Department of Mechanical, Materials and Manufacturing Engineering

The University of Nottingham

Electromechanical Devices MMME2051

Exercise Sheet 7 – Digital Electronics 2

7.1 Draw the truth table of a JK flip flop.

7.2 Explain in words why is it impractical to use a simple OR gate with a feedback loop as a latch.

7.3 Draw a Shift Register and name one application of this type of circuit.

7.4 Simplify the following expressions:

a. 1 + 1 + 1
b. 1 + 0 + 0
c. 1′ + 1′ + 1′
d. 0 + 0 + 0

Note: A single apostrophe (') after a binary variable is a way of denoting "complement/inverse" of the variable – NOT gate!

7.5 Simplify the following expressions:

a. A * 1
b. A * 0
c. A + 1
d. A + A
e. A * A
f. A + A + B
g. (A + B) * (A + C)
h. (A + B) * (A + C) * (A′ + C) * (B′ + D)

7.6 Now draw the circuits (using gate symbols) from above.

7.7 Given the following truth table, write the Boolean algebra expression to represent it. Can you simplify the answer?

A	B	C	Q
0	0	0	**1**
0	0	1	**0**
0	1	0	**1**

0	1	1	**0**
1	0	0	**1**
1	0	1	**0**
1	1	0	**1**
1	1	1	**0**

7.8 Draw a diagram of a relay and explain how it works.

7.9 Why can't we supply large voltage and currents from microchips?

7.10 Draw a circuit diagram for a circuit that would use a small voltage/current signal to turn on a 20V light bulb using an NPN bipolar junction transistor.

7.11 What are the advantages/disadvantages of bipolar junction transistor?

7.12 What are the advantages/disadvantages of using a MOSFET? Why would you use a push-pull pair to drive a MOSFET?

7.13 Draw a circuit diagram showing how a push-pull pair would be used to drive a MOSFET and describe what the advantages of using a push-pull pair to drive a MOSFET are. Explain how the circuit works.