The final circuits investigated were diode logic circuits. These circuits operate by utilizing diodes to produce an output voltage that is dependent on two input voltages, A and B. Depending how the voltage sources and diodes are oriented, the output voltage can be programmed to hold different voltages for the different voltage combinations of A and B. The input-output patterns of the gates are essential in computer circuitry, since they can be used to mimic the boolean logic functions necessary for computation. In this case, the functions represented were the AND and OR gates:

CIRCUIT DIAGRAMS HERE

In order to match the digital quality of the logic functions, the “0” and “1” states for the input voltages were represented by turning a 5 volt DC source either on (“1”) or off (“0”). The output voltage states were slightly different, since the architecture of the circuits prevent the output from always reaching a perfect 0 or 5 volts. Instead, the “0” state was defined as any output voltage lower than 1 volt, and the “1” state as any voltage higher than 4 volts. The two functions represented in this lab were the AND and OR gates.

AND Truth table And results Or truth table Or results

In both circuits, the behavior of the output voltage matched the output behavior of their corresponding logic functions. Every output voltage larger than 4 volts corresponded to a truth table output of “1”, and every output voltage less than 1 volt corresponded to a truth table value of 0. These results verify the ability of basicscircuits to model logic gates using dioodes, and gives a glimpse into the kinds of circuitry used in modern computers. It should be noted that these results only matched when the input voltages were replaced with closed circuits when in the “0” (off) state. For example, if voltage A in the AND gate was turned off (disconnected from the circuit), the positive terminal of A had to be shorted with the negative ground, or else the voltage developed in the output would never discharge and remain charged at 1. This suggests that the power sources used for the input voltages in computers must have some mechanism or structure that allow them to short (or at least keep from remaining open) when in the off state.