



Digital clock worksheets pdf

Here is a quick overview of the components of a digital clock at a high level. At the heart of the clock there is a piece that can generate this signal: The signal can be extracted from the 60-Hz oscillations in a normal power line. Many clocks that get their power from a wall socket use this technique because it is cheap and easy. The 60-Hz signal on the power line is reasonably accurate for this purpose. The signal can be generated using a crystal oscillator. Obviously, any battery-operated clock or wristwatch will use this technique instead. It takes more parts, but is generally much more accurate. The 60-Hz signal is divided down using a counter. When building your own clock, a typical TTL part to use is a 7490 decade counter. This part can be configured to divide it by 6 and now you have a 1-Hz (1 oscillation per second) signal. This 1-Hz signal is perfect for driving the "second hand" portion of the display. So far, the clock looks like this in a block diagram: To actually see the seconds, then the outputs. We want to display these binary numbers. The divide-by-10 counter is produce on its outputs. We want to display these binary numbers on something called a 7-segment display. A 7-segment display has seven bars on it, and by turning on different bars you can display, you use a (appropriately named) "binary number to 7-segment display converter." This chip looks at the binary number coming in and turns on the appropriate bars in the 7-segment LED to display that number. If we are displaying the seconds, then the seconds part of our clock looks like this: The output from this stage oscillates at a frequency of one-cycle-per-minute. You can imagine that the minutes section of the clock looks like this: The output from this stage oscillates at a frequency of one-cycle-per-minute. except that the divide-by-6 counter is replaced by a divide-by-2 counter.Now there are two details left to figure out if you are building a real clock: The clock as designed here does not understand that at 12:59:59 it is supposed to cycle back to 1:00. That is a messy little problem, and there are a couple of ways to solve it. One technique involves creating a little bit of logic that can detect the number 13 and reset the hour section back to 1 (not zero). Another technique involves using an adder. For our purposes, it is easier to deal in military time, because military time includes a zero hour. We need a way to set the clock. Typically this is handled by gating higher-than-normal frequencies into the minutes section. For example, most clocks have "fast" and "slow" set buttons. When you press the "fast" button, the 60-Hz signal is driven straight into the minutes counter. When you press the "slow" button, a 1-Hz signal is driven into the minutes section. There are other possible techniques, but this one is the most common.Now let's see what we have to do to build a real clock! The best way to understand the different components of a digital clock and how they work together is to actually walk through the steps of building your own clock. Here we will build just the "seconds" part of the clock, but you can easily extend things to build a complete clock with hours, minutes and seconds. To understand these steps, you will need to have read How Boolean Logic Works and How Electronic Gates Work. In particular, the electronic gates article introduces you to TTL chips, breadboards and power supplies. If you have already played around with gates as described in that article, then the electronic gates article. That time, we used a standard wall transformer that produced DC (direct current) power and then regulated it to 5 volts using a 7805. For our clock, we want to do things slightly differently because we are going to extract our 60-Hz timebase from the power line. That means that we want an AC rather than a DC transformer, and we will use a part called a bridge rectifier to convert the AC to DC. Therefore, we need the following parts for our power supply:12-volt AC transformer (Jameco part #115602)Bridge rectifier (Jameco part #103018)7805 5-volt regulator (TO-220 case) (Jameco part #51262)Two 470-microfarad electrolytic capacitors (Jameco part #36097)1-K-ohm resistor (Jameco part #29663) A few notes on the parts used: The difference between the AC transformer we are using here and the DC transformer we used in the article on gates is that the AC transformer preserves the 60-Hz sine wave found in 120-volt household current. If you want to use your volt-ohm meter to measure the voltage of an AC transformer, be sure you use an AC voltage range rather than a DC range. We use the bridge rectifier to convert the AC to DC. One of the terminals on the rectifier will be marked with a "+" -- from that you can find the minus and AC inputs. There is no polarity to an AC transformer, so it does not matter which transformer, so it does not matter which transformer, so it does not matter which transformer is no polarity to an AC transformer, so it does not matter which transformer is no polarity to an AC transformer, so it does not matter which transformer is no polarity to an AC transformer, so it does not matter which transformer is no polarity to an AC transformer, so it does not matter which transformer is no polarity to an AC transformer, so it does not matter which transformer is no polarity to an AC transformer i sine wave. A diode is a one-way valve for electrons. A zener diode is also a one-way valve, but it also passes electrons in the other direction if they are above a certain voltage. The zener diode therefore turns a 10-volt sine wave into a clipped wave oscillating between 0 and 5 volts. This is perfect for clocking the TTL counters. The 1-K-ohm resistor makes sure that the current to the zener diode is limited so we do not burn out the diode. The diode will have a band painted on one end -- this band should be the end connected to the resistor. Instructables is a community for people who like to make things. Come explore, share, and make your next project with us!Instructables is a community for people who like to make things. Come explore, share, and make your next project with us!Instructables is a community for people who like to make things. 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