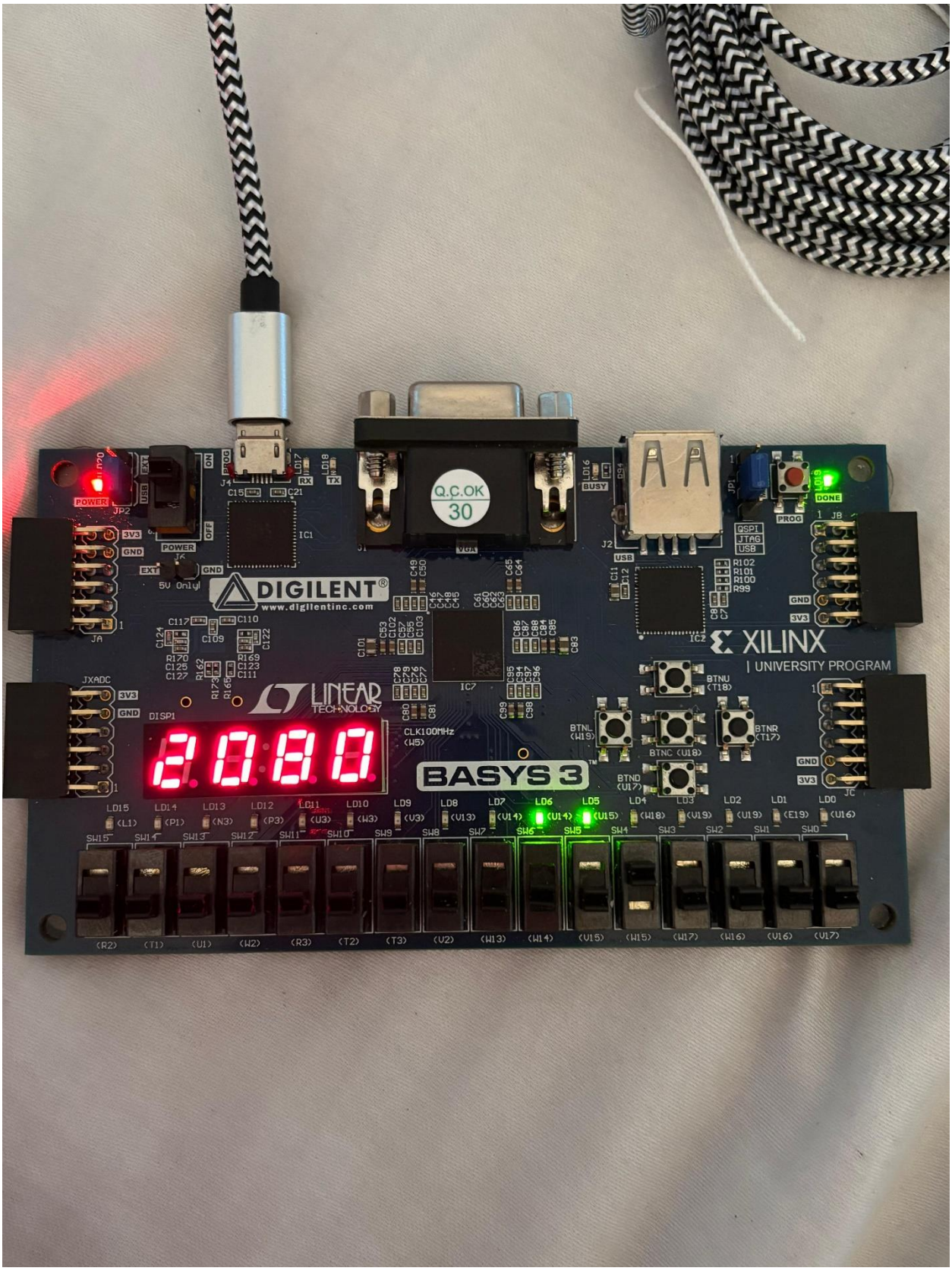
MIPS PIPELINED – PHOTOS

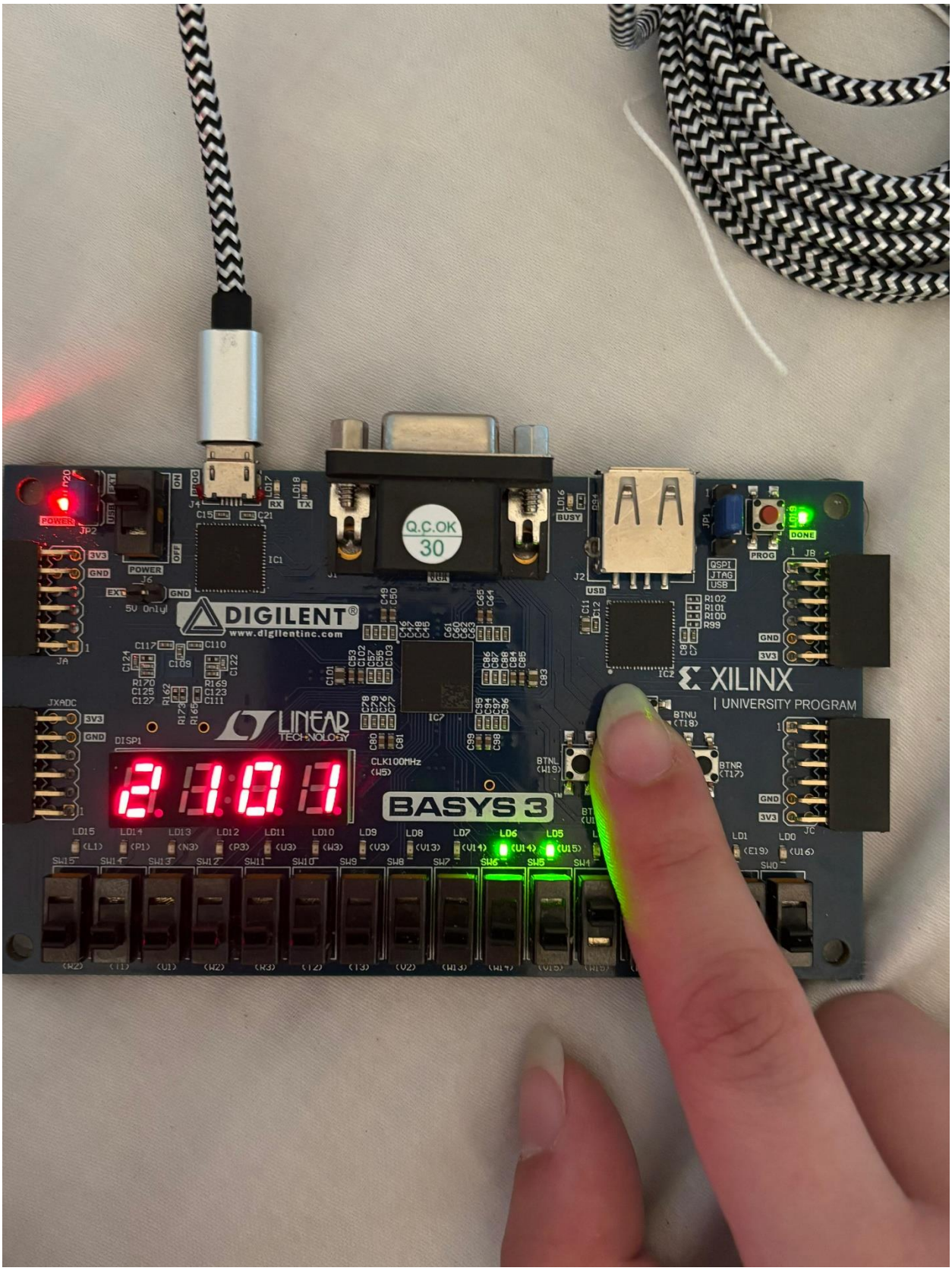
PROGRAM COUNTER IN MIPS PIPELINED

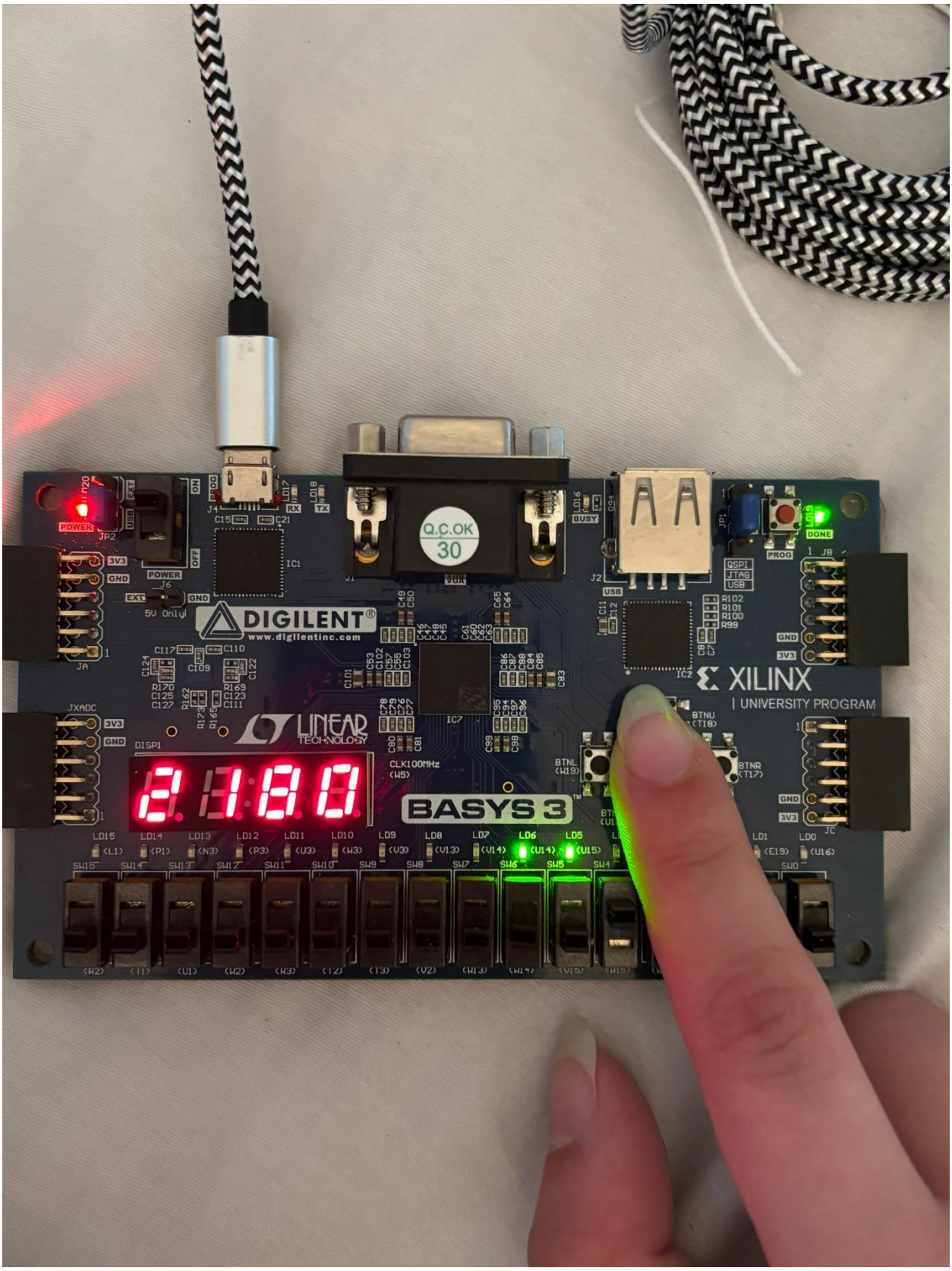
Program Fibonacci:

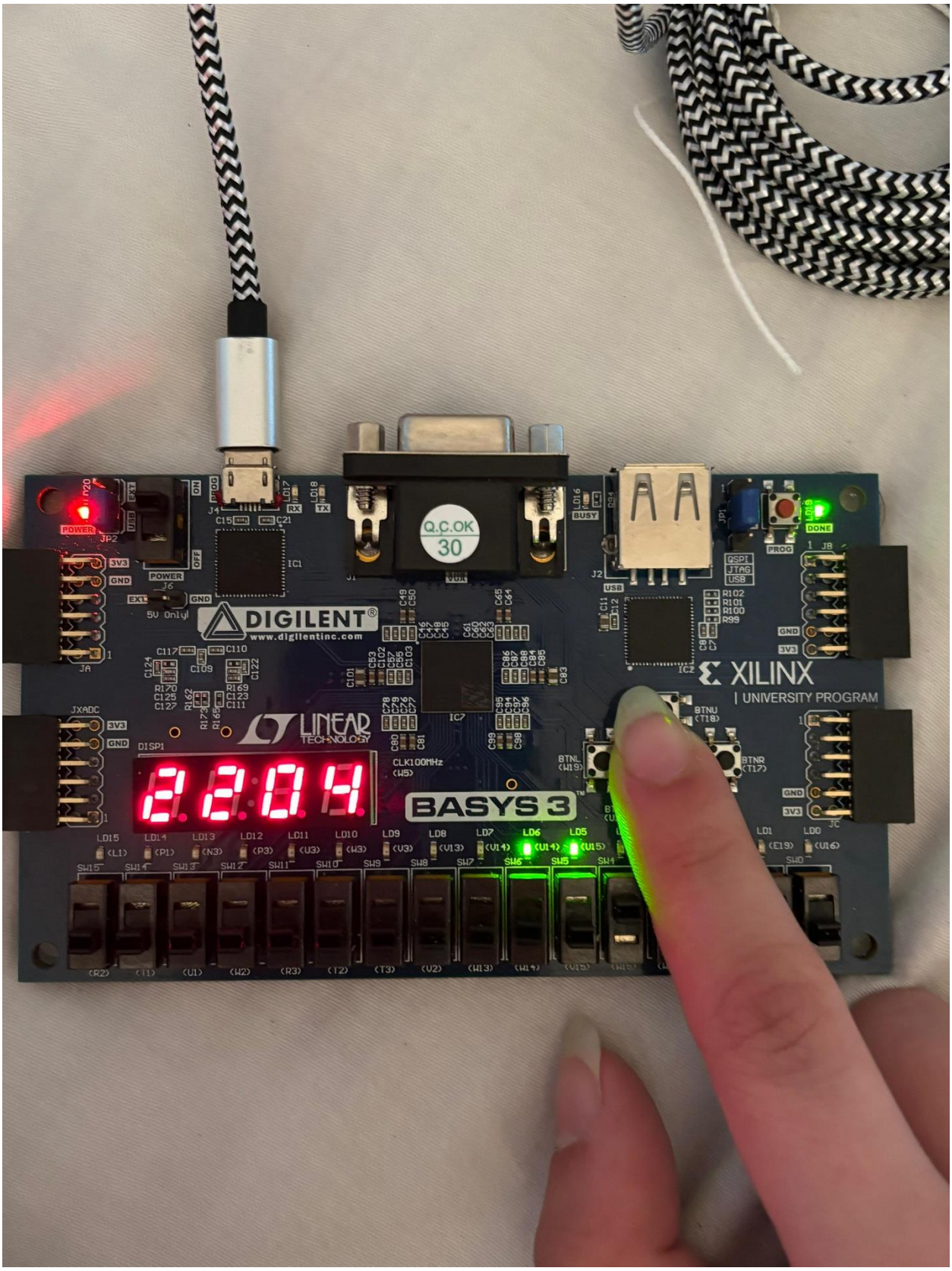
```
-- Initialize registers
 B"001_000_001_0000000",  -- addi $1, $0, 0      ; $1 = 0
 B"001_000_010_0000001",  -- addi $2, $0, 1      ; $2 = 1
 B"001_000_011_0000000",  -- addi $3, $0, 0      ; $3 = 0 (address base)
 B"001_000_100_0000100",  -- addi $4, $0, 4      ; $4 = 4 (address base aligned)

 -- Store $1 at 0($3) → RAM[0]
 B"011_011_001_0000000",  -- sw $1, 0($3)
 -- Store $2 at 0($4) → RAM[1] (4 bytes offset)
 B"011_100_010_0000000",  -- sw $2, 0($4)

 -- Load $1 from 0($3)
 B"010_011_001_0000000",  -- lw $1, 0($3)
 B"000_000_000_000_0_000",-- NoOp
 B"000_000_000_000_0_000",-- NoOp

 -- Load $2 from 0($4)
 B"010_100_010_0000000",  -- lw $2, 0($4)
 B"000_000_000_000_0_000",-- NoOp
 B"000_000_000_000_0_000",-- NoOp
 B"000_000_000_000_0_000",-- NoOp

 -- Fibonacci addition $5 = $1 + $2
 B"000_001_010_101_0_000",-- add $5, $1, $2
```

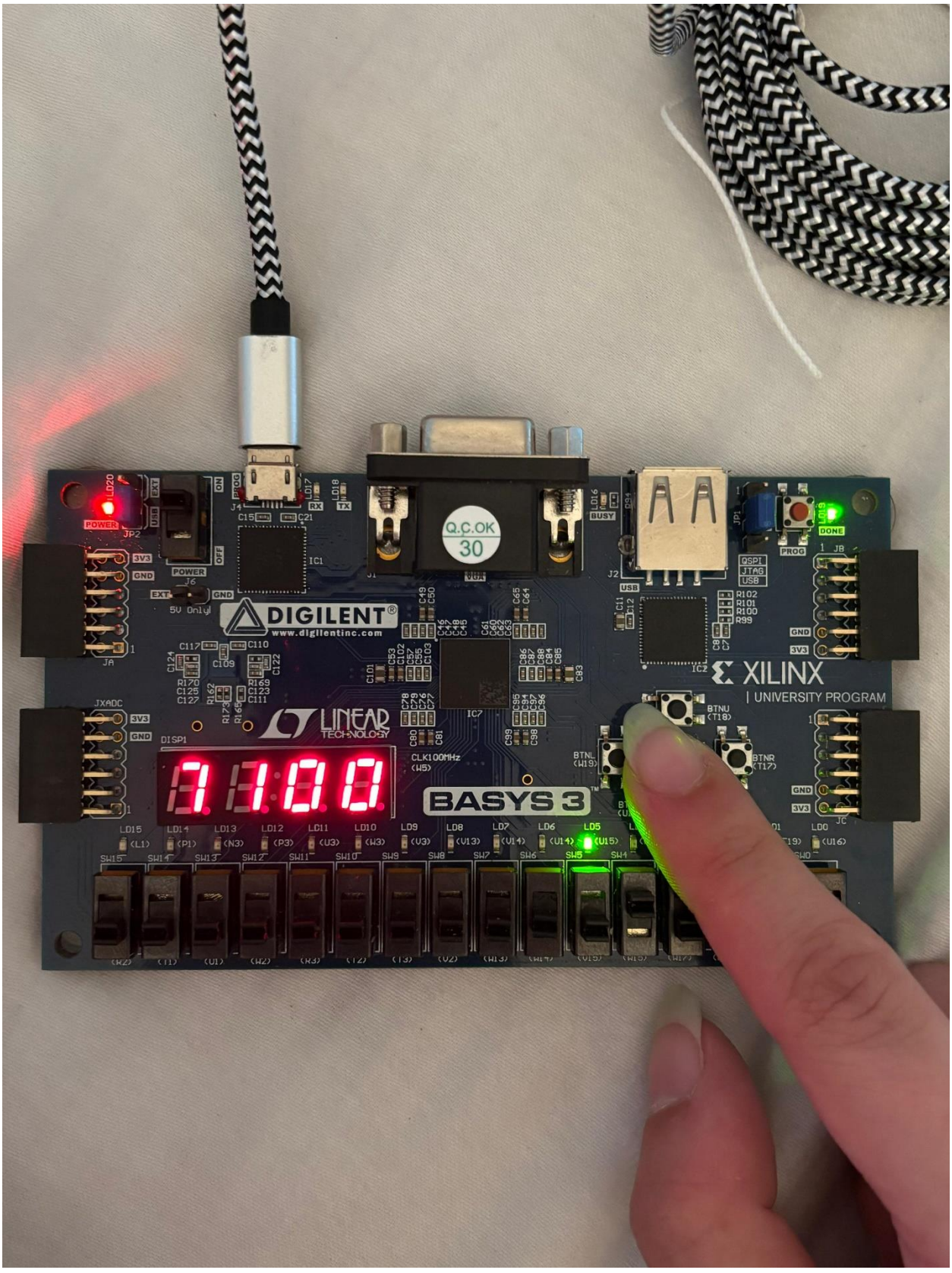
```
B"000_000_000_000_0_000",-- NoOp
B"000_000_000_000_0_000",-- NoOp

-- Next steps: update registers for next Fibonacci terms
B"000_000_010_001_0_000",-- add $1, $0, $2   ; $1 = $2 (next term)
B"000_000_101_010_0_000",-- add $2, $0, $5   ; $2 = $5 (next term)
B"000_000_000_000_0_000",-- NoOp (delay slot)

-- Jump to loop start at address 12 (index 12 in ROM)
B"111_000_000_0001100",  -- jump to address 12 (hex E00C)
```

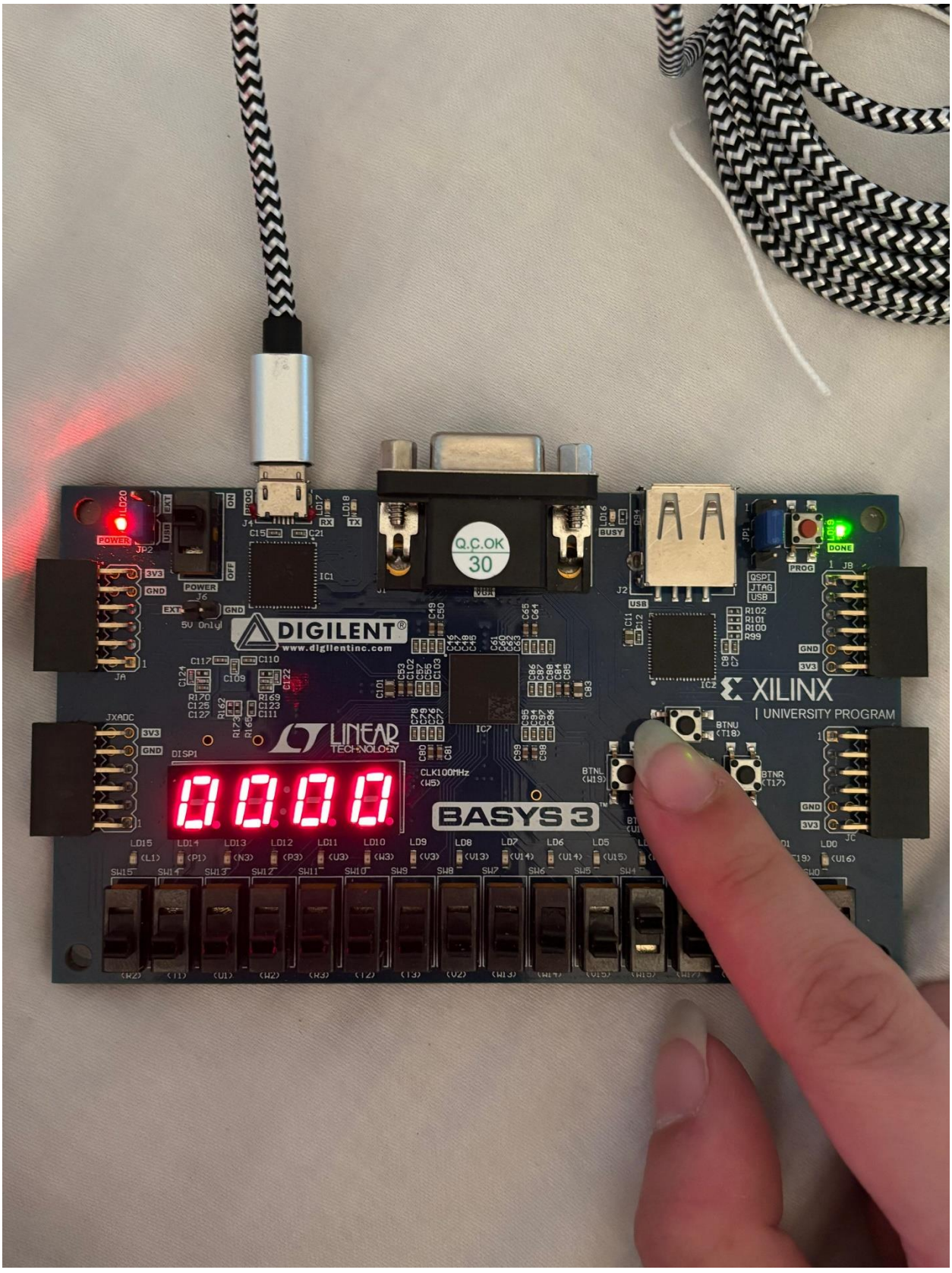

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
2.0.8.0
CLK100MHz (W5)
Q.C.OK
30

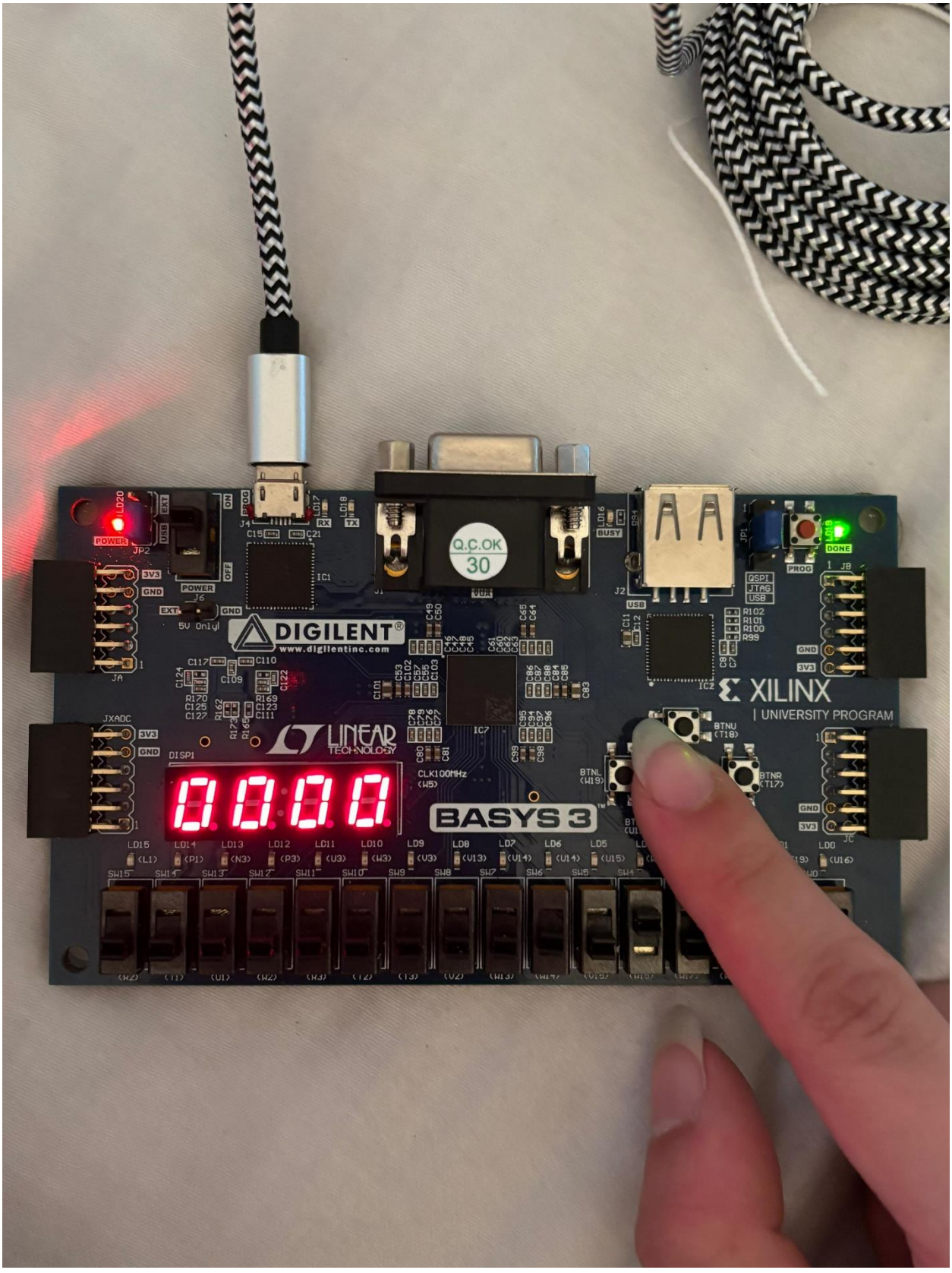

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
CLK100MHz
(W5)
DISP1
JXADC
POWER
PROG
DONE
QSPI
JTAG
USB
5V Only
LD15 LD14 LD13 LD12 LD11 LD10 LD9 LD8 LD7 LD6 LD5 LD1 LD0
SW15 SW14 SW13 SW12 SW11 SW10 SW9 SW8 SW7 SW6 SW5 SW1 SW0

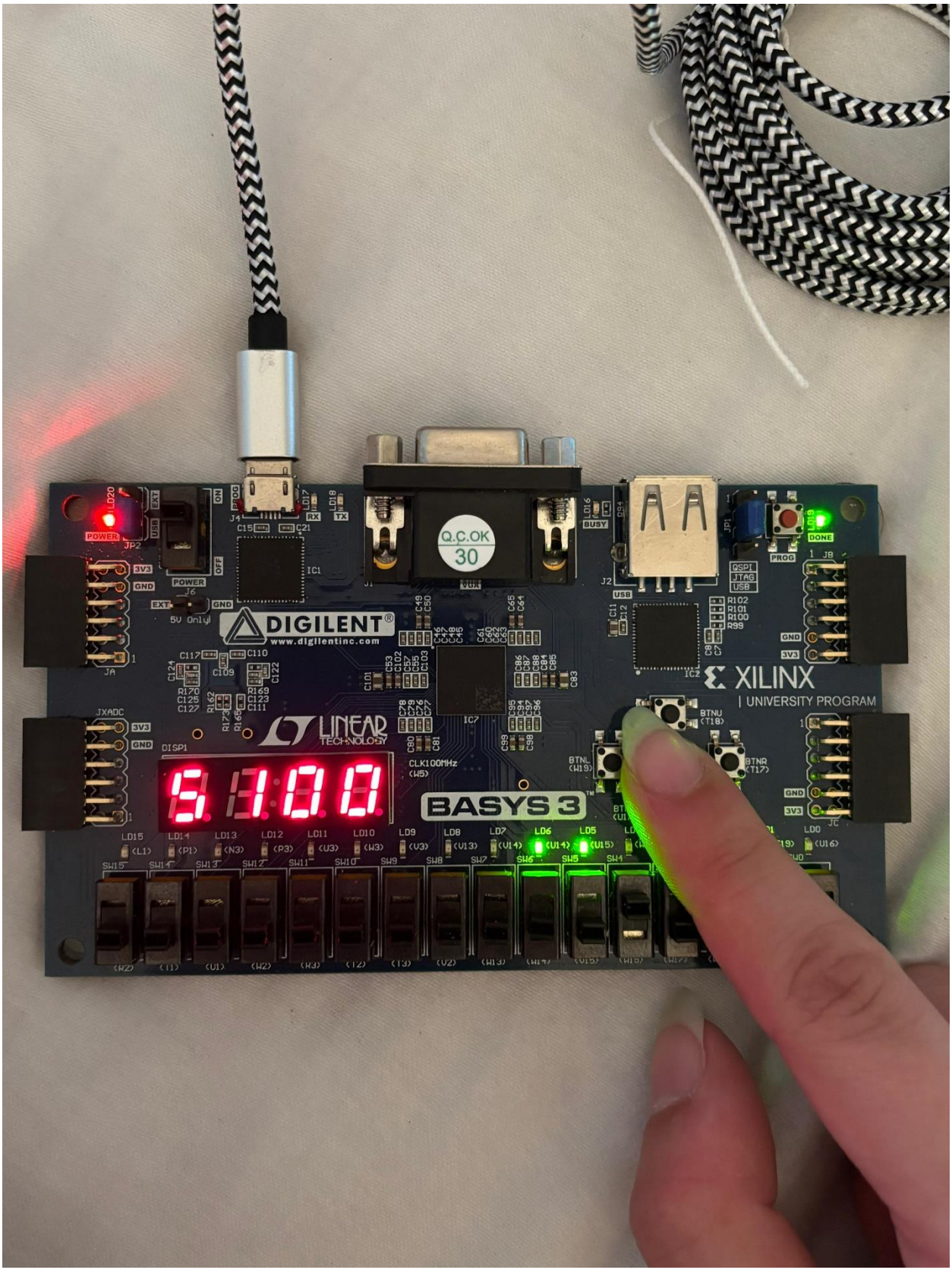

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
QSPI
JTAG
USB
CLK100MHz
(W5)
DISP1
JXADC
JA
JB
JC
BTNL
(W19)
BTNR
(T17)
BTNU
(T18)
LD15 LD14 LD13 LD12 LD11 LD10 LD9 LD8 LD7 LD6 LD5
SW15 SW14 SW13 SW12 SW11 SW10 SW9 SW8 SW7 SW6 SW5 SW4

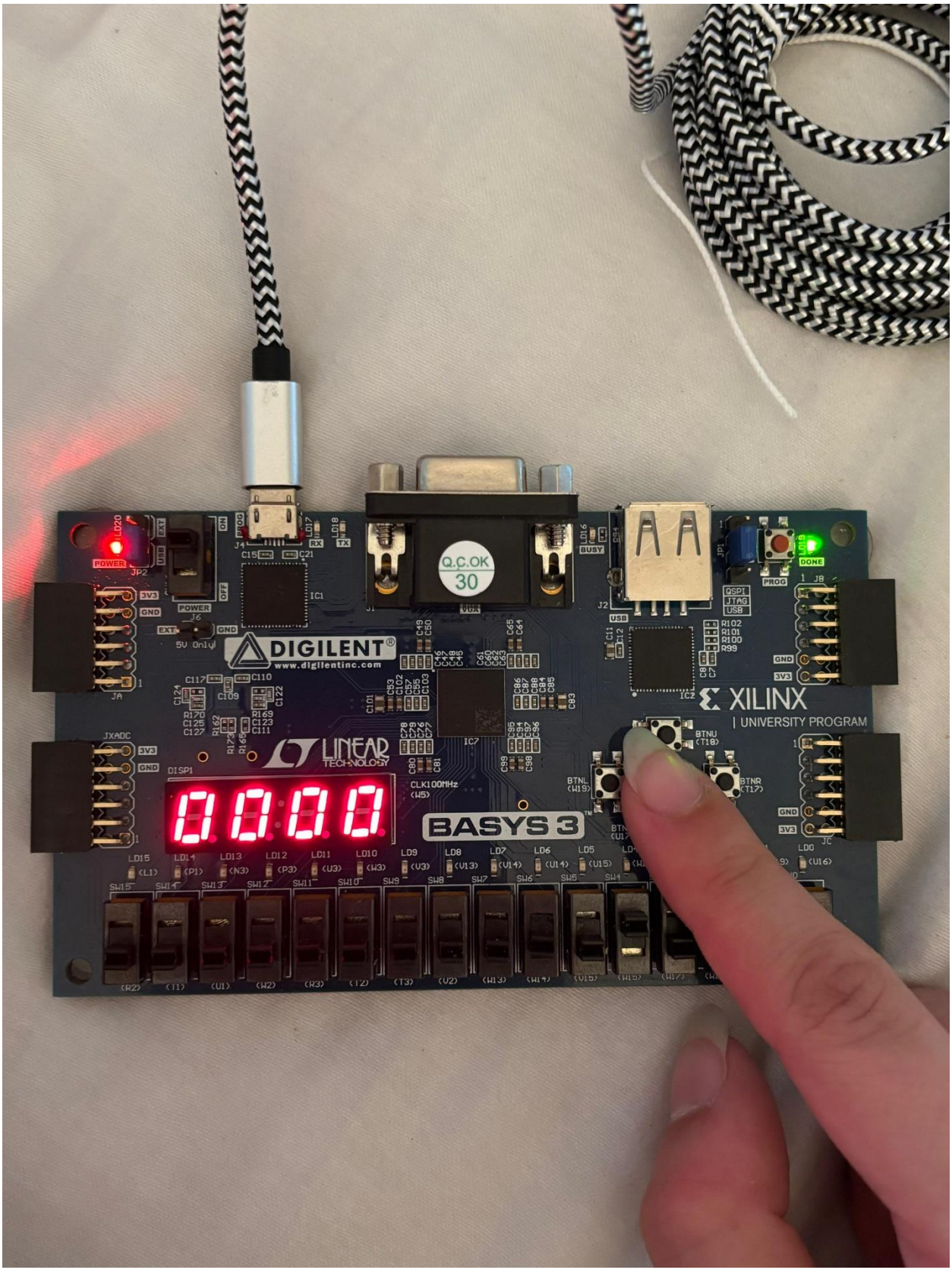

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
CLK100MHz
(W5)
DISP1
JXADC
POWER
5V Only
PROG
DONE
BUSY
QSPI
JTAG
USB
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
LD15 LD14 LD13 LD12 LD11 LD10 LD9 LD8 LD7 LD6 LD5
SW15 SW14 SW13 SW12 SW11 SW10 SW9 SW8 SW7 SW6 SW5 SW4 SW0

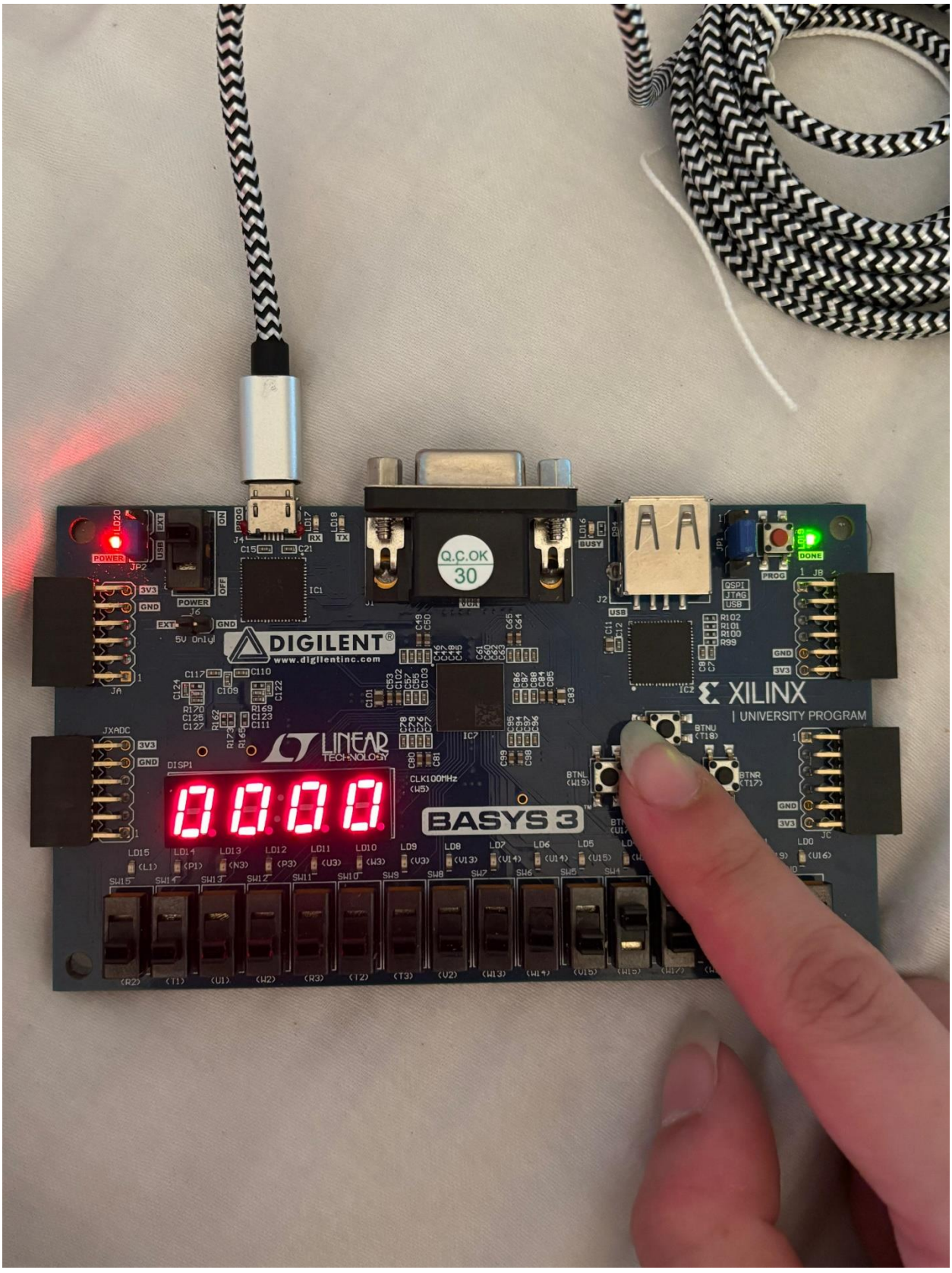

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
DISP1
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
JXADC
JA
JB
JC
PROG
DONE
QSPI
JTAG
USB
5V Only
LD15 LD14 LD13 LD12 LD11 LD10 LD9 LD8 LD7 LD6 LD5
SW15 SW14 SW13 SW12 SW11 SW10 SW9 SW8 SW7 SW6 SW5 SW4

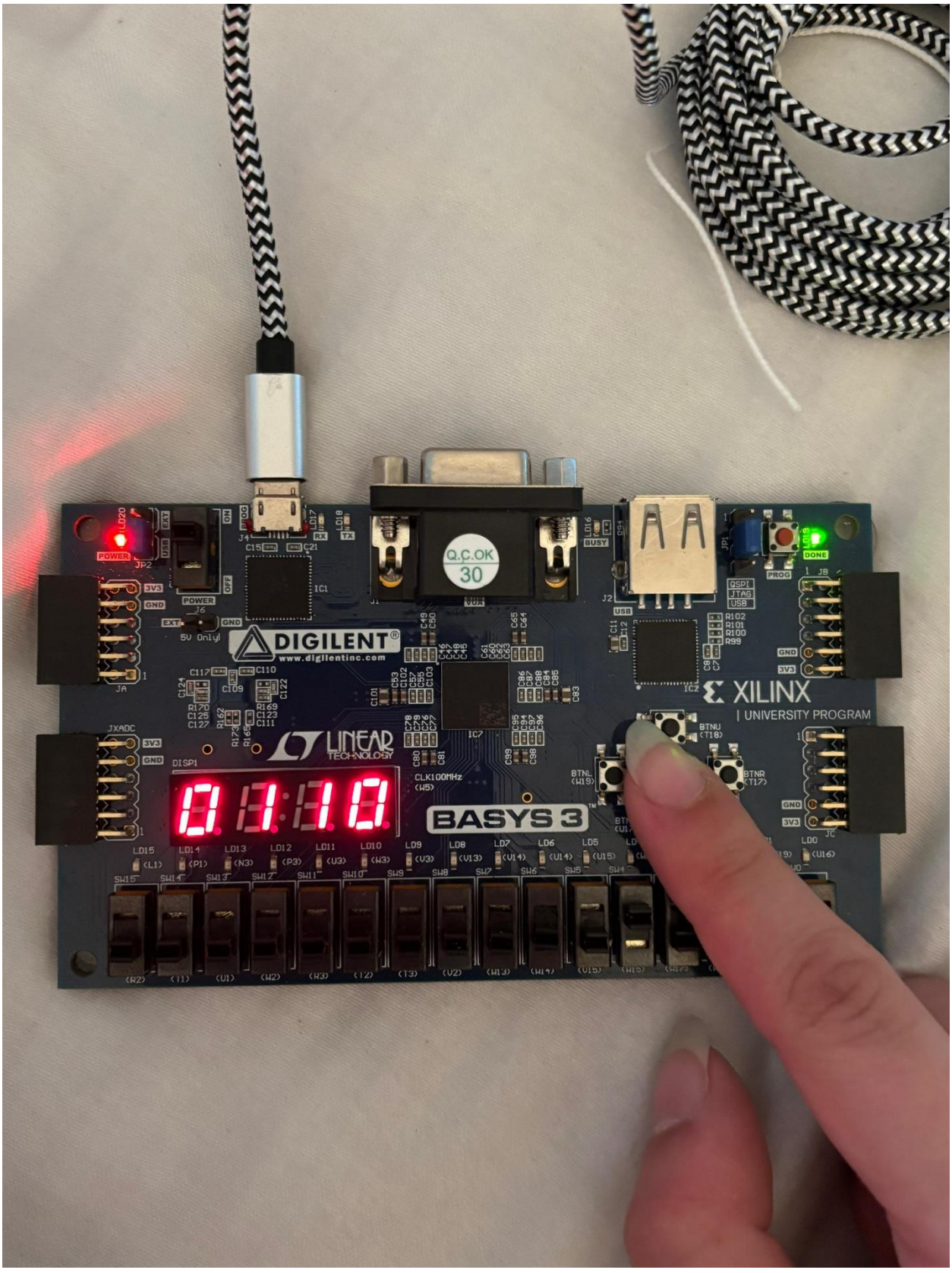

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
DISP1
JXADC
POWER
PROG
DONE
QSPI
JTAG
USB
BUSY
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5
LD0

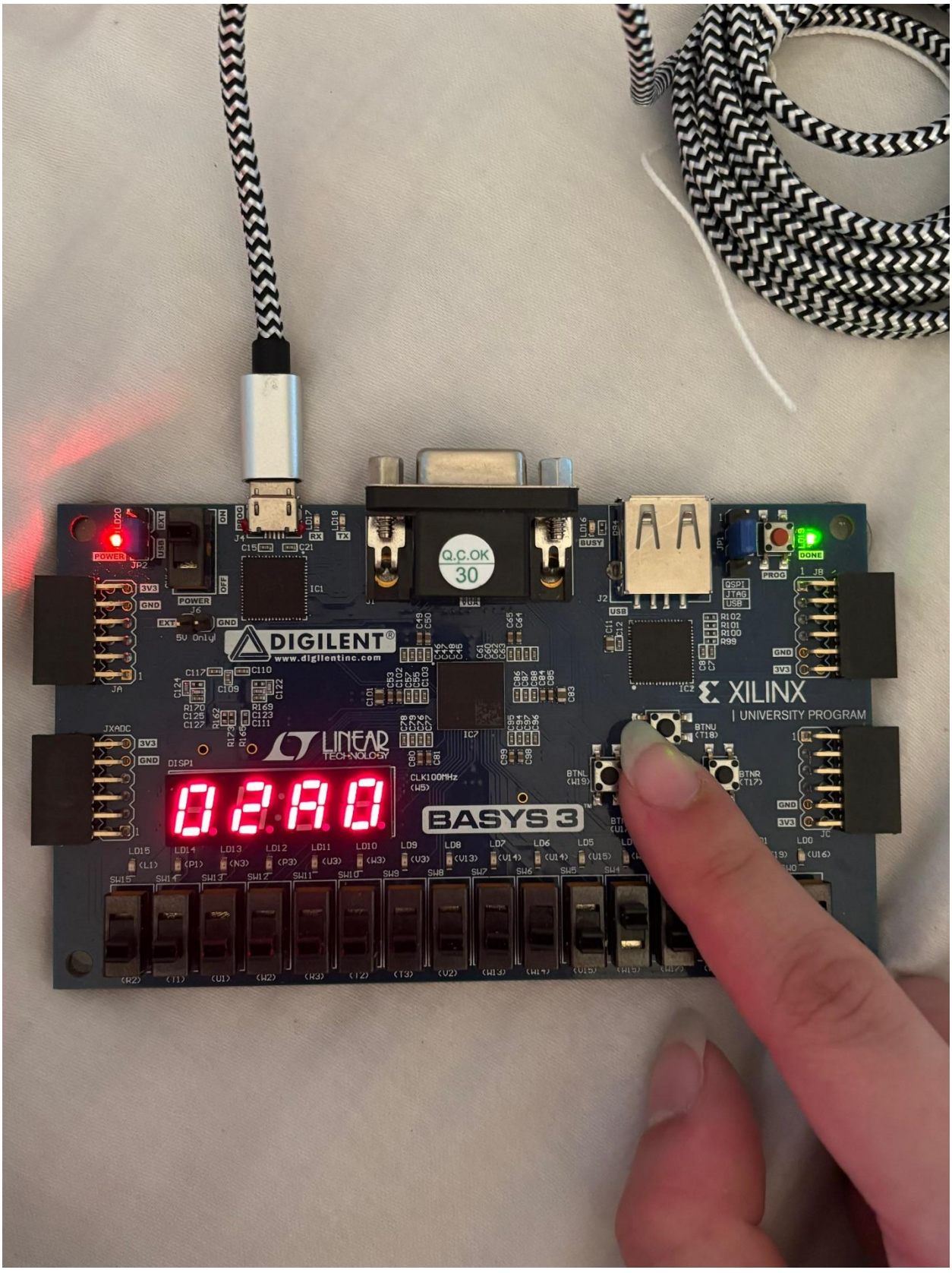

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
QSPI
JTAG
USB
5V Only!
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
DISP1
JXADC
JA
JB
JC

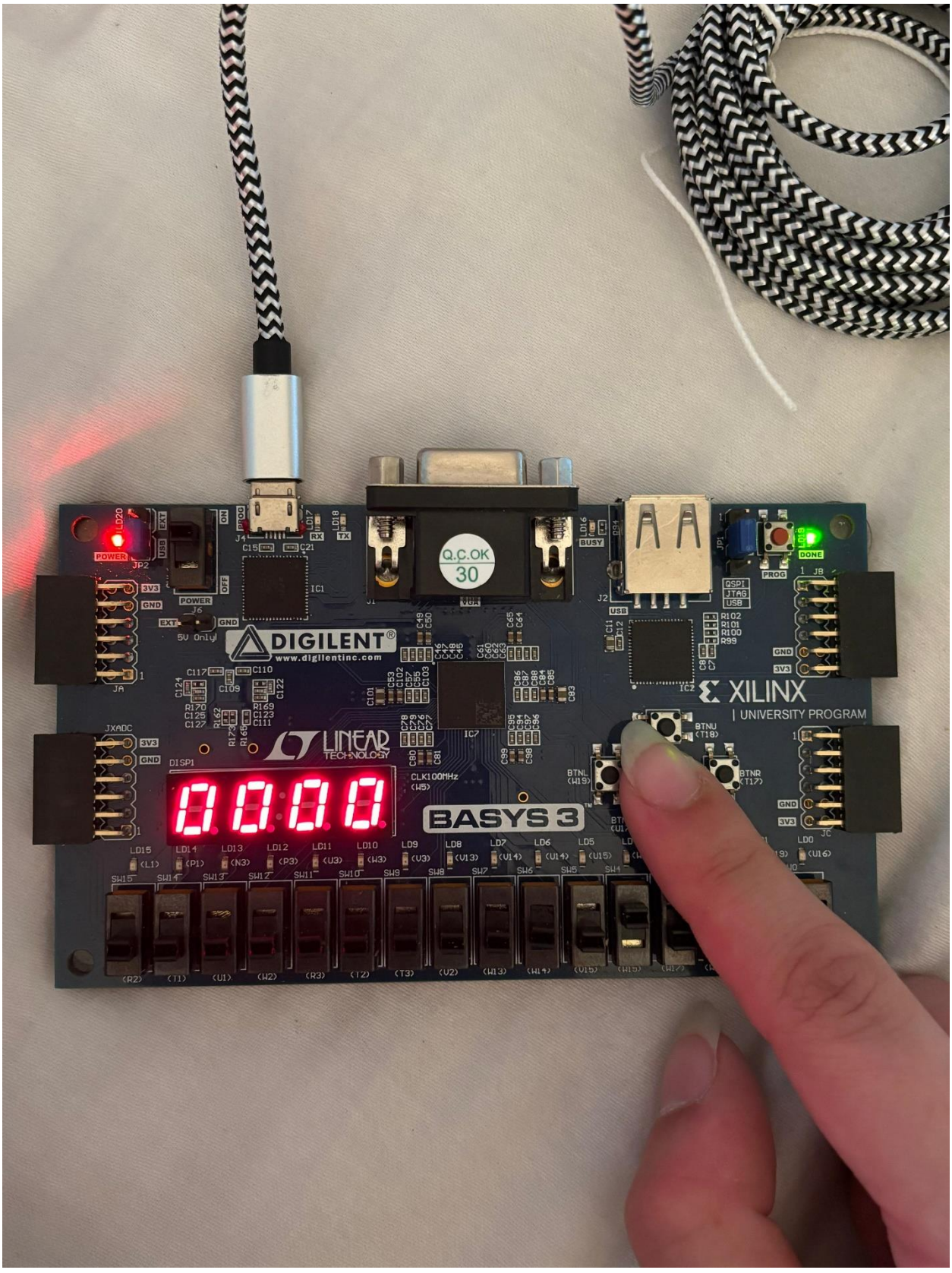

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
5V Only
CLK100MHz
(W5)
DISP1
JXADC
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
LD15 LD14 LD13 LD12 LD11 LD10 LD9 LD8 LD7 LD6 LD5
SW15 SW14 SW13 SW12 SW11 SW10 SW9 SW8 SW7 SW6 SW5 SW4

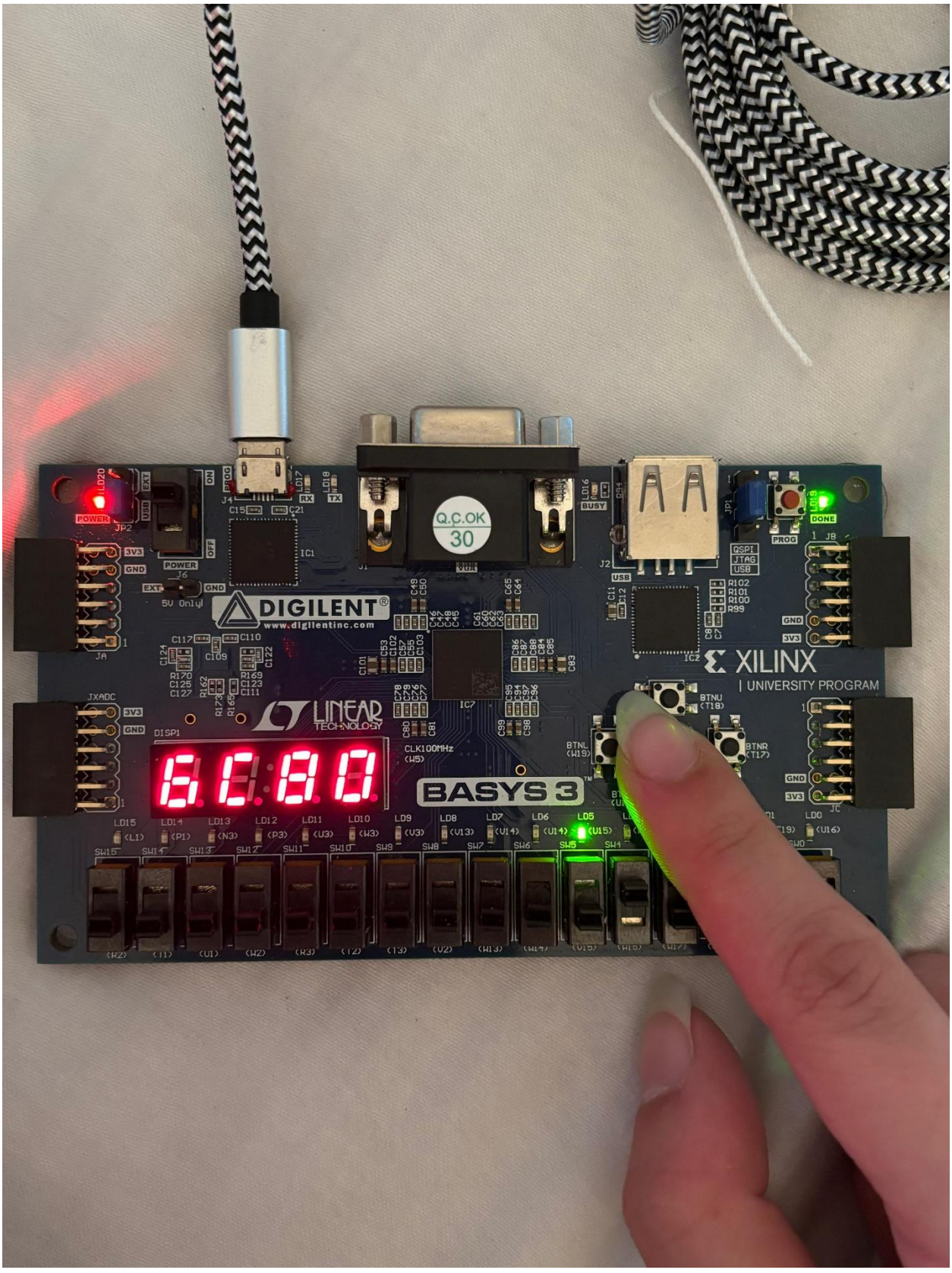

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
DONE
BUSY
PROG
QSPI
JTAG
USB
5V Only
DISP1
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
JXADC
JA
JB
JC
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5
SW15
SW14
SW13
SW12
SW11
SW10
SW9
SW8
SW7
SW6
SW5

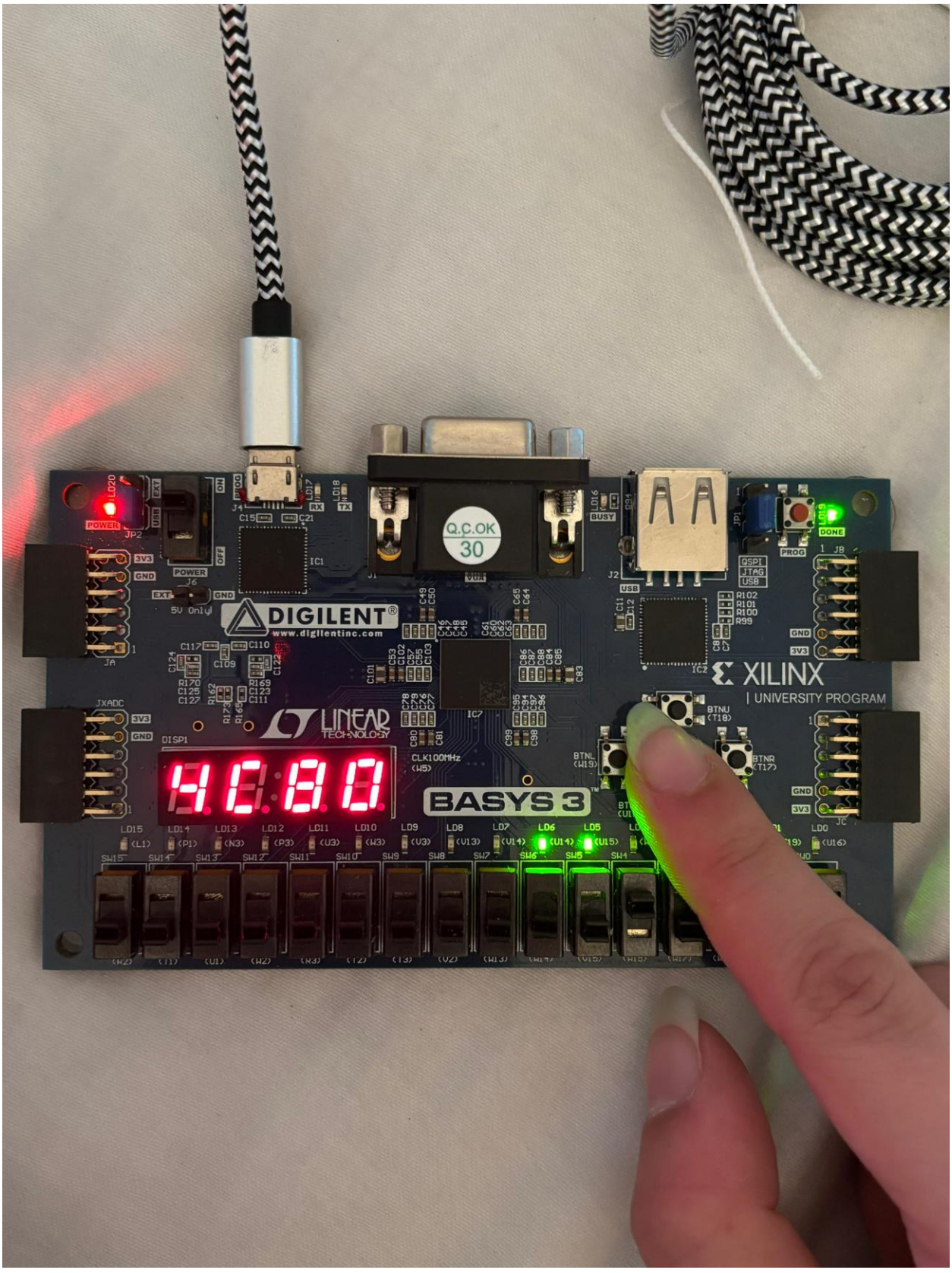

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
QSPI
JTAG
USB
VGA
JXADC
DISP1
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5
SW15
SW14
SW13
SW12
SW11
SW10
SW9
SW8
SW7
SW6
SW5
SW4

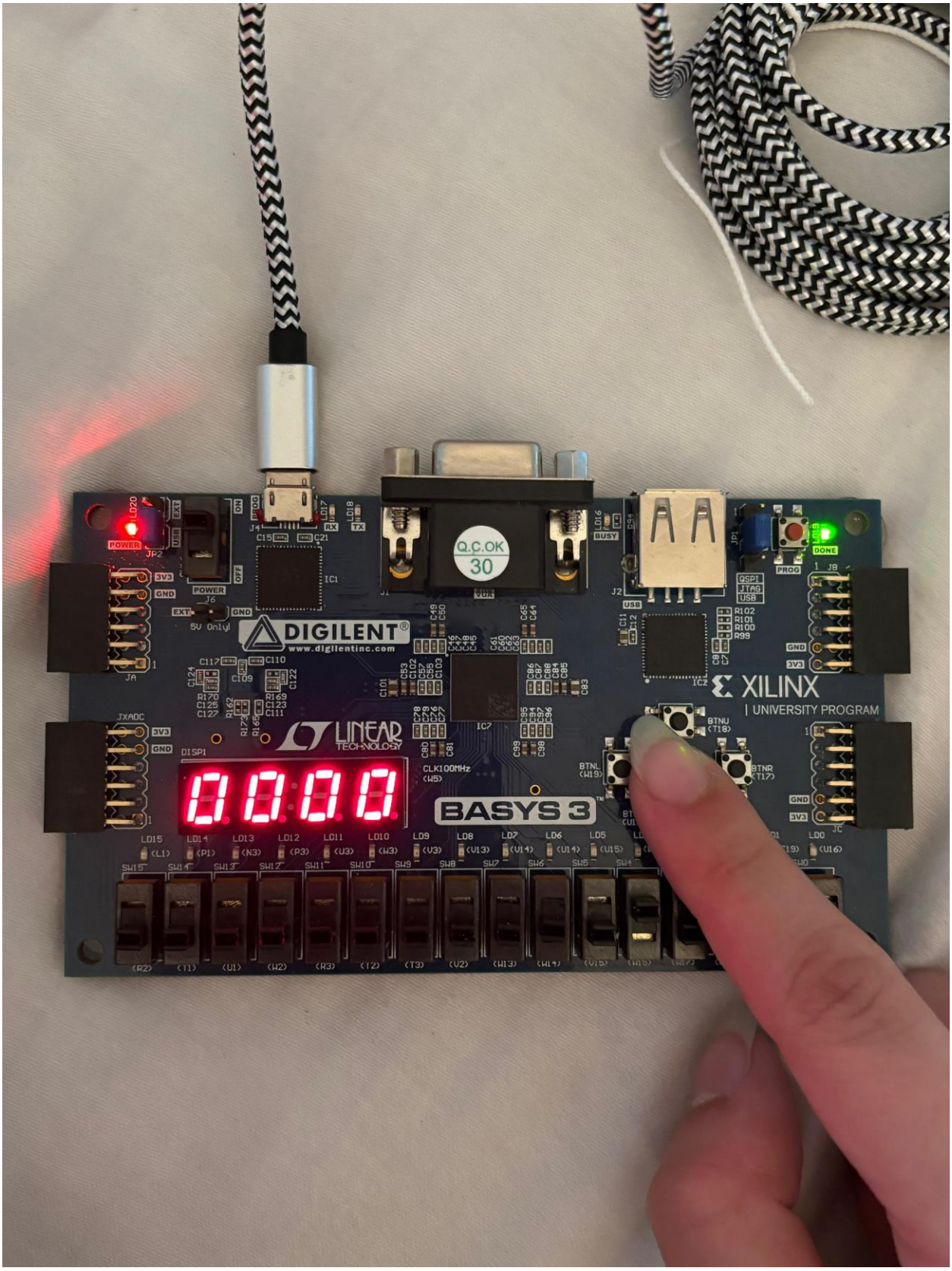

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
QSPI
JTAG
USB
DISP1
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
JA
JB
JC
JXADC
3V3
GND
5V Only
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5
LD0
SW15
SW14
SW13
SW12
SW11
SW10
SW9
SW8
SW7
SW6
SW5

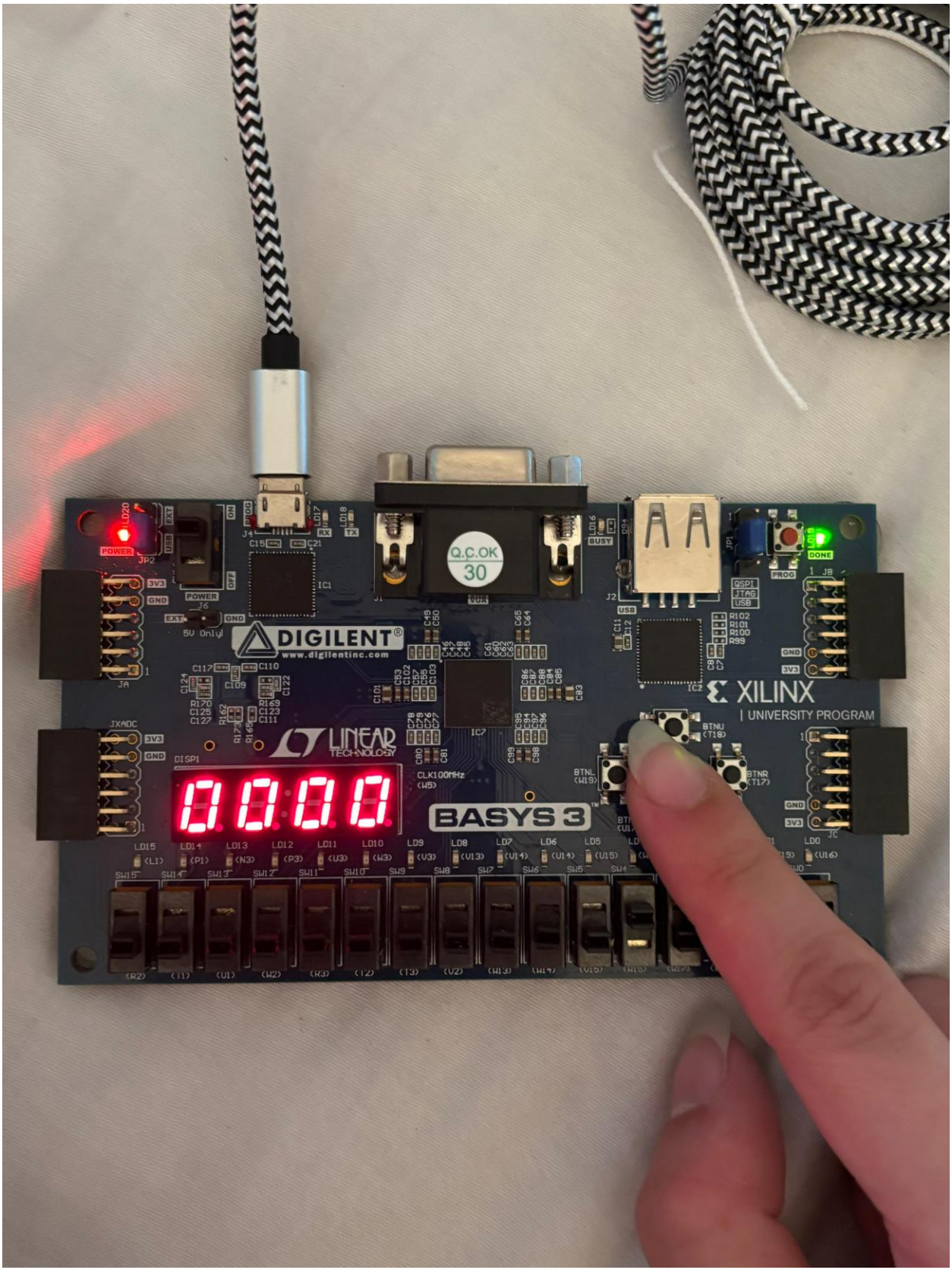

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
0 2 A 0
CLK100MHz
(W5)
DISP1
JXADC
POWER
PROG
DONE
BUSY
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5
SW15
SW14
SW13
SW12
SW11
SW10
SW9
SW8
SW7
SW6
SW5
SW4

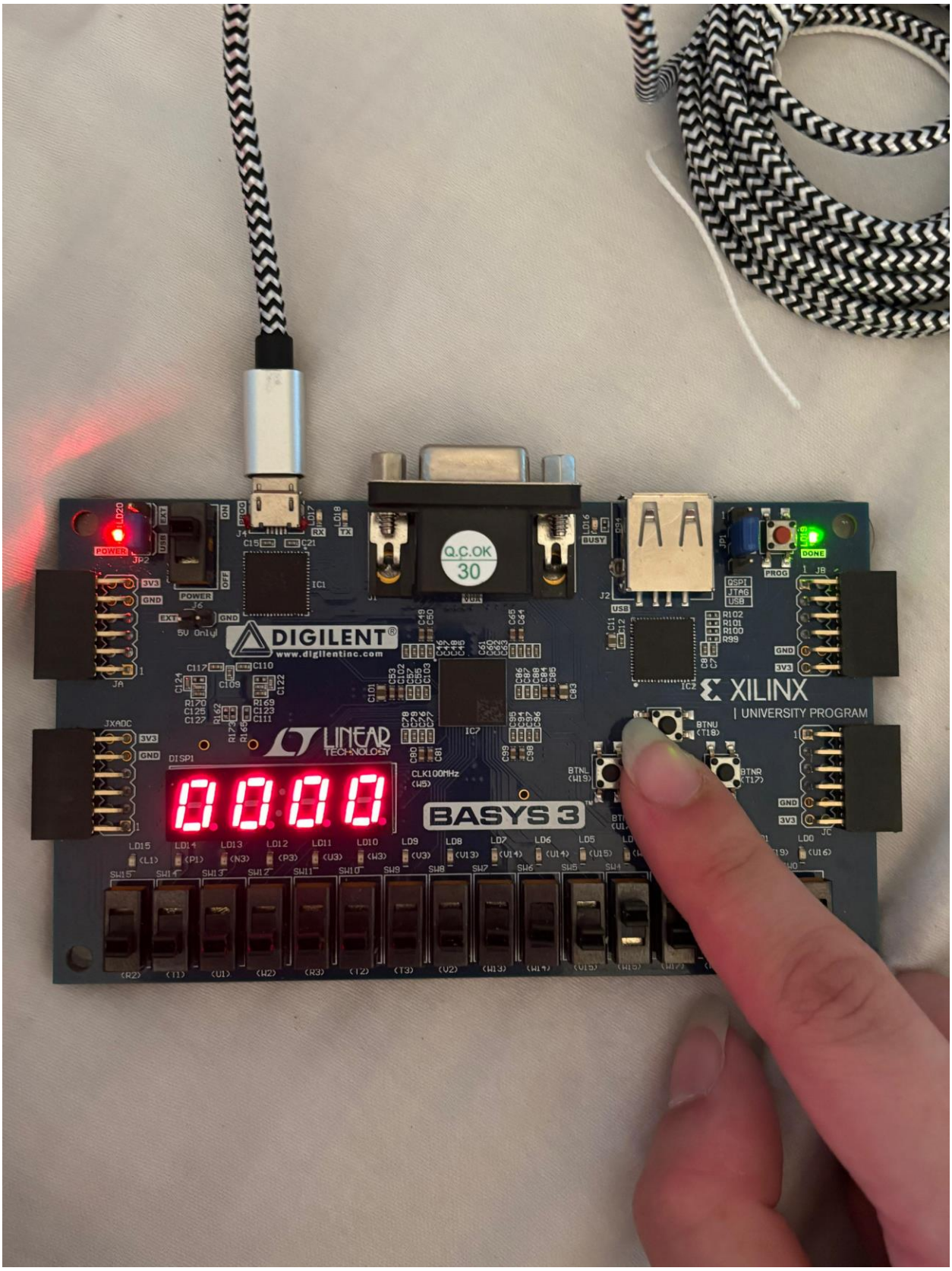

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
DISP1
JXADC
QSPI
JTAG
USB

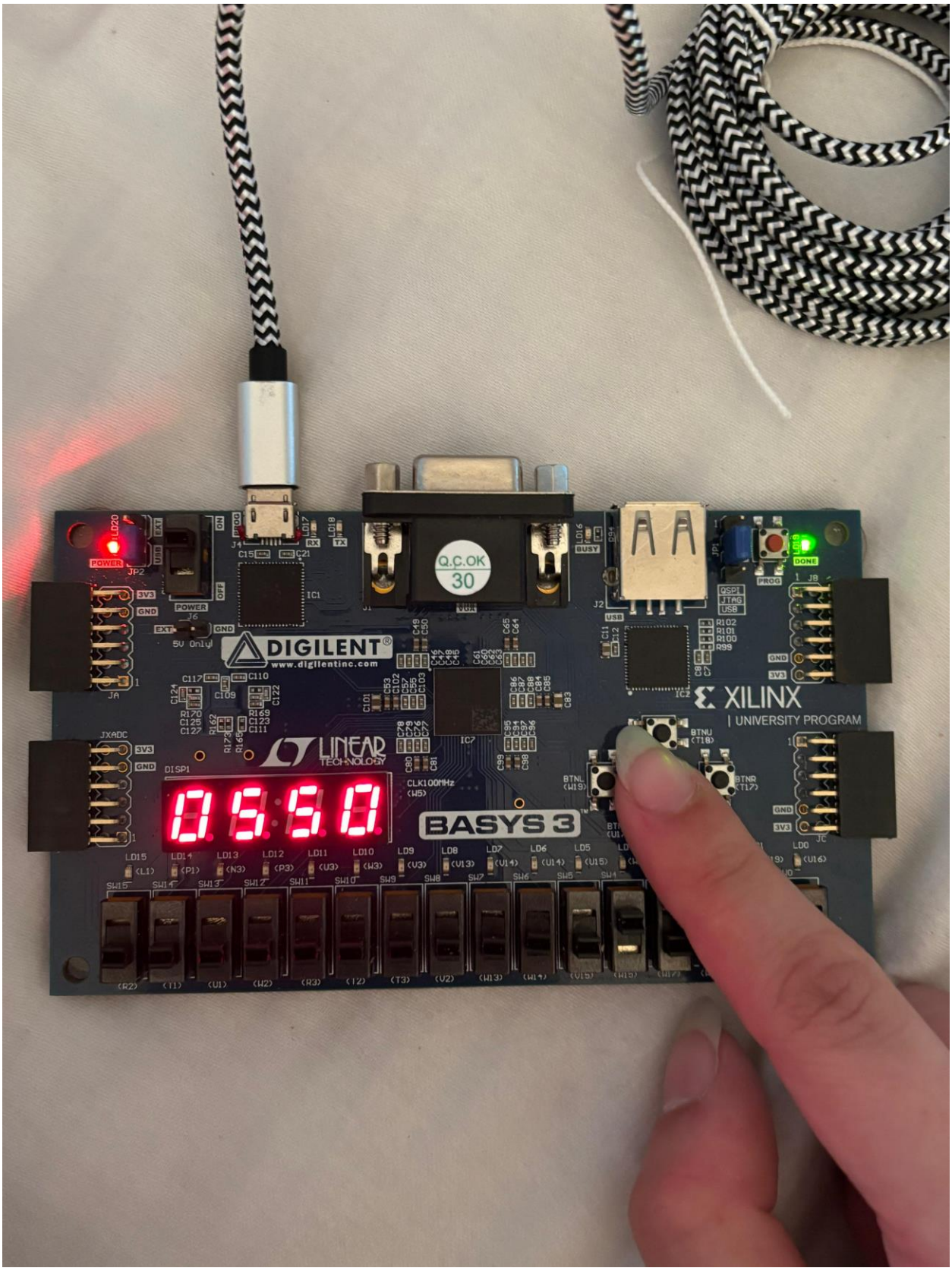

DIGILENT®
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
DISP1
JXADC
JA
JB
JC
LD15 LD14 LD13 LD12 LD11 LD10 LD9 LD8 LD7 LD6 LD5
SW15 SW14 SW13 SW12 SW11 SW10 SW9 SW8 SW7 SW6 SW5 SW4

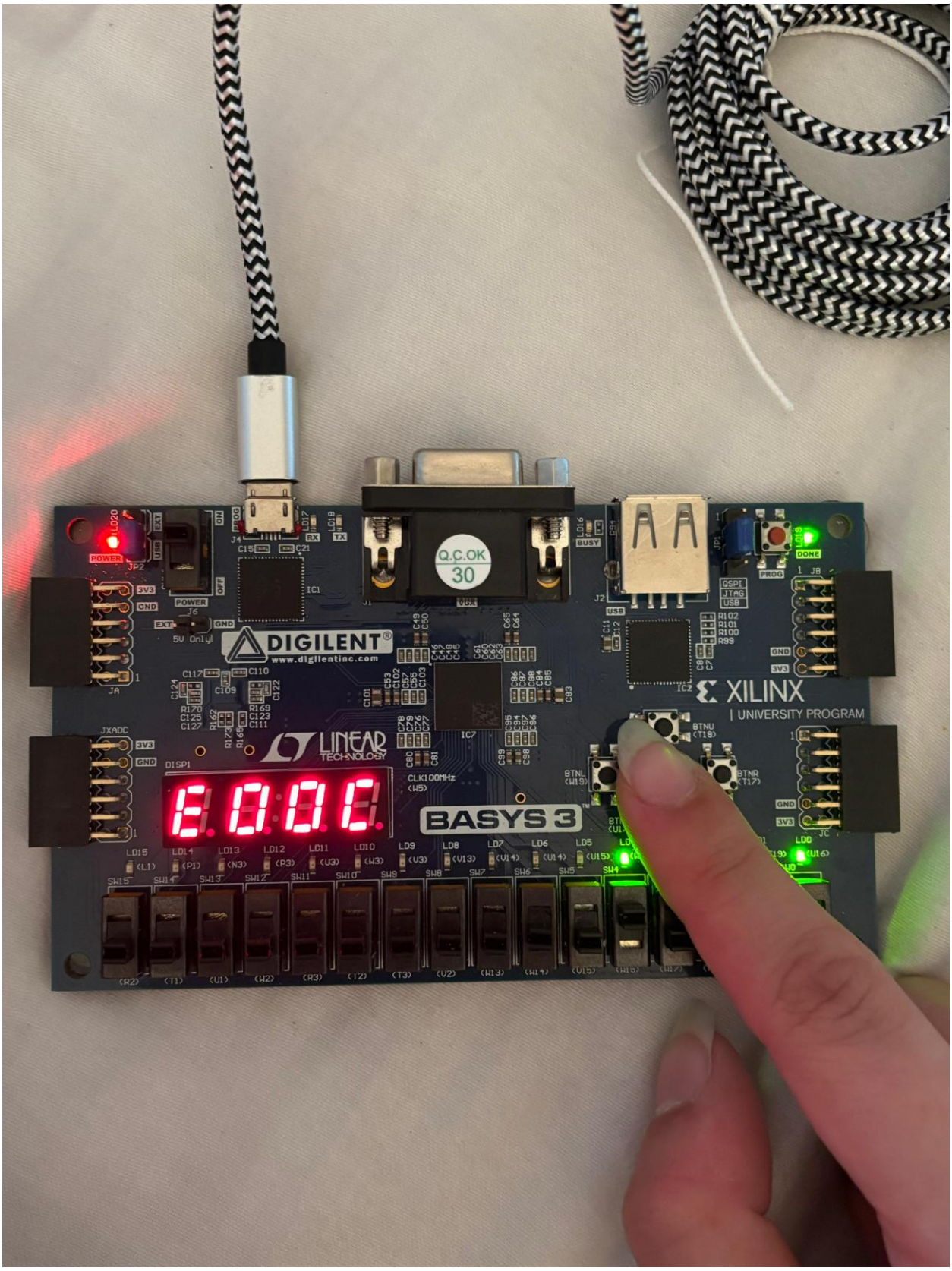

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
USB
JTAG
QSPI
DISP1
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
JXADC
LD15 LD14 LD13 LD12 LD11 LD10 LD9 LD8 LD7 LD6 LD5
SW15 SW14 SW13 SW12 SW11 SW10 SW9 SW8 SW7 SW6 SW5 SW4

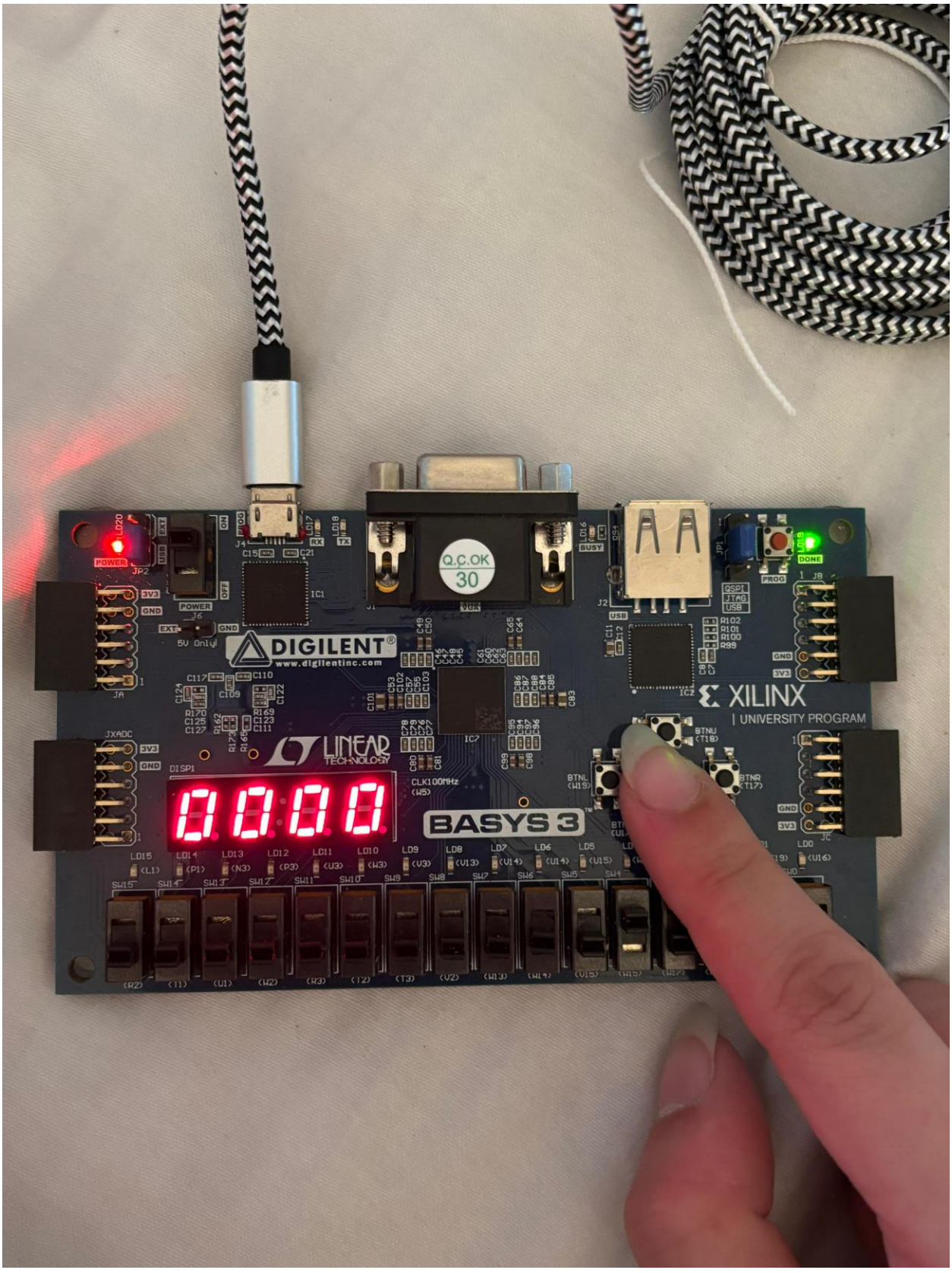

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
QSPI
JTAG
USB
JXADC
DISP1
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5
SW15
SW14
SW13
SW12
SW11
SW10
SW9
SW8
SW7
SW6
SW5
(R2)
(T1)
(U1)
(W2)
(R3)
(T2)
(T3)
(V2)
(W13)
(W14)

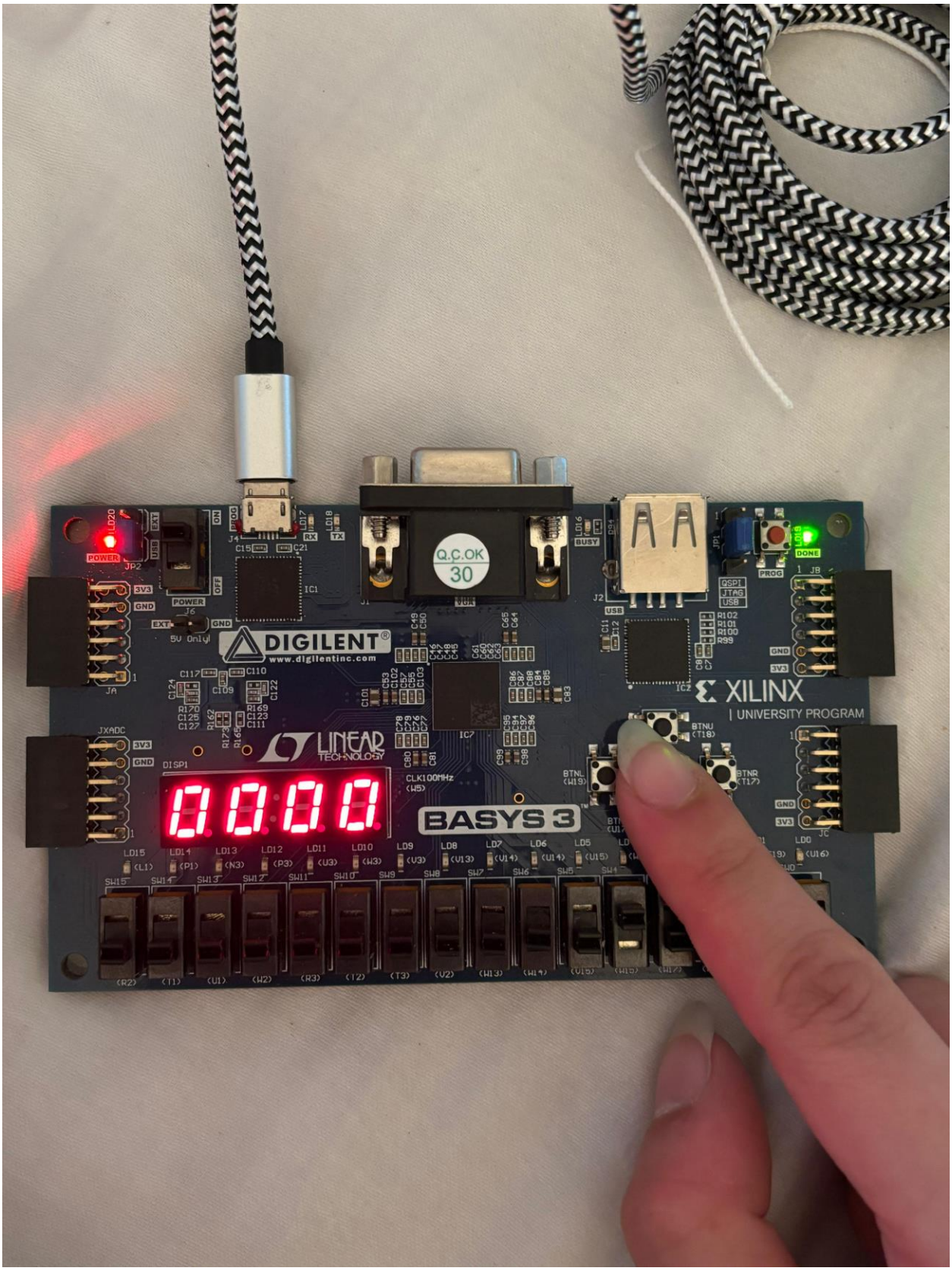

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
CLK100MHz
(W5)
DISP1
JXADC
POWER
PROG
DONE
BUSY
QSPI
JTAG
USB
5V Only!
BTNU (T18)
BTNL (W19)
BTNR (T17)

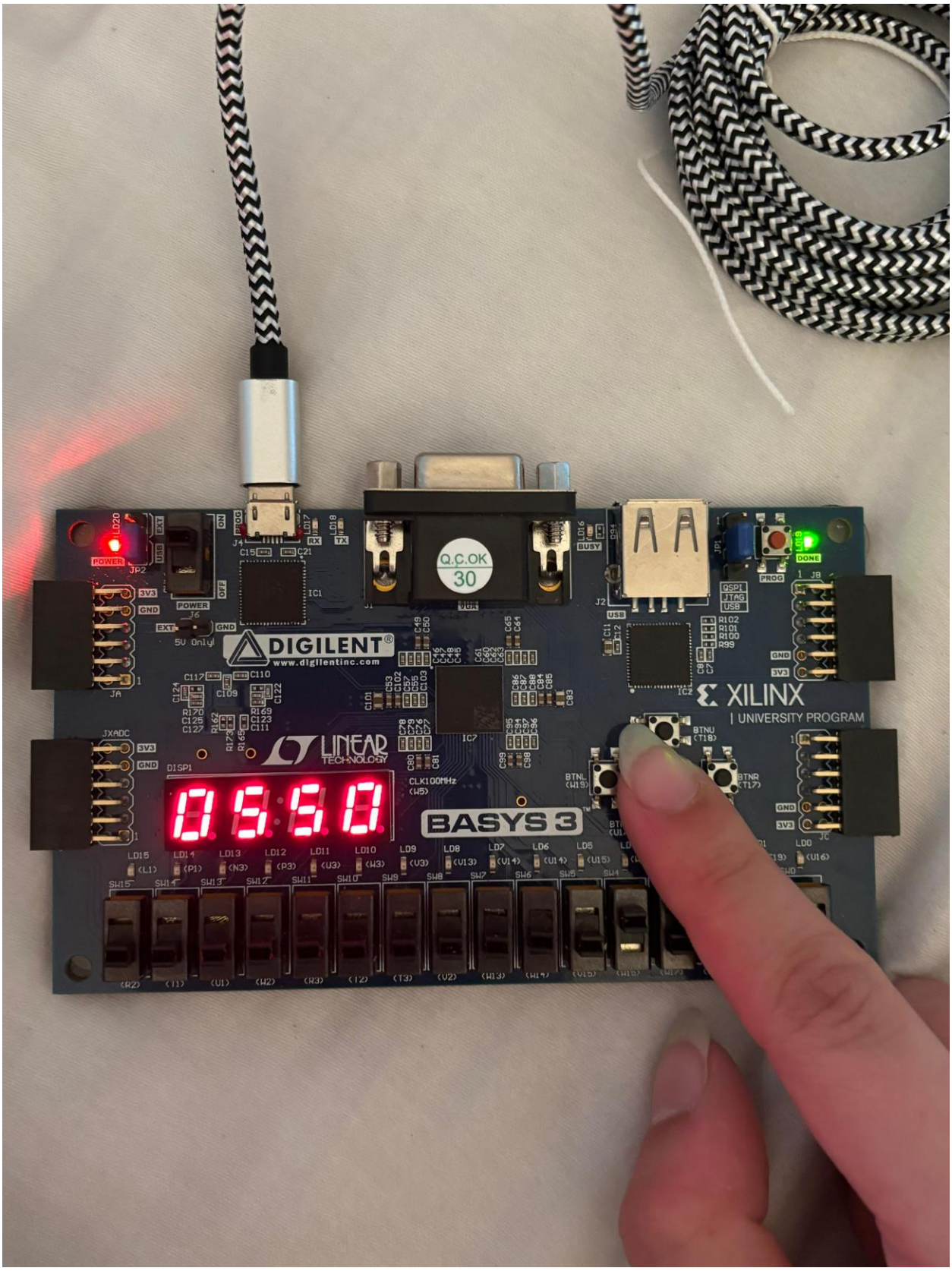

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
CLK100MHz
(W5)
DISP1
0000
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
POWER
PROG
DONE
JXADC
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5
SW15
SW14
SW13
SW12
SW11
SW10
SW9
SW8
SW7
SW6
SW5

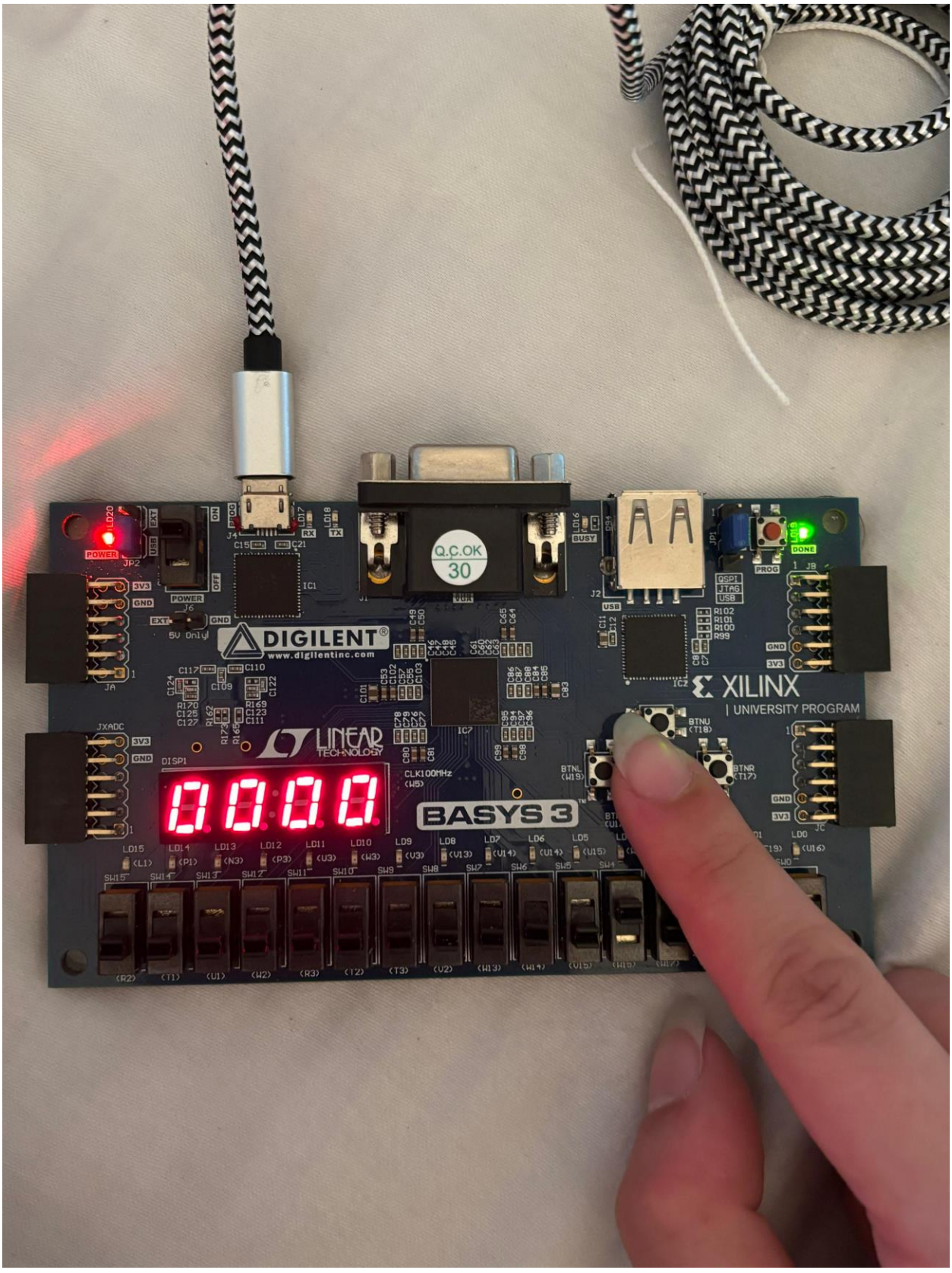

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
QSPI
JTAG
USB
5V Only
DISP1
CLK100MHz
BTNU
BTNL
BTNR
JXADC
JA
JB
JC

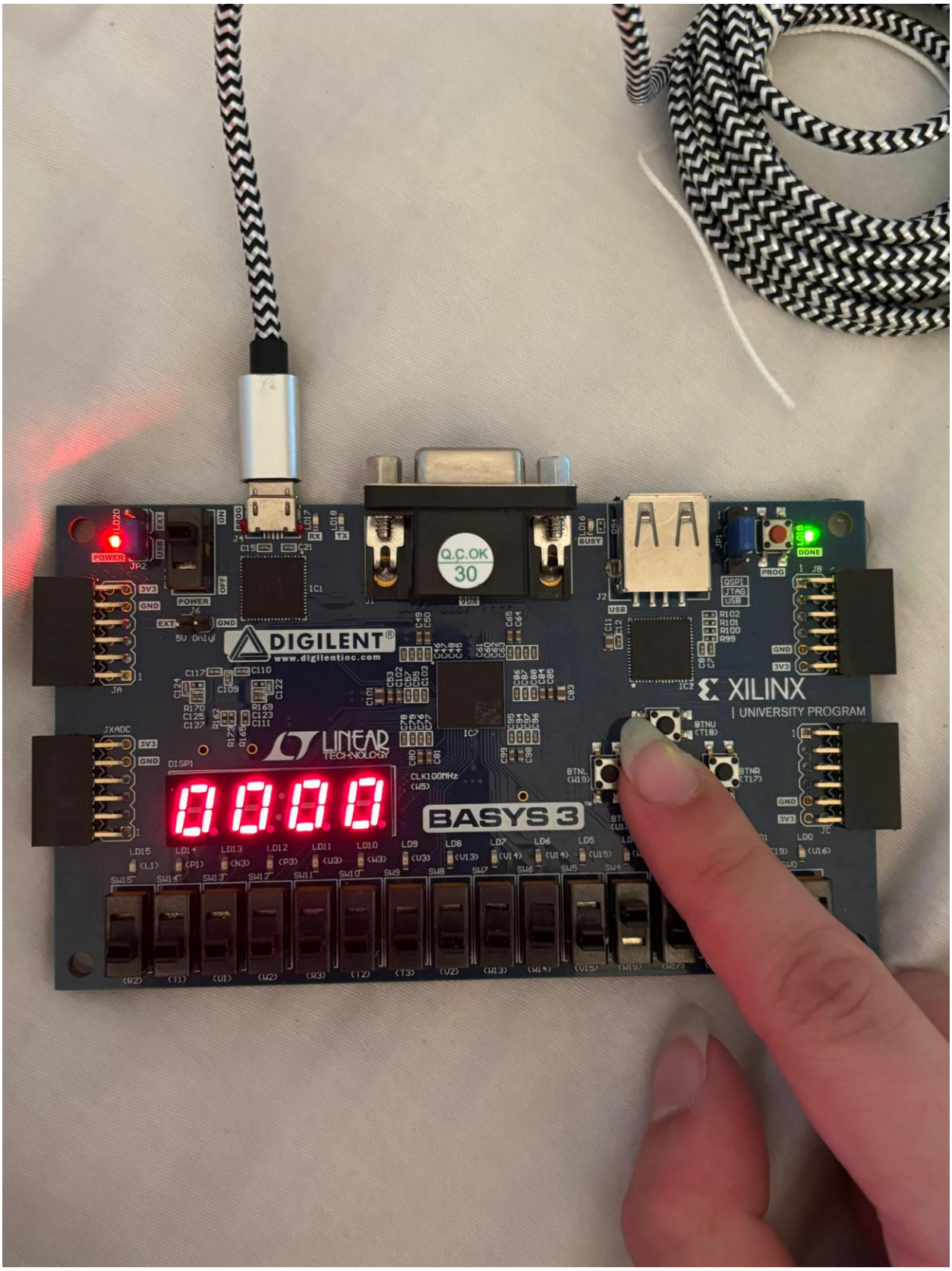

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
QSPI
JTAG
USB
JXADC
DISP1
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5
SW15
SW14
SW13
SW12
SW11
SW10
SW9
SW8
SW7
SW6
SW5
SW4

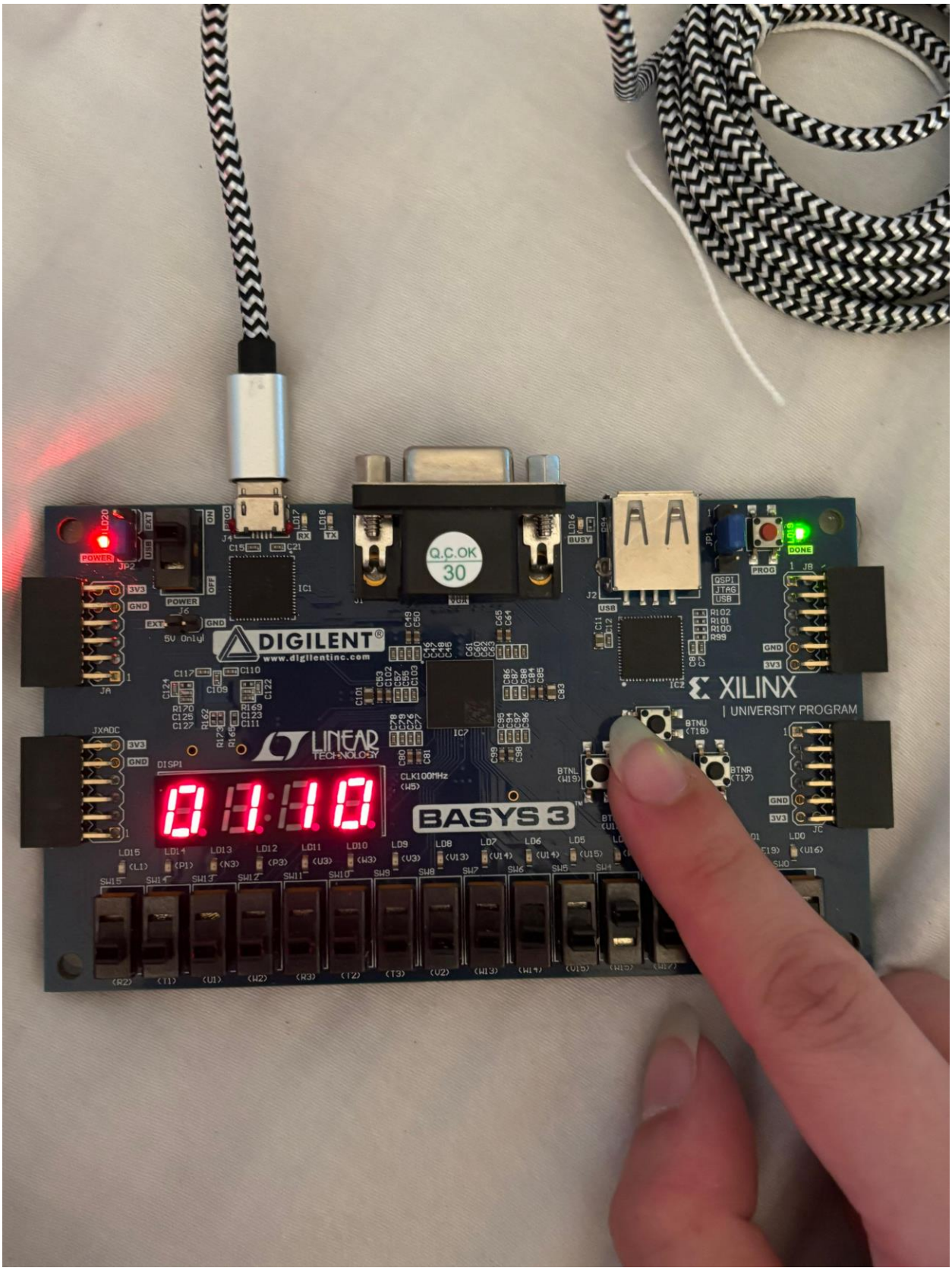

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
USB
JTAG
QSPI
5V Only
JXADC
DISP1
CLK100MHz
BTNU
BTNL
BTNR
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5
LD0

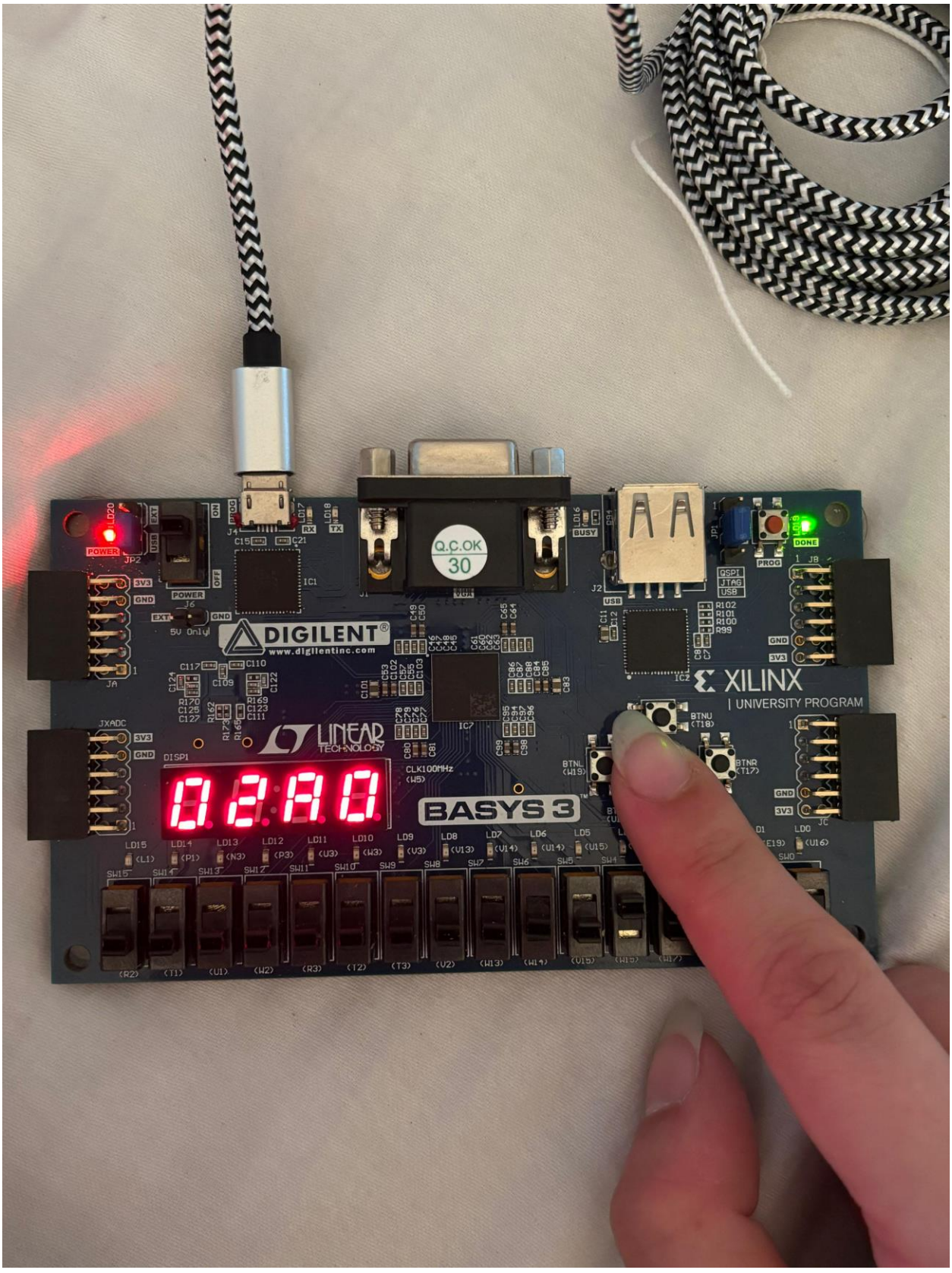

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
JA
JB
JC
JXADC
DISP1
CLK100MHz
BTNU
BTNL
BTNR
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5
SW15
SW14
SW13
SW12
SW11
SW10
SW9
SW8
SW7
SW6
SW5

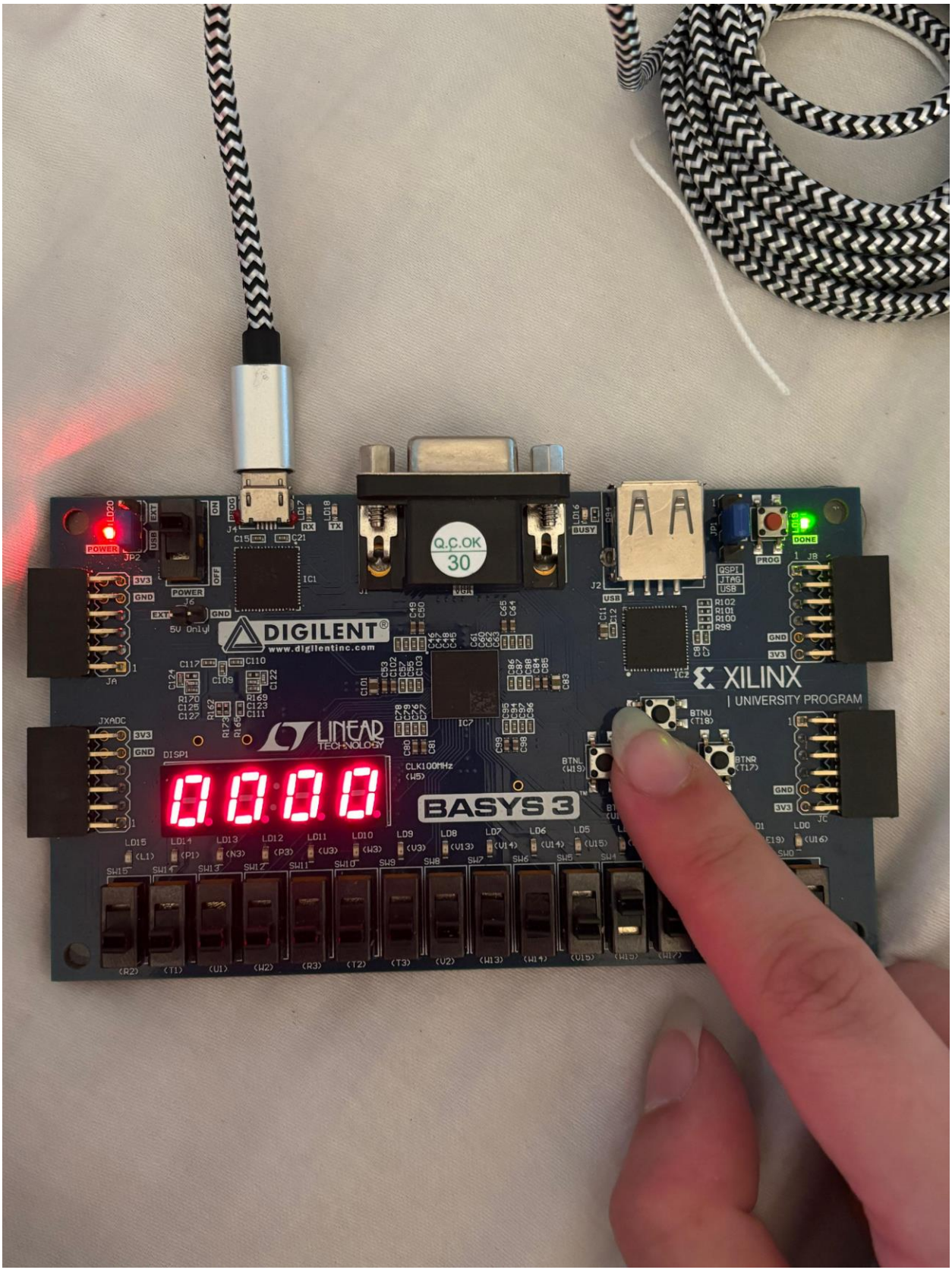

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
QSPI
JTAG
USB
5V Only!
JXADC
DISP1
CLK100MHz
(W5)
BTNL
(W19)
BTNU
(T18)
BTNR
(T17)
LD15 LD14 LD13 LD12 LD11 LD10 LD9 LD8 LD7 LD6 LD5
SW15 SW14 SW13 SW12 SW11 SW10 SW9 SW8 SW7 SW6 SW5

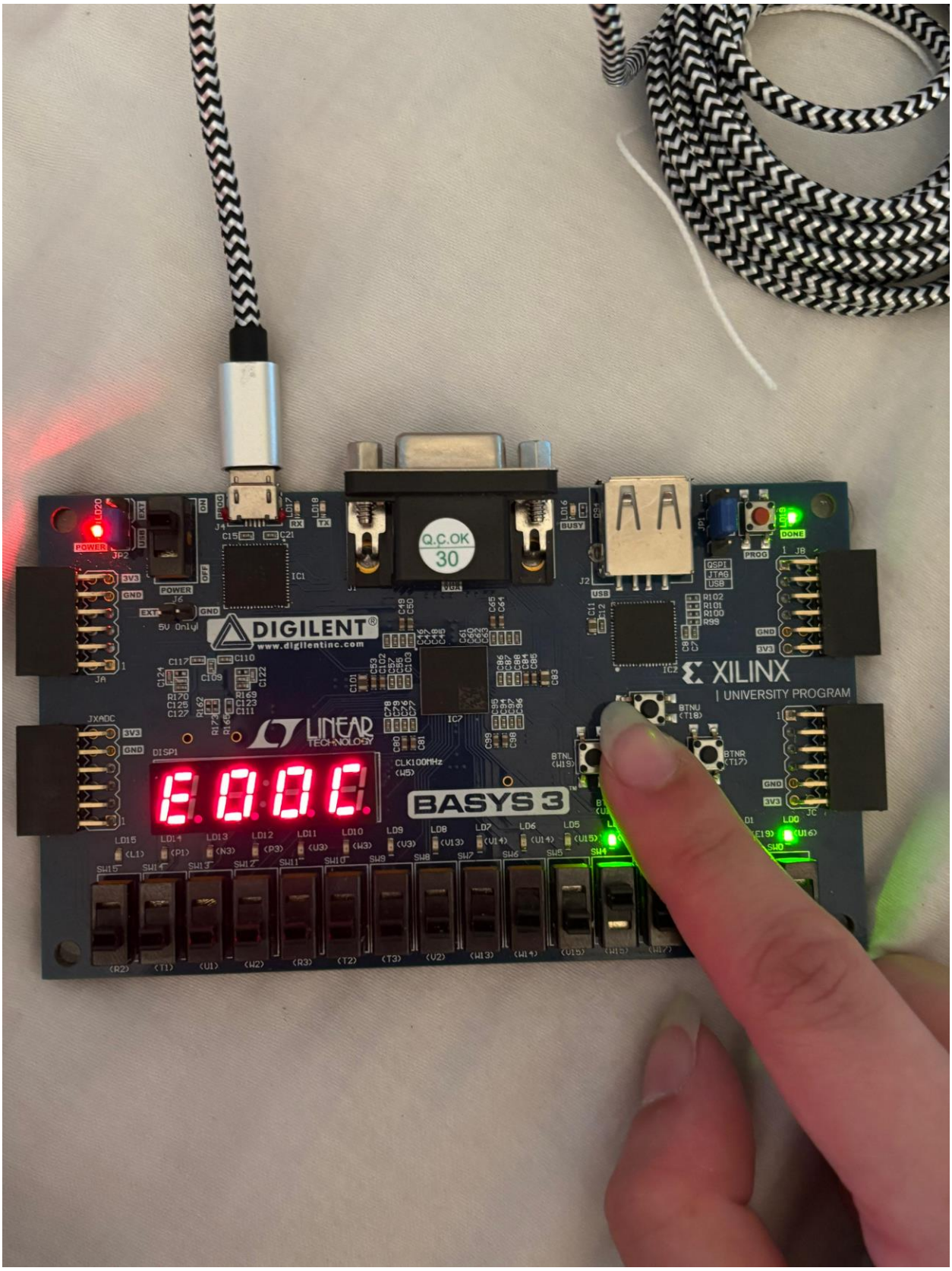

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
QSPI
JTAG
USB
5V Only
JXADC
DISP1
CLK100MHz
BTNU
BTNL
BTNR
0000

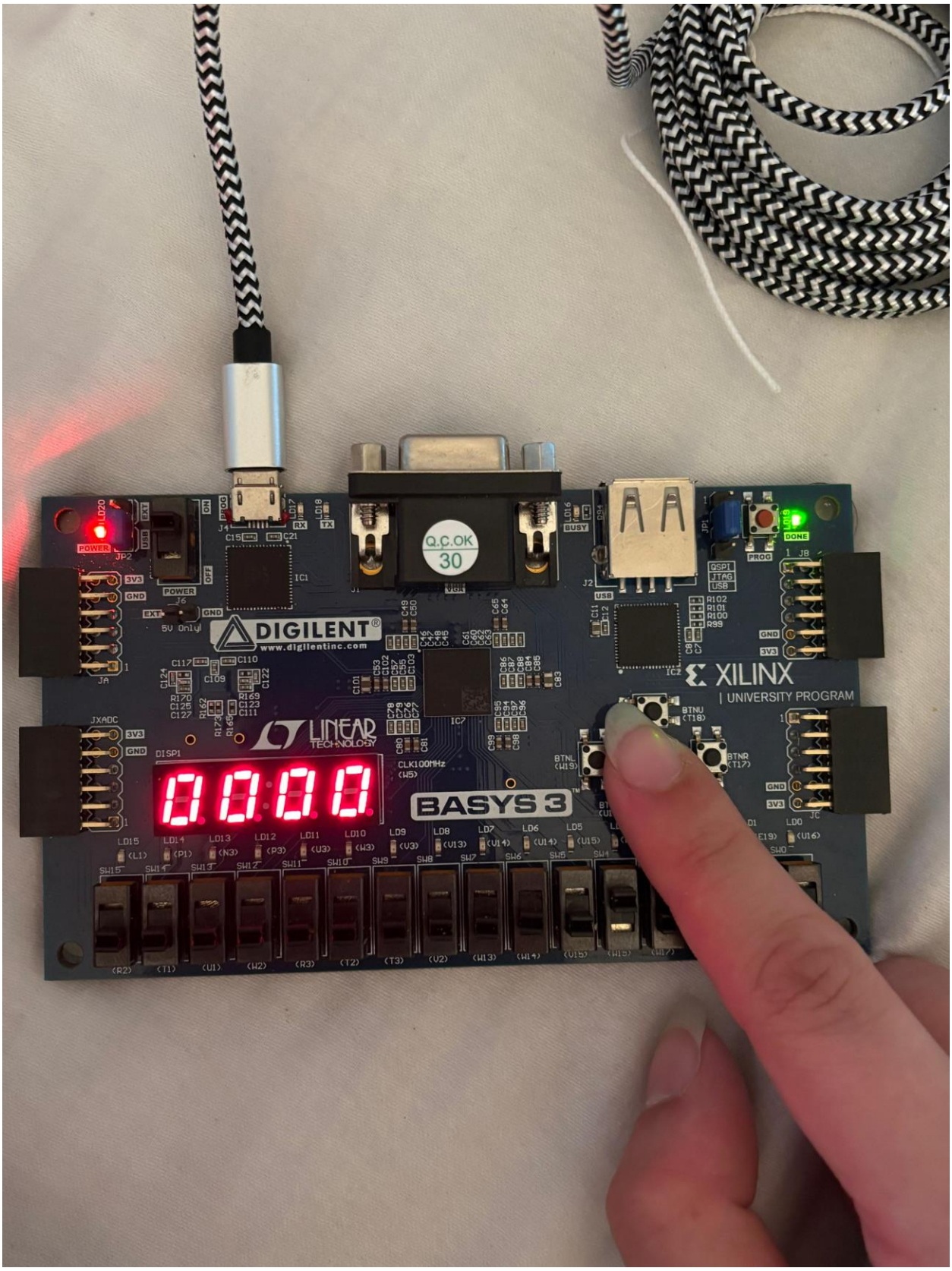

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
DONE
PROG
QSPI
JTAG
USB
BUSY
DISP1
CLK100MHz
(W5)
JXADC
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5
LD0
SW15
SW14
SW13
SW12
SW11
SW10
SW9
SW8
SW7
SW6
SW5
SW4


DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
PROG
DONE
BUSY
QSPI
JTAG
USB
5V Only!
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
DISP1
JXADC
JA
JB
JC

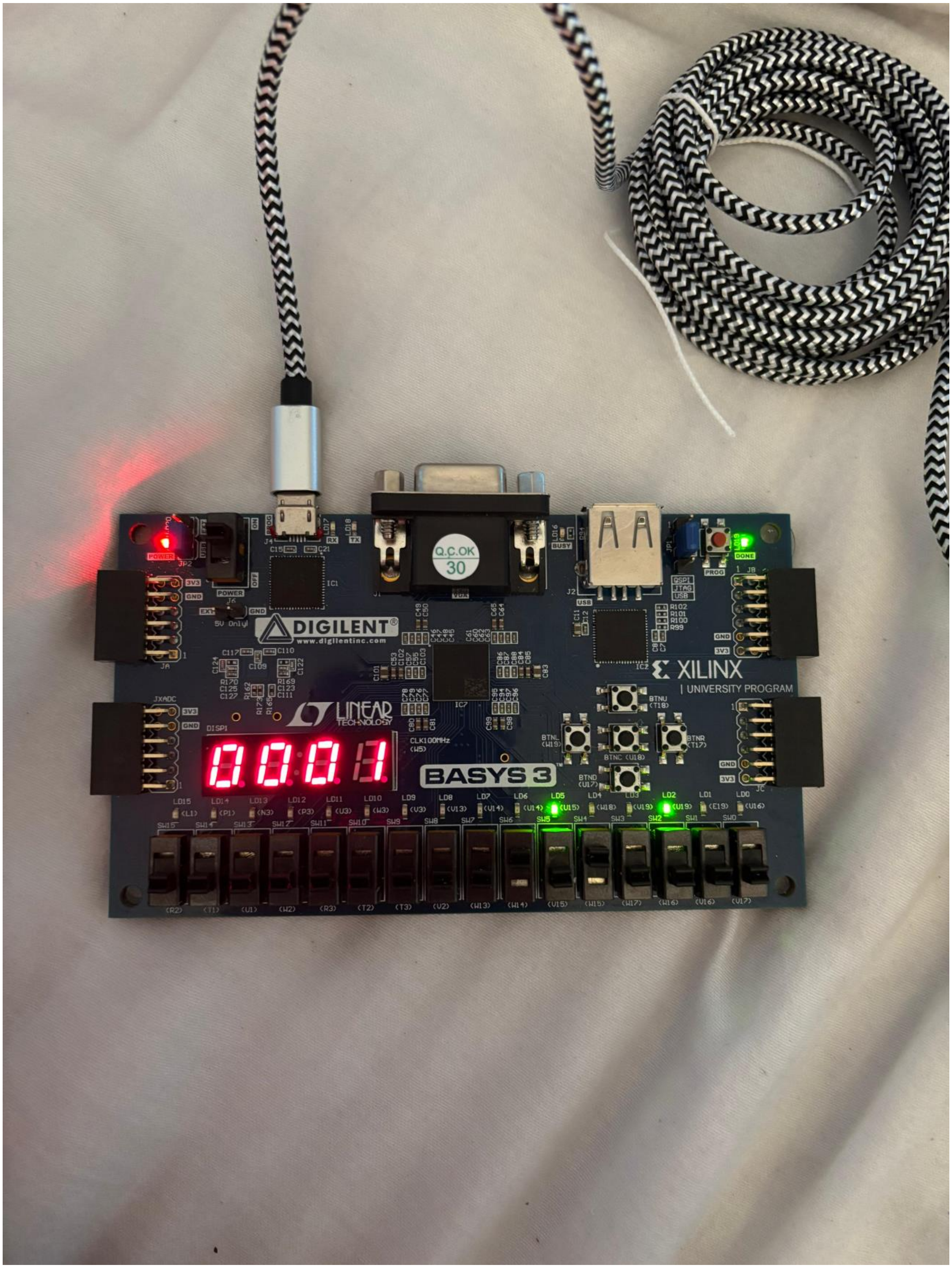

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
0 2 A 0
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
POWER
PROG
DONE
BUSY
JTAG
USB
QSPI
5V Only!
DISP1
JXADC
SW15
SW14
SW13
SW12
SW11
SW10
SW9
SW8
SW7
SW6
SW5
SW4
(R2)
(T1)
(U1)
(W2)
(R3)
(T2)
(T3)
(V2)
(W13)
(W14)
(V15)
(W15)
(W17)

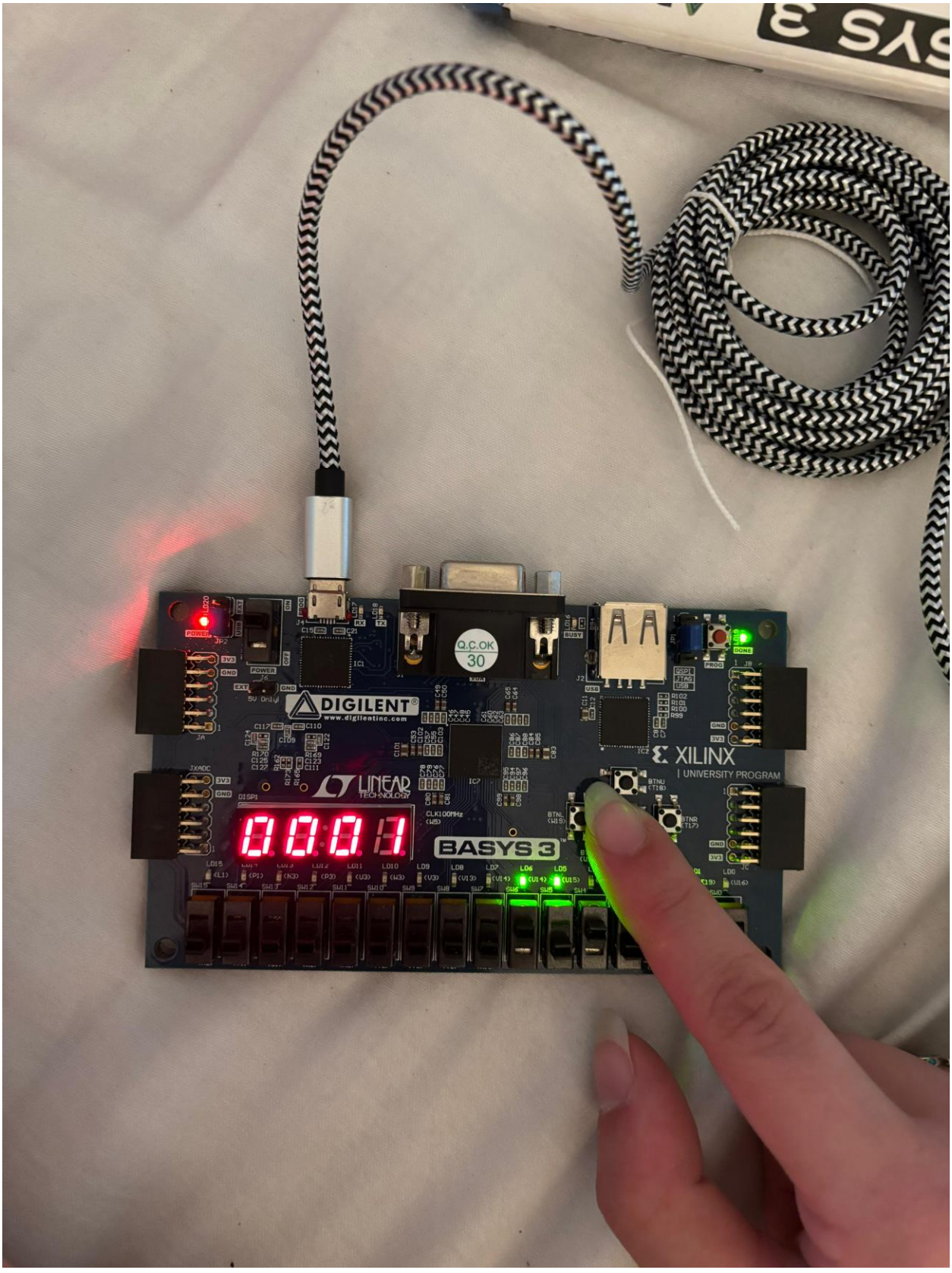

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
DISP1
JXADC
POWER
PROG
DONE
BUSY
DSPI
JTAG
USB
5V Only
SW15
SW14
SW13
SW12
SW11
SW10
SW9
SW8
SW7
SW6
SW5
SW4
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5

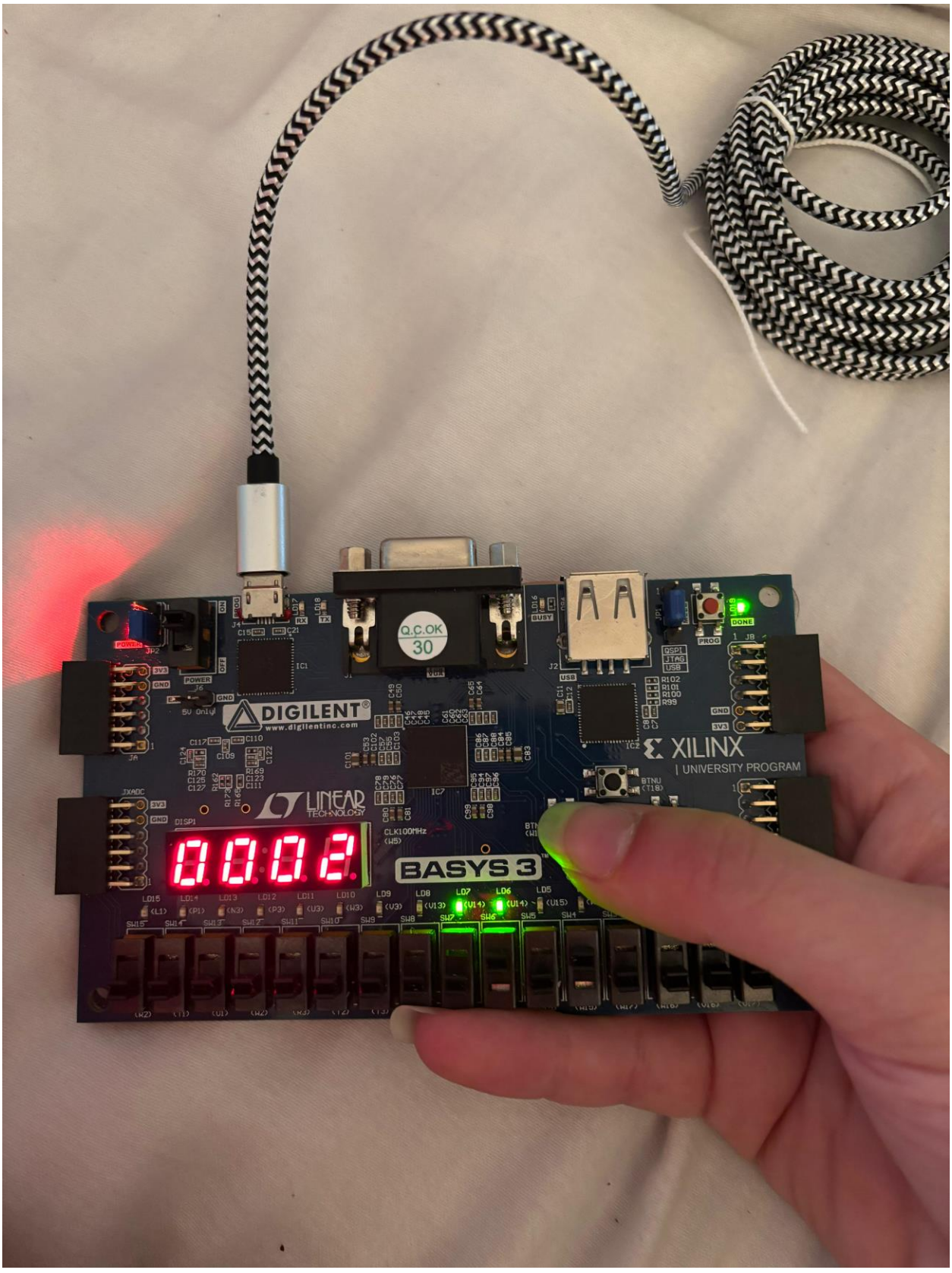

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
E.0.0.C.
POWER
PROG
DONE
QSPI
JTAG
USB
5V Only
JXADC
CLK100MHz
BTNU
BTNL
BTNR

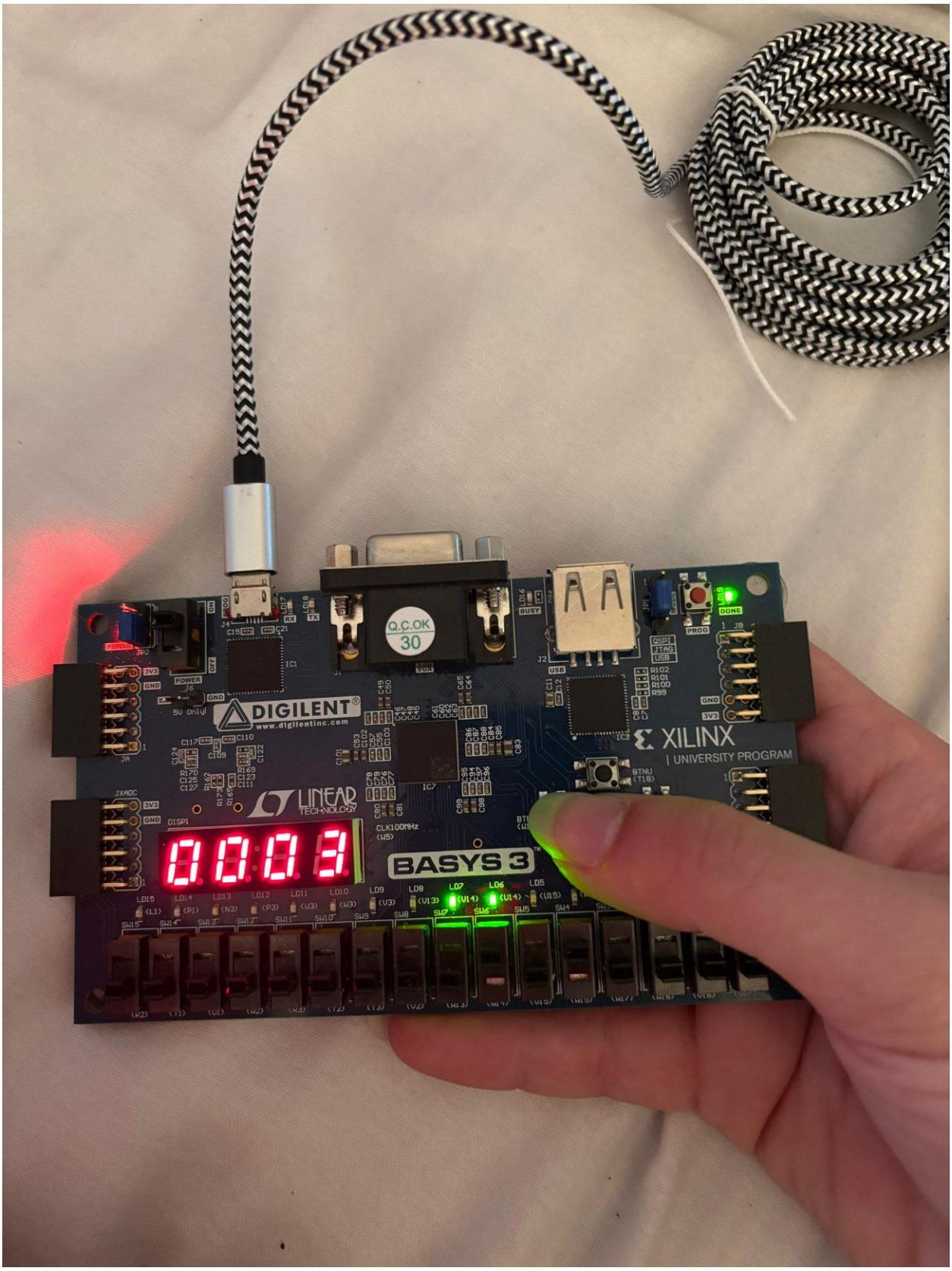

Q.C.OK
30
DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
DISP1
CLK100MHz
(W5)
BTNU
(T18)
BTNL
(W19)
BTNR
(T17)
POWER
PROG
DONE
JXADC
JA
JB
JC
LD15
LD14
LD13
LD12
LD11
LD10
LD9
LD8
LD7
LD6
LD5
SW15
SW14
SW13
SW12
SW11
SW10
SW9
SW8
SW7
SW6
SW5
SW4
(R2)
(T1)
(U1)
(W2)
(R3)
(T2)
(T3)
(V2)
(W13)
(W14)

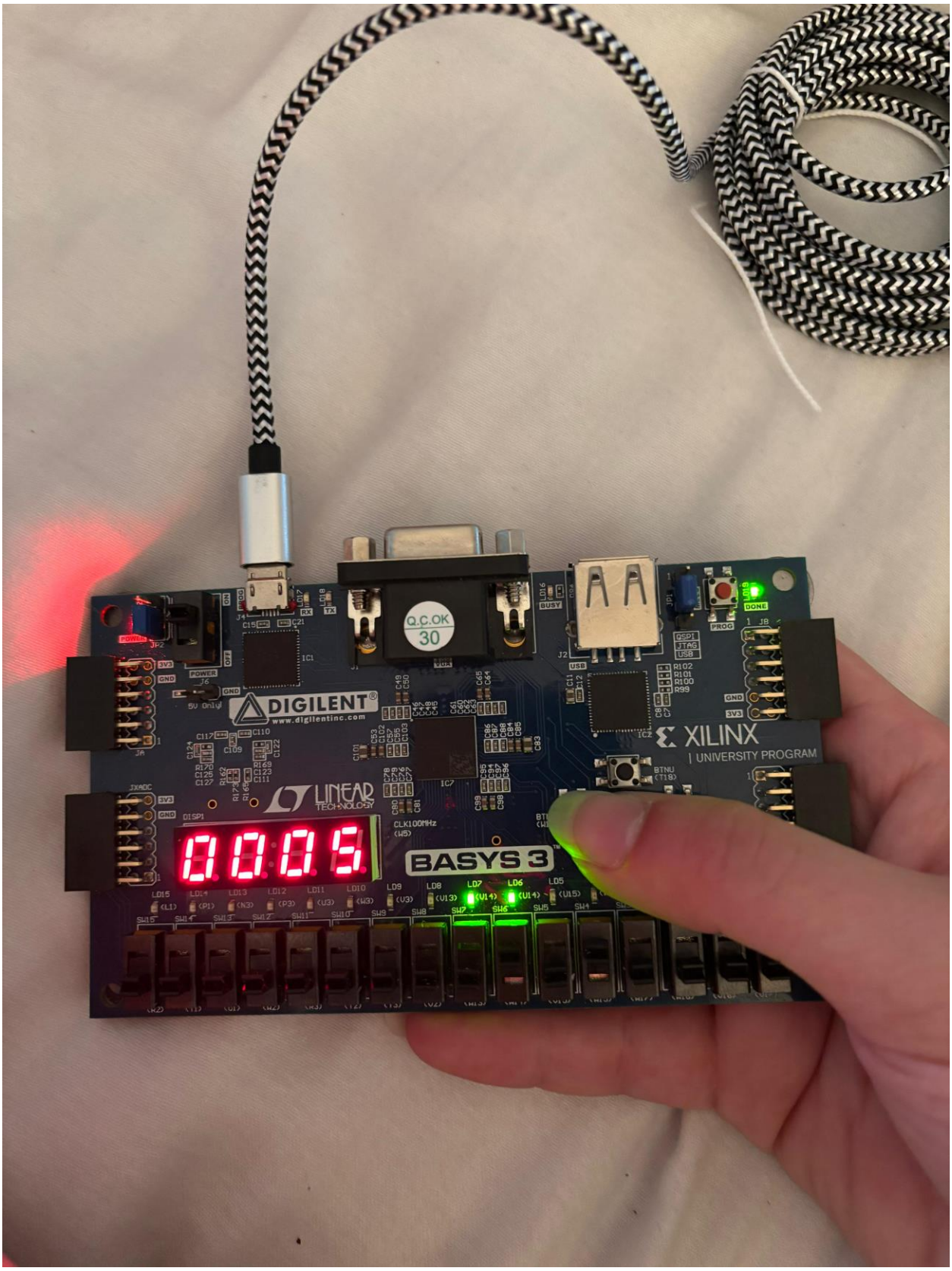
The Fibonacci Numbers displayed:

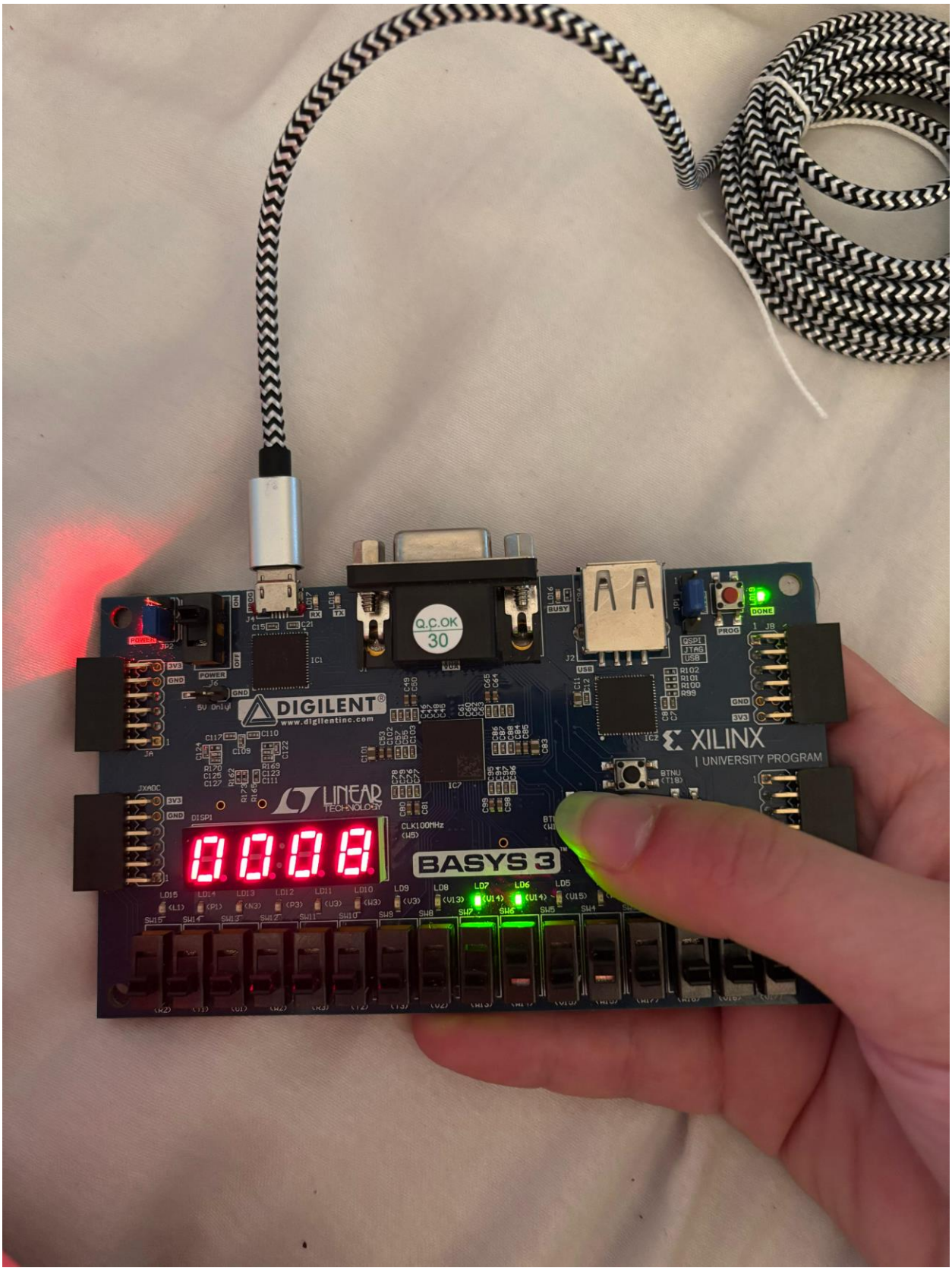

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
0001

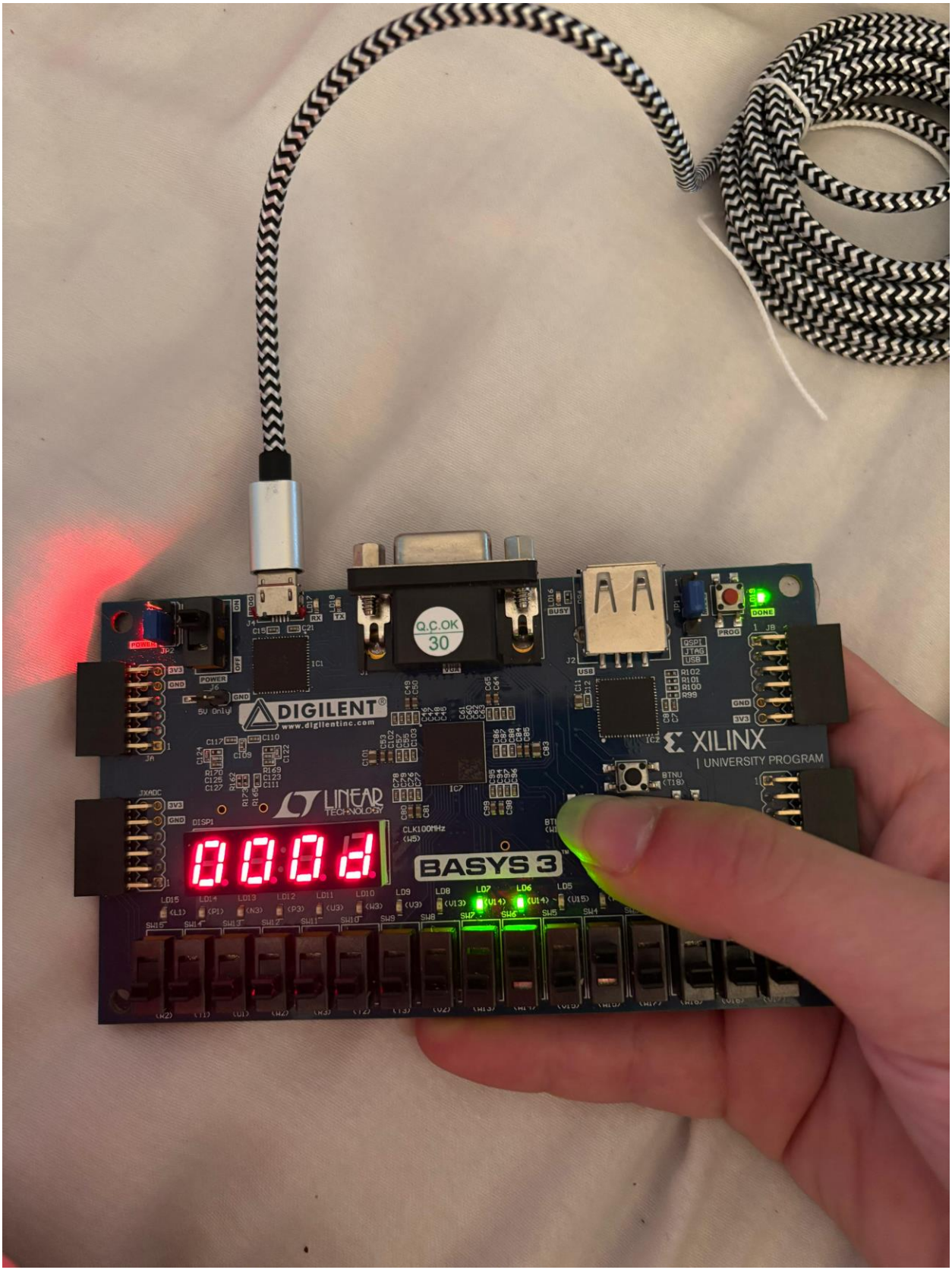

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
POWER
DONE
0 0 0 1

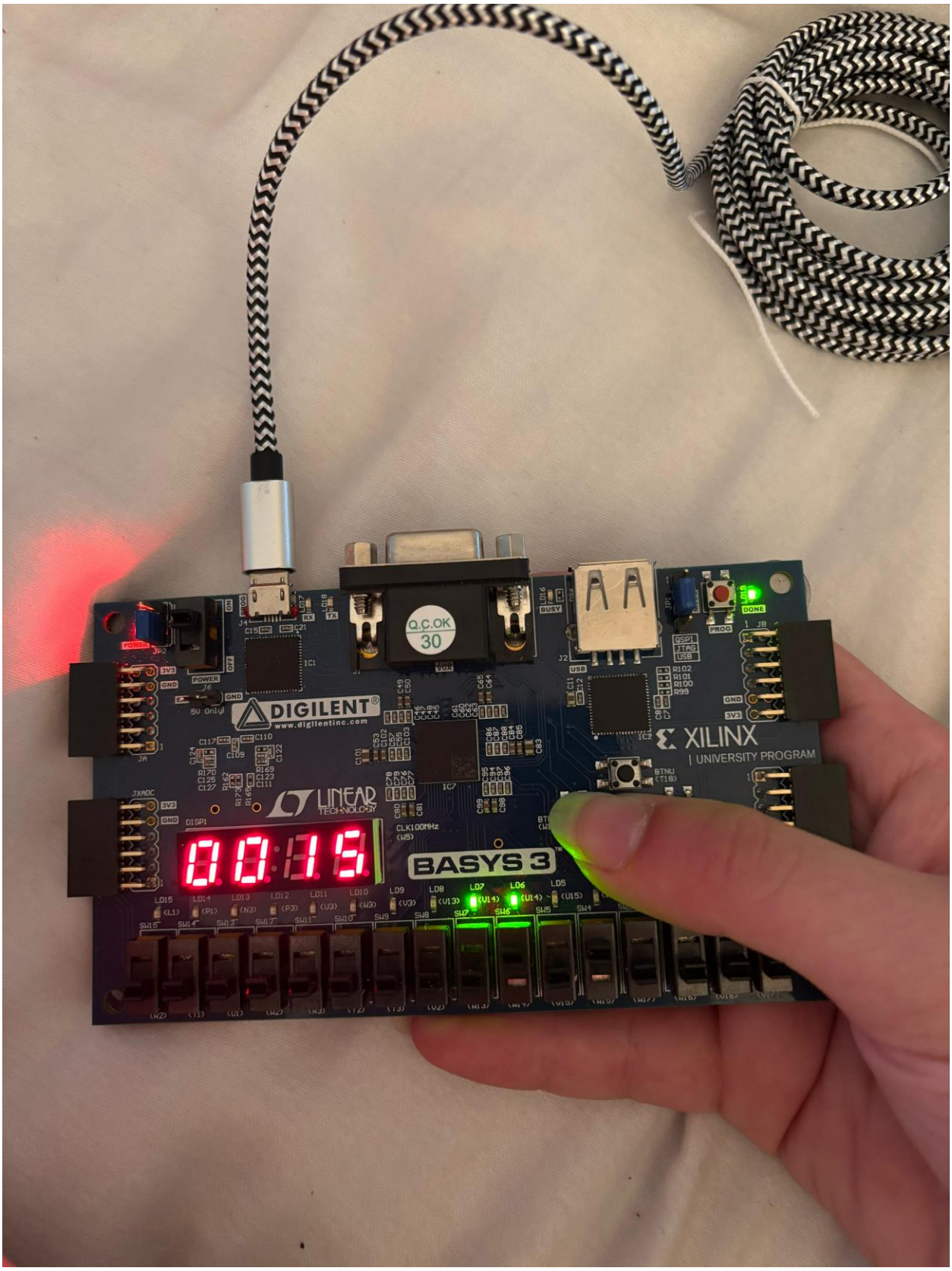

Q.C.OK
30
DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
0002
CLK100MHz
(W5)
BTNU
(T18)
DONE
PROG
POWER
JXADC
DISP1

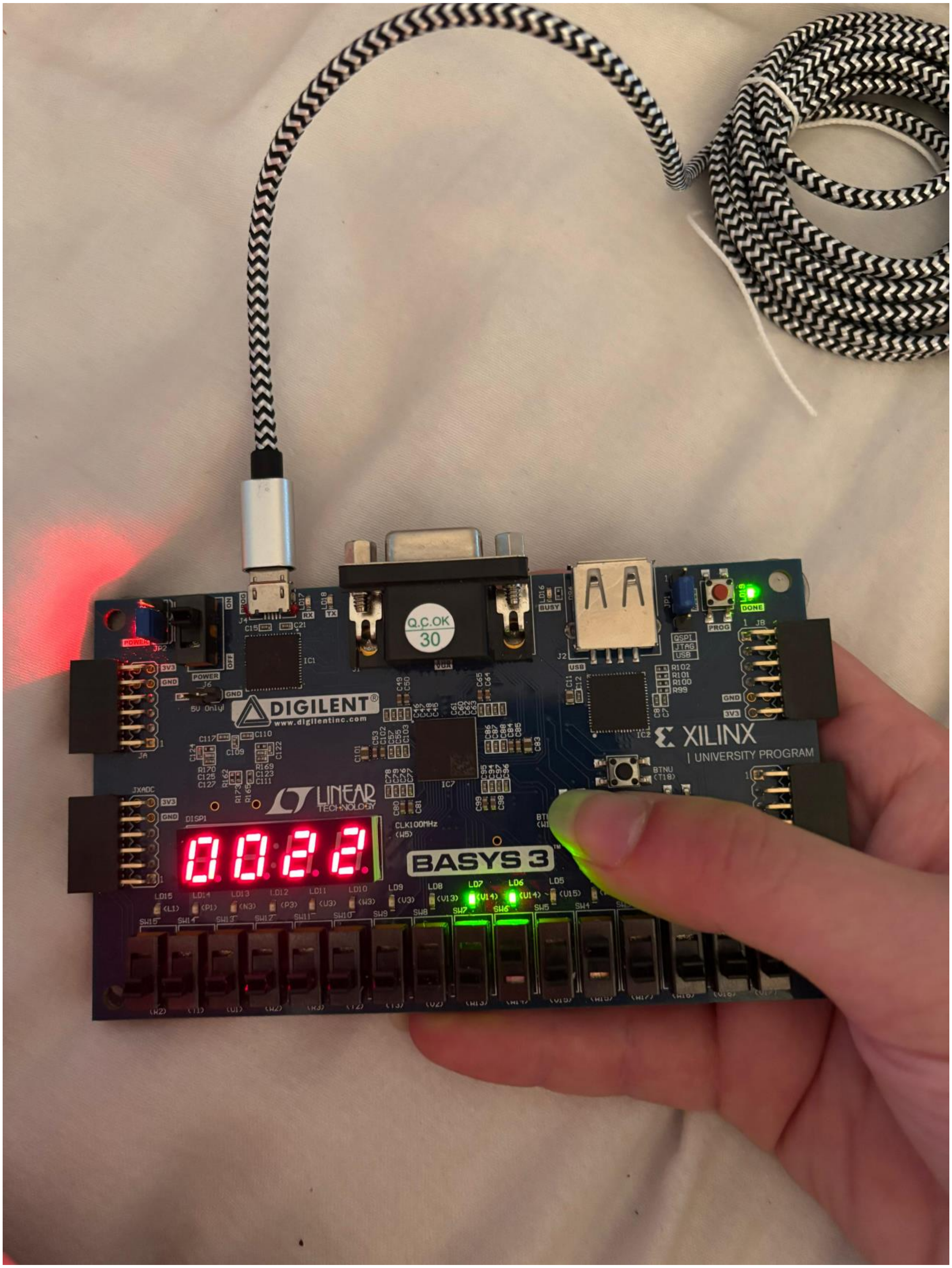

Q.C.OK
30
DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
CLK100MHz
(W5)
DISP1
0 0 0 3
LD7
LD6
SW7
SW6
DONE
PROG
BUSY
POWER
5V Only
JXADC
BTNU
(T18)

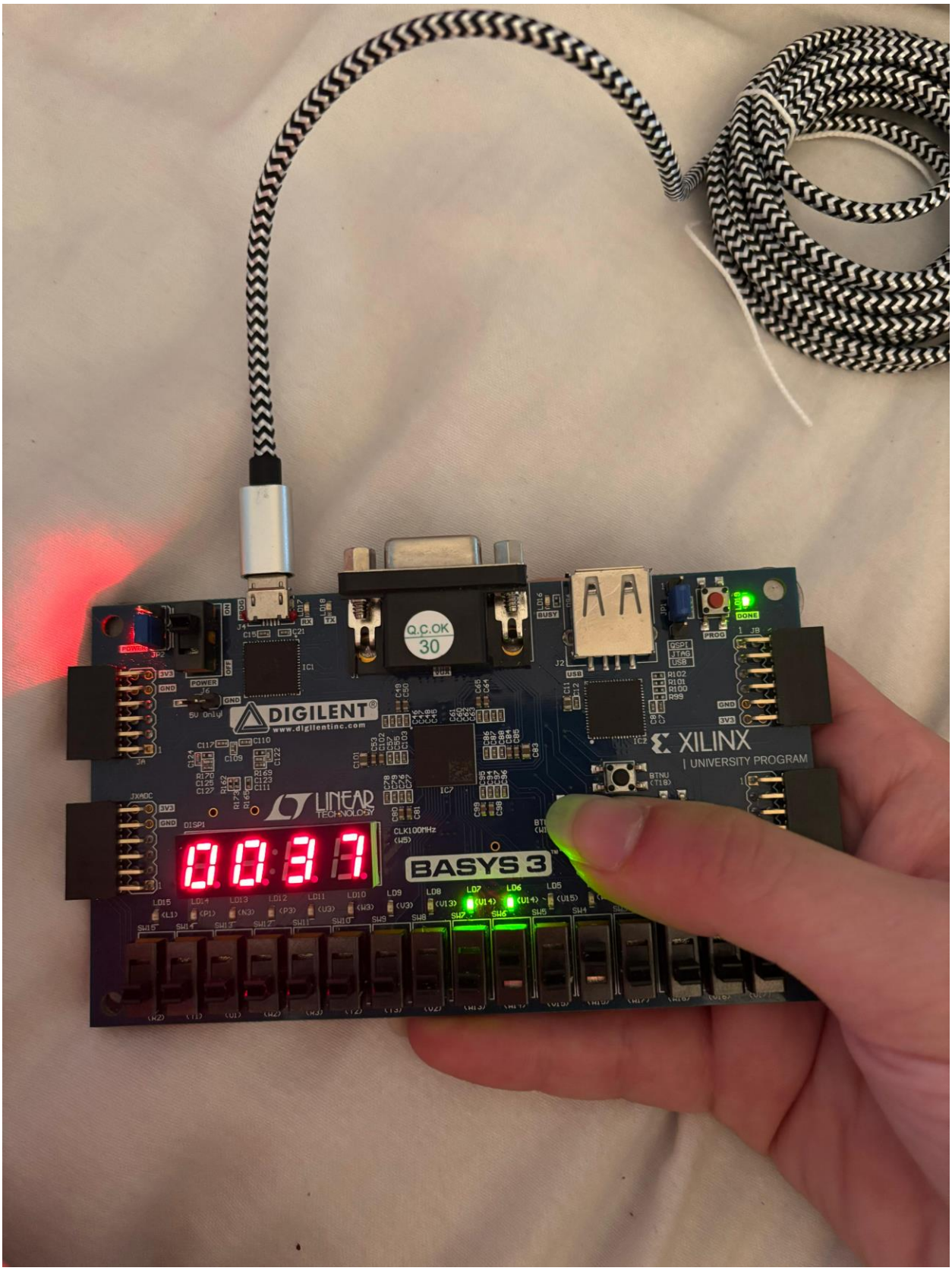

DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
Q.C.OK
30
0005

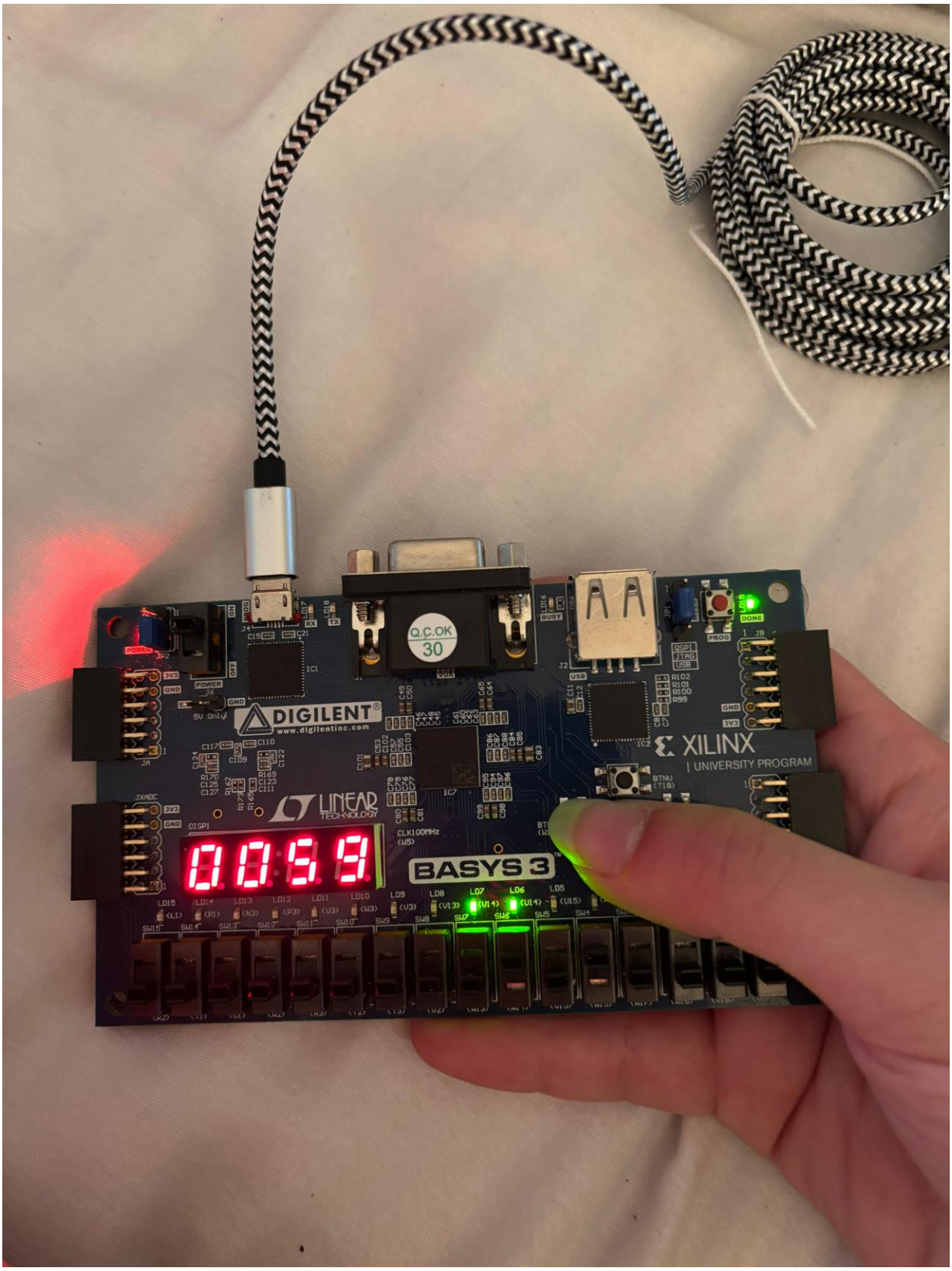

Q.C.OK
30
DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
0008


Q.C.OK
30
DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
DONE
PROG
QSPI
JTAG
USB
POWER
5V Only
CLK100MHz
(W5)
DISP1
JXADC
BTNU
(T18)


Q.C.OK
30
DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
0.0.1.5.




Q.C.OK
30
DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
0 0 3 7


Q.C.OK
30
DIGILENT
www.digilentinc.com
XILINX
UNIVERSITY PROGRAM
LINEAR TECHNOLOGY
BASYS 3
0059