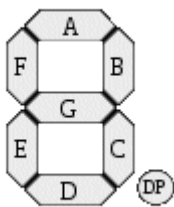


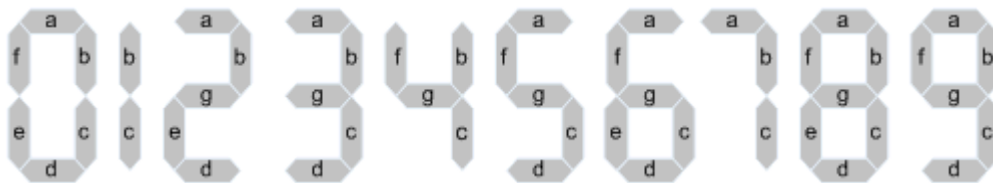
Homework 8 – FM Radio Stations Display

Seven-segment displays are widely used in digital clocks, digital watch, microwaves, ovens, electronic meters, temperature controllers, radio, CD, DVD, Blu-ray players, basic calculators, pedometers, and other electronic devices that display numerical information.

A 7-segment display is an assembly of light emitting diode-bars (segments). Each bar can be powered individually. They are arranged and labeled as shown in the diagram below. When all the segments are powered on, the display shows the number 8. Powering up segments a, b, c, d, and g will display the number 3. Some single displays have an additional input pin for the **decimal point (DP)** in their lower right or left hand corner.



Each individual 7-segment can display numbers from 0 to 9.

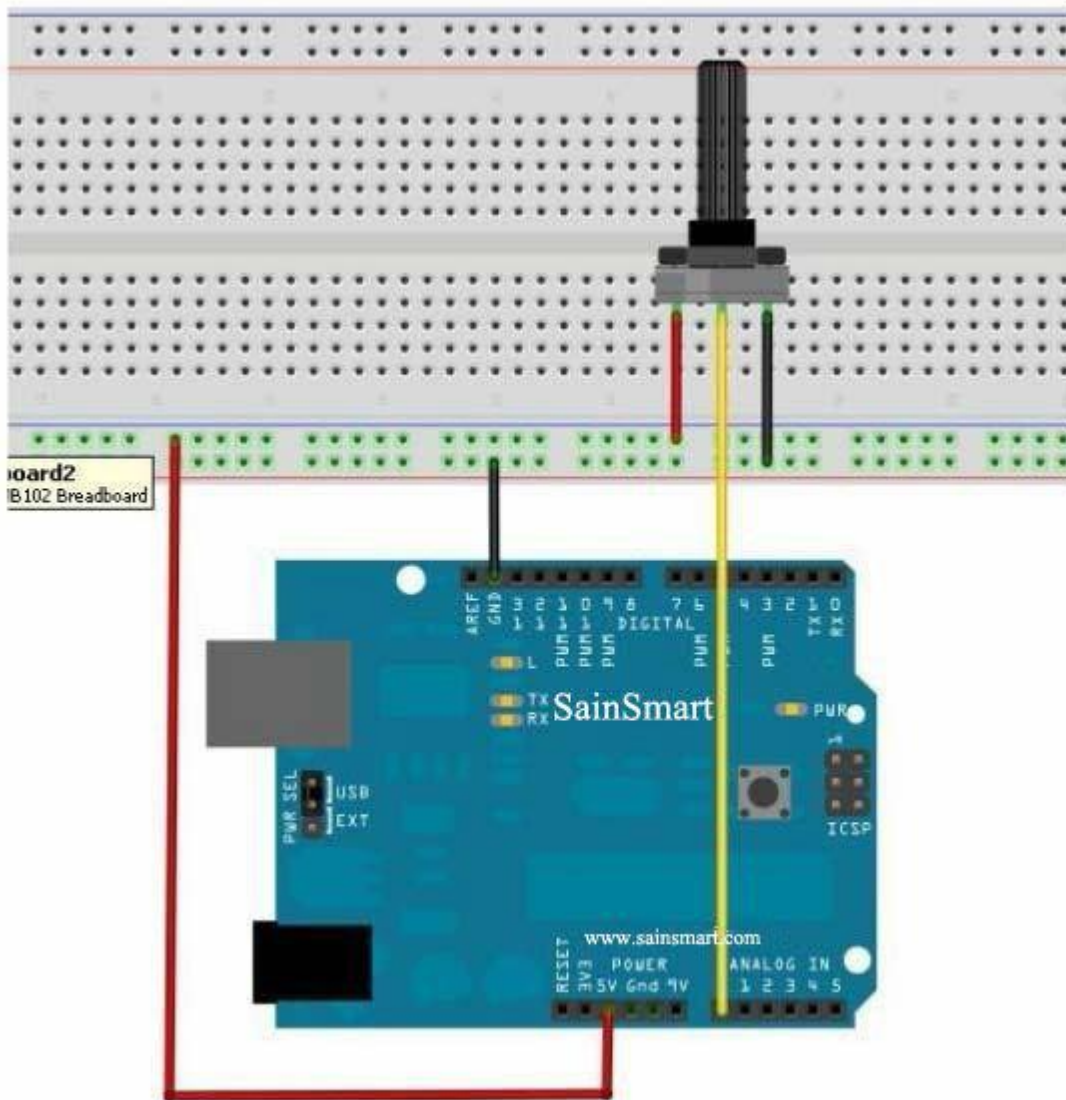


Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment and light dimmers. A **potentiometer** is a simple knob that provides a variable resistance. It is a three-terminal resistor with a rotating or sliding contact that forms an adjustable voltage divider. It is used for measuring electric potential (voltage).

Connect **one of the outer pins** of the potentiometer to **ground**.

Connect the other outer pin of the potentiometer to **5 volts**.

Connect **the middle pin** of the potentiometer to the **analog pin A0**.

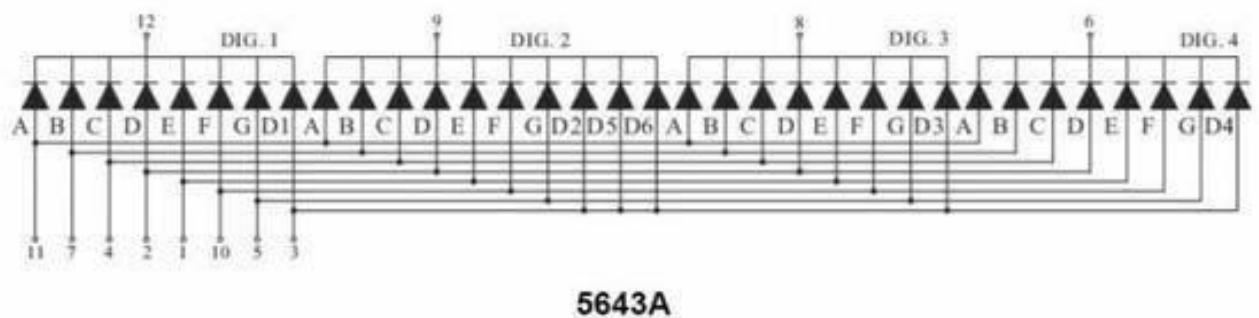


By turning the knob of the potentiometer, we change the amount of resistance of the potentiometer. The voltage of the potentiometer changes between 0 volts and 5 volts. When we read the value from the **analog pin A0**, we will **read a value between 0 and 1023**. If there is **0 volt** going to the analog pin A0, we read **0**. If there is **5 volt** going to the analog pin A0, we read **1023**. **The values in between is proportional to the amount of voltage being applied to the pin.**

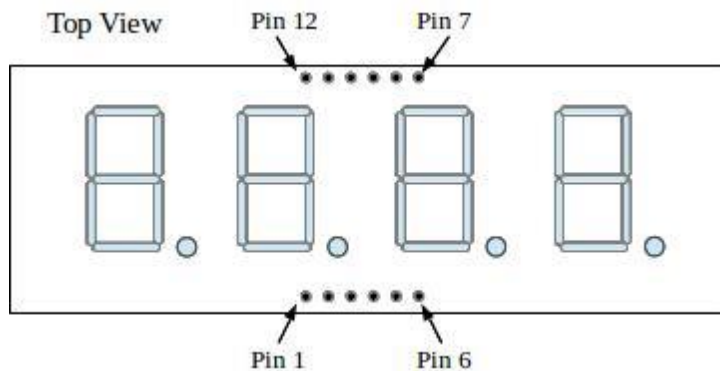
A multi-digit 7-segment display is an integration of several 7-segment displays into a single package. To reduce the total number of registers needed to control many digits, the segment pins are shared by all the digits. **There is a single pin that connects to all the “a” segments, a single pin that connects all the “b” segments, etc.** When all the segments are powered on at the same time, every digit will display the same number.



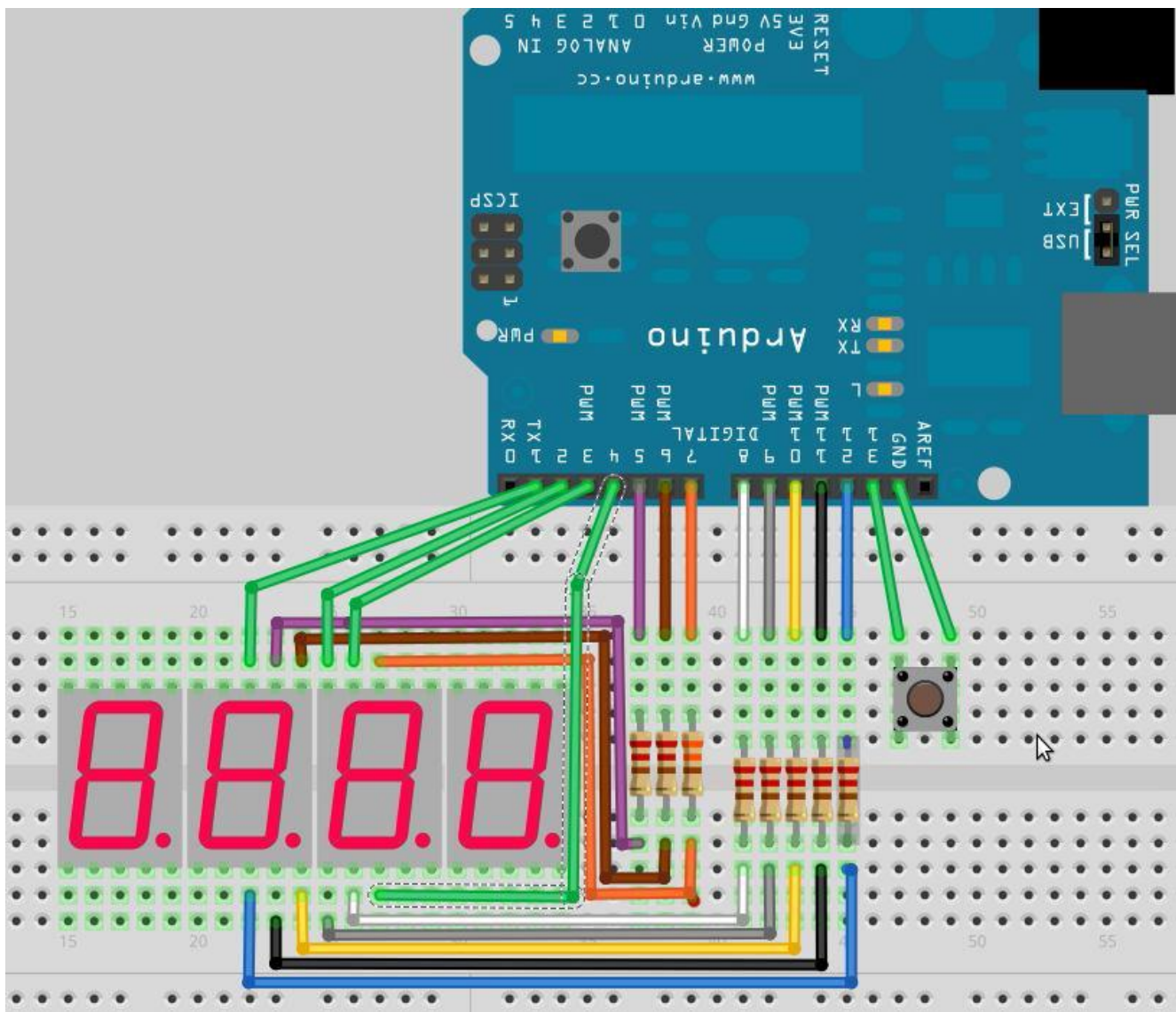
Time division multiplexing allows each digit to take a turn to be enabled to display a particular digit. When this is done fast enough, our eyes are not able to tell the difference. The numbers will appear to be lit at the same time, although they are not.



There are 12 pins in one 4-digit 7-segment display. The pin numbers for the 4-digit 7-segment display are shown below.



Connect the Arduino Uno R3 compatible board with a breadboard and a 4-digit 7-segment display module using the circuit diagram below.



Instead of a button, connect a LED light to digital pin 13.



The FM broadcast band, used for FM broadcast radio by radio stations, usually spans from 87.5 to 108.0 megahertz (MHz).

Write a c program, [using the Arduino's integrated development environment \(IDE\)](#), to simulate a FM broadcast radio display. Rotating the Potentiometer should display radio frequency from 87.5 to 108.0 megahertz (MHz).

When the potentiometer is turned to the following FM radio stations, turn the LED light ON.

| Frequency | Call Sign | Format |
|-----------|-----------|----------------|
| 88.9 | KXPR | CSU-Sacramento |
| 90.9 | KXJZ | CSU-Sacramento |
| 92.5 | KBEB | Country |
| 96.9 | KSEG | Classic Rock |
| 102.5 | KSFM | Hip Hop |
| 107.9 | KDND | Top 40 |

The LED light should be turned off when the 4-digit 7-segment display is not showing any FM radio station. Turning the light on for additional FM radio stations is welcome.

When the radio frequencies are 3 digits, for example 88.9, the leading 0 should be omitted in the display.

Homework 8 will also be presented in lab. If you are not able to present Homework 8 during the lab time, I will grade your Homework 8 using my circuit board with the I/O pins specified above. Your program may not function properly if the program is written to control different I/O pin numbers.