EE 49

- 1. Binary signals represent one of two possible states, e.g. 0 or 1, yes or no, current or no current, etc. In electronic systems binary signals can be represented by a voltage on a wire, e.g. 0 V or 3.3 V. Each binary signal carries one "Bit" of information, the unit of information. Answer the questions below:
  - a) How many bits (wires carrying binary signals) are required to represent the output of a motion detector, "motion" or "no motion" detected?
  - b) How many bits are required to represent integers (whole numbers) 0 ... 63?
  - c) How many bits are required to represent integers (whole numbers) -128 ... 127?
  - d) How many bits are required to represent integers (whole numbers) 0 ... 100?
  - e) The output voltage of a sensor varies between 0 V and 5 V. How many bits are required to represent that output with a resolution of 1 mV? I.e. the output voltage is rounded to the nearest mV value before representation as a binary signal.
- 2. Computers use binary, rather than decimal numbers to represent numeric information. The article at <a href="https://en.wikipedia.org/wiki/Binary\_number">https://en.wikipedia.org/wiki/Binary\_number</a>, section "Counting in binary", explains how to convert between the representations. Complete the table below:

Decimal	Binary
5	101
8	
23	
127	
128	
	10
	111
	1000
	10010110

3. In the circuit below,  $S_1$  and  $S_2$  represent transistors. Specify the values of  $V_o$  in the table below.



4. Although computers use voltages to represent binary signals, it is customary to represent their values with just 0 or 1. For example, a computer operating with a 5 V supply would use 5 V to represent a "1" and 0 V to represent a "0". Likewise, signals are just represented by their names, not their physical

realization as e.g. voltage. So we write just "A" for the signal represented by voltage  $V_A$ . Fill in the table below, called "truth table" for the circuit shown.



5. Draw the truth table for the circuit shown below. Can you think of a name for the function the circuit realizes?



6. Draw the truth table for the circuit shown below.

