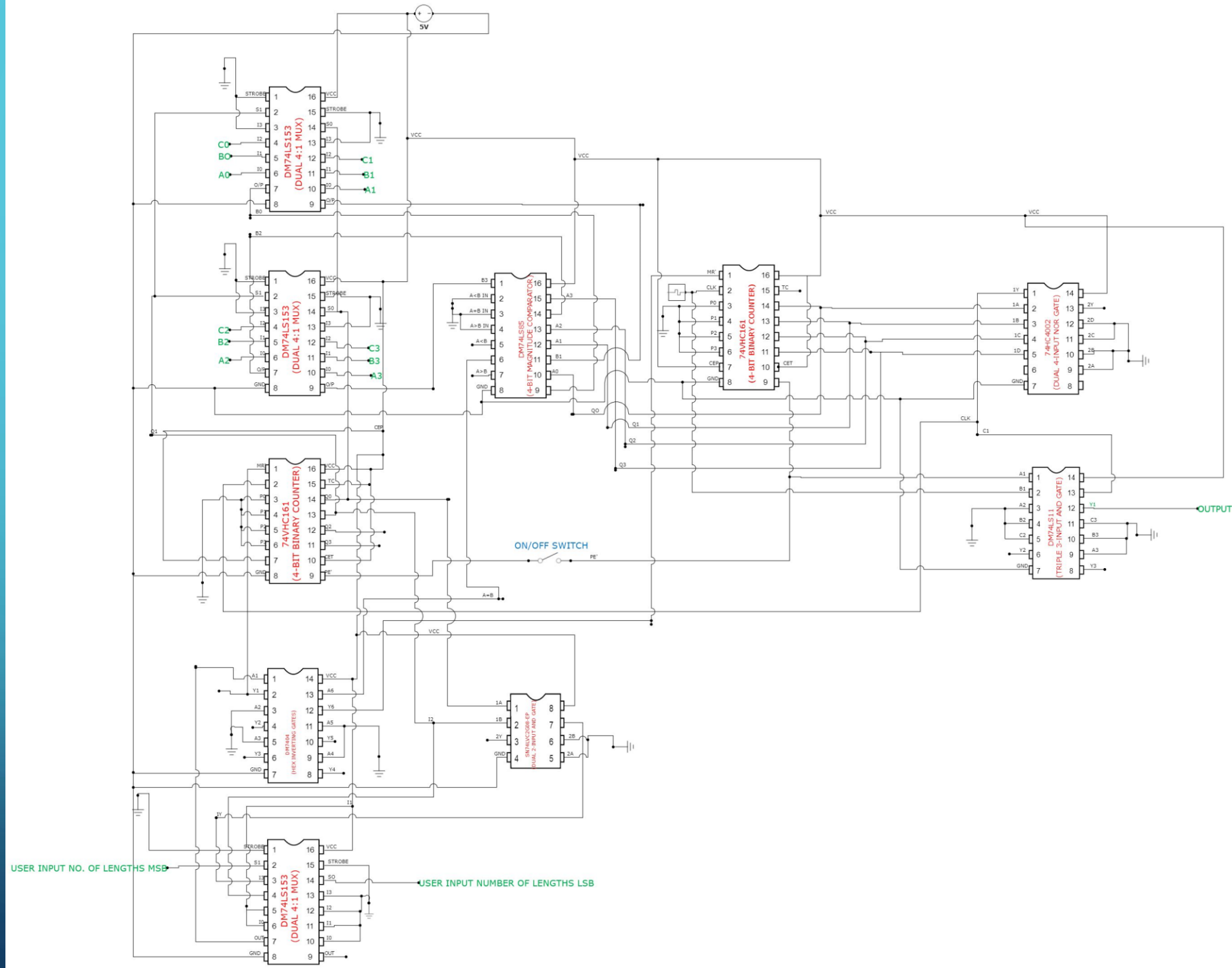
APPENDIX

S.No.	IC NAME	DESCRIPTION	COMPANY
1.	74HC4002	Dual 4-inut NOR gate	Nexperia
2.	74VHC161	4-Bit Counter with Asynchronous Clear	Fairchild
3.	DM74LS11	Triple 3-Input AND gate	Fairchild
4.	DM74LS85	4-Bit Magnitude Comparator	Fairchild
5.	DM74LS153	Dual 1-of-4 Line Data Selectors/Multiplexers	Fairchild
6.	DM7404	Hex Inverting Gates	Fairchild
7.	SN74LVC2G08-EP	Dual 2-Input Positive AND Gate	Texas Instruments

BILL OF MATERIALS

COMPONENT	CHIP NUMBER	QUANTITY	PRICE OF 1 CHIP	PRICE
			(in Indian Rupees)	(in Indian Rupees)
Dual MUX	DM74LS153	3	12.71	38.13
4Bit Binary binary counter	74VHC161	2	57.00	114.00
4Bit Magnitude Comparator	DM74LS85	1	19.00	19.00
Dual 4 input NOR gate	74HC4002	1	15.00	15.00
Triple 3 input AND gate	DM74LS11	1	17.50	17.50
Hex Inverting gates	DM7404	1	18.00	18.00
Dual 2 input positive AND gate	SN74LVC2G08	1	10.40	10.40

TOTAL COST = RUPEES 232.02