Digital multiplexer and demultiplexer pdf

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When we transfer data, there are a few things that we need to consider to ensure that our transfers are fast, without loss, and efficient. However, data transfer requires bandwidth. Or let's put it in even easier situations. From the layman's point of view, if we've had a high number of connections or wires between two dots, you can pass a huge amount of data. However, transmission lines, connections, even works on board the circuit of an expensive commodity - both costly and real estate-wise. You ideally need a system where you can transfer the most data using the lowest connections and cost. That's one of the main aspects of communication system design. Multiplexing is a concept that is very important in this aspect. Multiplexing means transmitting more than one signal on a single transmission line. In this, we will look at the circuits of multiplexer and demultiplexer. We will also tabate the fact table of multiplexer and demultiplexer. What's multiplexer? Multiplexer is a digital hybrid logic circuit with n inputs and an output. Its purpose is to connect one of the inputs to the output line, depending on a control signal. The general symbol of a multiplexer is shown below. A muxBasically n:1 switches between one of the many incoming lines, connecting them one by one to the output. Decides which input line to use to use a control signal. Physically, a multiplexer has an input n pin, an output pin, and an m control pin. n = 2^m. We can refer to multiplexer with MUX and MPX conditions too. Since the work of a multiplexer is to select one of the input lines of the data and send it to the output, it is also known as the data selector. There are three main ways to make multiplexers. The digital multiplexes that are our focus are made up of logic gates. Analog multiple eyelids are made using transistors. Mechanical switches, also known as rotary switches, are made using rotating shafts. The mux itself acts like a digitally controlled multi-position switch where the binary code applied to the selected entries controls the data input, which will be switched to output. How does a multiplexer work? To understand the design and work of a multiplexer, we will dive right in. We will start by designing the easiest digital multiple eyelids: 2:1 mux. For a 2:1 mux, we have two input lines, one selection line (2^x = 2, then x=1) and one output line. Since we have a control input, there are only two possible values for it. 0 and 1. When the control input is 0, the first input line is connected to the output. When the control output is 1, the second input line is connected to the output. So now you understand how to control the control line that the input attaches to the output.2:1 Multiplexer Fact TableI0I1SOutput000000010010001000111100 11 101101111From the k-map of the above truth table we getOutput = SI1 + S'I02:1 multiplexer circuit designAs we can see in the multiplexer circuit, Depending on the value of the selection line (S), we can choose one Line to connect it to the output. The current value on the line that is selected passes to the output. In this way, multiplexer acts as a switching circuit. Now, as the number of entries increases, the number of selected lines will also increase. Let's now design a 4:1 multiplexer circuit. Can you calculate how many lines to choose from in this mux? We have four inputs, how many digits in a binary number will give you four possible combinations? Or can you count up to four by using multiple digits in a binary number? If you are unable to answer these questions, you still have the formula we saw above to count on. For the input n, select m lines, where n=2^m. 4 = 2^m, therefore, m =2. We need two lines to choose from for 4:1 mux.4:1 multiplexer fact tableI0I1I1I3S0S1Output0xxx0001xxx001xxx001x00xx0 10x1xx01xx00xx1x101xxx010x10x11x because that particular line is not selected by the values of the lines. WhenS0S1 = 00 (0 – decimal value), I0 is connected to the output. S0S1 = 01 (1), I1 output. S0S1 = 10 (2), I2 is the outputS0S1 = 11 (3), I3 is the outputSolving for output using the method we saw in the post for comparators. Output is 1 when I0 = 1 and S0 = 0 and S1 = 0 OR when I1 = 1 and S0 = 0 and S1 = 1 and so we getOutput = I0S 0'''S1′ + I1S0'S1 + I2S0S1′ + I3S0S1Plotting circuit for our above equation will get the following Logic circuit for multiplexer 4:1. 4:1 What are the multiplexer circuit designs for using multiplexer? Applications of a multiplexer include a communication system in which we have a communication network, a multiplexer increases the efficiency of the system by allowing the transmission of audio and video data on a single channel. In fiber optic communication, a multiplexer does the same to combine multiple fiber cables on a fiber cable using a technique called dense wavelength split multiplexing. In satellite communications, multiplexsters transport data from the satellite computer system to the Earth division using GSM communications. It also works as parallel to the serial data converter. On a computer it reduces the number of copper lines necessary to connect memory to other parts of the computer. How to join multiplexers? If the multiple eyelids have small eyelids, but we want to increase their capability, we can join them to obtain a mucus with more input. Multiplex falls are easy. You just need to make sure you connect in a way that gives the same number of inputs and control lines as your target mux. Let's have a 4:1 mux using multiplexone 2:1. We know that a 2:1 mux has two inputs and a selection line. So joining two 2:1 multiplexies gives us four inputs, two outputs (we only need 1), and two selection lines. So how do we go? If we can somehow reduce the output to one, it will be really easy. Since we wish to use only multiple eyelids, how do I combine two lines to get a single line? We will use another 2:1 mux! However, though that gives us an outlet that we need, it gives An additional selection line. So now we have three lines to choose from. How to reduce three selected lines to two selected lines? If only we can only delete a selection line. Well, we can do that by joining two lines of choice. That basically reduces two lines to one line. This is the result we get by applying our logic.4:1 multiplexer using 2:1 multiplexerHow to design 8:1 multiplexer, 16:1 multiplexer, and so on? Similar to the process we saw above, you can design an 8-1 multiplexer using a 2:1, 16:1 mux multiplexer using 4:1 mux, or 16:1 mux using a 8:1 mux multiplexer. Try designing this using multiplexesets using only the same logic as the one we saw above. Check your answers with the following designs. Joining multiplexerto can also go the opposite way and use a multiplexer with more input than is needed as a smaller mucosa. Here 8:1 multiplexer is used as a 2:1 multiplexer. Bigger mux to make the muxHow smaller into logic gateway using multiple eyelids? Since logic gates we study in general with two inputs and one output, we can see it as a logical challenge to design all logic gates using multiplexer 2:1. As with many logical circuits, building gates using mux also does not have a method written in stone. You can try alternative designs and arrive at the same logical conclusion. lets start with gate no . We know it just turnes the entrance upside down and has an entry. If we consider the selection line as input B, apply a above logic in Io, and low logic in I1, we get an NOT gate. Gateway Nine uses 2:1 MuxSimilarly, using some Logic, you can derive all other gates using just 2:1 Mux. Try it! It's a good exercise to increase logical ability. Logic's gateways using MultiplexerWhat demultiplexer? A demultiplexer is a hybrid logic circuit that performs the opposite function as a multiplexer. In a demux, we n select the output line, an input line, and m lines. The relationship between the number of output lines and the number of selection lines is the same as we saw in a multiplexer. It is, 2^m = n. Depending on the amount of binary number formed by the selected lines, each output line is connected to the input line. The rest of the output lines go to an OFF mode at this point. As the remaining lines 0.In, a demultiplexer converts serial data into parallel data and acts as a serial-parallel converter. Also, since it connects a data line to multiple data lines and switches between them, a demultiplexer is also known as the data distributor. A demultiplexer is alternatively referred to as demux. The overall symbol of a demultiplexer is shown below.1:n demuxHow Does a demultiplexer work? To understand the work of a demultiplexer, we instantly design one. Demux 1:2 is the easiest of all demultiplexers. We have one input, two outputs, and a selection line (2^m = 2, so m=1). Let's write the fact table for this demux.1:2 demultiplexer truth table of truth = I0S' andY1 = I0SThe resulting circuit of a 1:2 demultiplexer using logic gates using the equations we got from the truth table is shown below. As you can see, depending on the amount of the selection line, one of the outputs will be connected to the input line. When the S is 0, the first output line is connected to the input. When the S is 1, the second output line is connected to the input. In this way, a demultiplexer distributes data from a data line to several data lines. Next, we will design a 1:4 demultiplexer. From the formula for the selection lines we saw above, a 1:4 demux will have two selection lines. Let's pull the truth table for a 1:4 demox truth table for 1:4 demultiplexerI0S0S1Y0Y1Y2Y3I000I01010I1000I100I11000IAs you can see, this fact table is shorter than the one for 4:1 mux. This is because instead of getting both possible value from the entrance, we just took it as I did. The resulting equations will be the same. Once you have great truth tables, tricks like this are handy and it's easier for you to reach the equations you need. So from the fact table,Y0 = S0'S1'Y1 = S0'S1Y2 = S0S1'Y3 = S0S1 the resulting circuit for the equations above is shown below. What are the uses of a demultiplexer? In a communication system, a demultiplexer can receive serial data from a multiplexer that exists at the end of the transition. Then demux converts the data into its original shape. We can store ALU output in multiple memory recordings using a demultiplexer. The demultiplexer also acts as a serial to parallel converter. Convert.