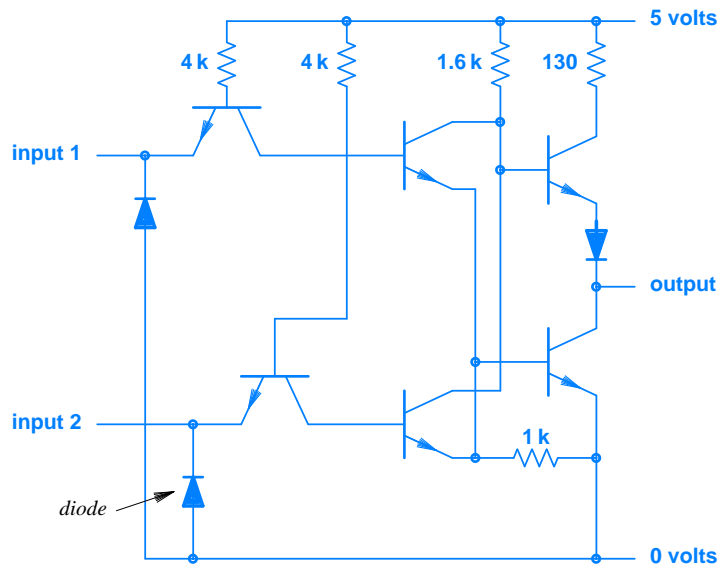


## 2.6 Construction Of Gates From Transistors

For our purposes, the internal details of gates are unimportant. All we need to understand is how gates are used. However, it is interesting to see that transistors can be used to create a gate. Figure 2.6 provides an example by showing the internal structure of a *nor* gate composed of transistors, resistors, and components known as *diodes*. The diagram reveals the underlying complexity: six transistors, five resistors, and three diodes are needed to form a single *nor* gate.



**Figure 2.6** The internal structure of a *nor* gate formed from transistors and other components. A solid dot indicates an electrical connection between two wires. Resistors are labeled with a value in ohms, with *k* indicating multiplication by 1000.

The drawing in the figure is known as a *schematic diagram*. Each line on a schematic corresponds to a wire that connects one component to another. In addition, the schematic shows wires that correspond to two inputs, an output, power (five volts), and ground (zero volts).

The diagram in Figure 2.6 uses a common convention: two lines that cross do not indicate an electrical connection unless a solid dot appears. That is, two lines that cross without a dot correspond to a situation in which there is no physical connection; we can imagine that the wires are positioned so an air gap exists between them (i.e., the wires do not touch).