

Turn on / off

Level 1

```
void setup() {
  // put your setup code here, to run once:
  pinMode(12,OUTPUT);
  digitalWrite(12,HIGH);
}

void loop() {
  // put your main code here, to run repeatedly:
}
```

**** Now try to turn it off by changing the word HIGH to something else

Blink

```
void setup() {
  // put your setup code here, to run once:
  pinMode(12,OUTPUT);
}

void loop() {
  // put your main code here, to run repeatedly:
  digitalWrite(12,HIGH);
  delay(1000);
  digitalWrite(12,LOW);
  delay(1000);
}
```

**** Now make it blink faster and then slower

Blink 2 LED's

Level 2

```
void setup() {
  // put your setup code here, to run once:
  pinMode(11,OUTPUT);
  pinMode(12,OUTPUT);
}

void loop() {
  // put your main code here, to run repeatedly:
  digitalWrite(12,HIGH);
  delay(1000);
  digitalWrite(12,LOW);
  delay(1000);

  digitalWrite(11,HIGH);
  delay(1000);
  digitalWrite(11,LOW);
  delay(1000);
}
```

```
**** Now try to add more blinking LED's
**** Then make it blink faster and then slower
again
```

Blink-const

Level 3

```
const int wait = 250;
```

New line

```
void setup() {  
  // put your setup code here, to run once:  
  pinMode(11,OUTPUT);  
  pinMode(12,OUTPUT);  
}
```

```
void loop() {  
  // put your main code here, to run repeatedly:  
  digitalWrite(12,HIGH);  
  delay(wait);  
  digitalWrite(12,LOW);  
  delay(wait);  
  
  digitalWrite(11,HIGH);  
  delay(wait);  
  digitalWrite(11,LOW);  
  delay(wait);  
}
```

Replace the number from your original program to "wait"

**** Now make it blink faster and then slower again

Notice how much easier it is to change just the first line instead of all the delays.

Blink-loop

Level 4

```
const int wait = 250;

void setup() {
  // put your setup code here, to run once:
  pinMode(11,OUTPUT);
  pinMode(12,OUTPUT);

  for (int i = 0; i < 10; i = i + 1) {
    digitalWrite(12,HIGH);
    delay(wait);
    digitalWrite(12,LOW);
    delay(wait);

    digitalWrite(11,HIGH);
    delay(wait);
    digitalWrite(11,LOW);
    delay(wait);
  }
}

void loop() {
  // put your main code here, to run repeatedly:
}
```

New line

Notice there are 2 brackets—
one for the loop and the other
for the setup

Blink in order with For-loops

Level 5

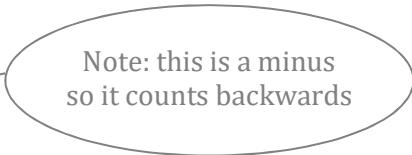
```
const int wait = 100;

void setup() {
  // put your setup code here, to run once:
  for (int i = 5; i < 14; i = i + 1) {
    pinMode(i, OUTPUT); // sets pinMode for pins 5-13
  }

  for (int i = 5; i < 14; i = i + 1) {
    digitalWrite(i, HIGH); // turns on pins 5-13 in order
    delay(wait);
  }

  for (int i = 13; i > 4; i = i - 1) {
    digitalWrite(i, LOW); // turns off 5-13 in backwards order
    delay(wait);
  }
}

void loop() {
  // put your main code here, to run repeatedly:
}
```

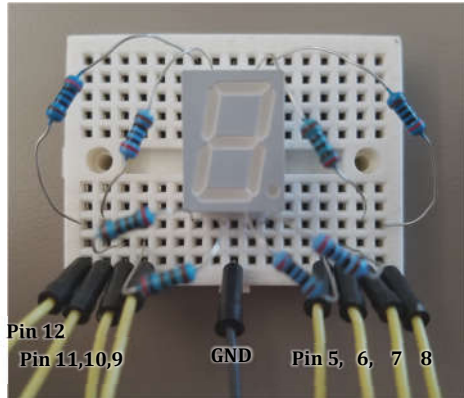


Fade with For-loops

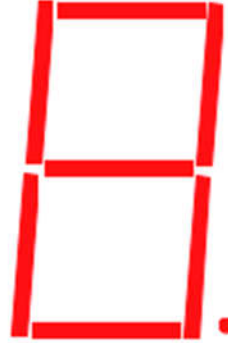
```
void setup() {
  // put your setup code here, to run once:
  pinMode(10, OUTPUT);
}

void loop() {
  // put your main code here, to run repeatedly:
  for (int i=0; i < 256; i=i+1) {
    analogWrite(10, i);
    delay(5);
  }
  for (int i=255; i > 0; i=i-1) {
    analogWrite(10, i);
    delay(5);
  }
  delay(50);
}
```

Wire it like this:



Map which pin turns on each segment:



```
void setup() {
  // put your setup code here, to run once:
  pinMode(5, OUTPUT);
  pinMode(6, OUTPUT);
  pinMode(7, OUTPUT);
  pinMode(8, OUTPUT);
  pinMode(9, OUTPUT);
  pinMode(10, OUTPUT);
  pinMode(11, OUTPUT);
  pinMode(12, OUTPUT);
}

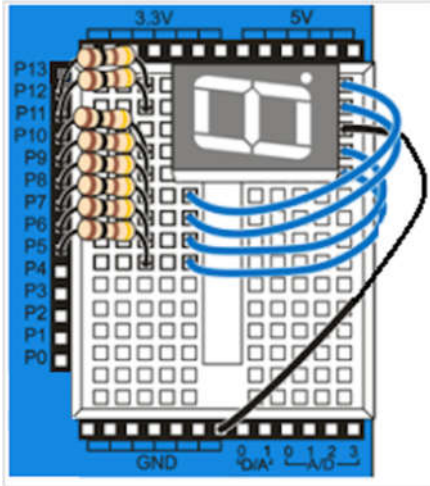
void loop() {
  // put your main code here, to run repeatedly:
  digitalWrite(5, HIGH); // #8
  digitalWrite(6, HIGH);
  digitalWrite(7, HIGH);
  digitalWrite(8, HIGH);
  digitalWrite(9, HIGH);
  digitalWrite(10, HIGH);
  digitalWrite(11, HIGH);
  digitalWrite(12, HIGH);
  delay(1000);

  digitalWrite(5, LOW); // #1
  digitalWrite(6, LOW);
  digitalWrite(7, HIGH);
  digitalWrite(8, LOW);
  digitalWrite(9, LOW);
  digitalWrite(10, LOW);
  digitalWrite(11, LOW);
  digitalWrite(12, HIGH);
  delay(1000);

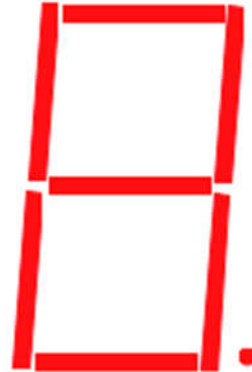
  digitalWrite(5, HIGH); // #2
  digitalWrite(6, HIGH);
  digitalWrite(7, LOW);
  digitalWrite(8, HIGH);
  digitalWrite(9, HIGH);
  digitalWrite(10, LOW);
  digitalWrite(11, HIGH);
  digitalWrite(12, HIGH);
  delay(1000);
}
```

*** Now make it work for all the digits 0-9

Wire it like this:



Map which pin turns on each segment:



```

void setup() {
  // put your setup code here, to run once:
  pinMode(5, OUTPUT);
  pinMode(6, OUTPUT);
  pinMode(7, OUTPUT);
  pinMode(8, OUTPUT);
  pinMode(9, OUTPUT);
  pinMode(10, OUTPUT);
  pinMode(11, OUTPUT);
  pinMode(12, OUTPUT);
}

void loop() {
  // put your main code here, to run repeatedly:
  digitalWrite(5, HIGH); // #8
  digitalWrite(6, HIGH);
  digitalWrite(7, HIGH);
  digitalWrite(8, HIGH);
  digitalWrite(9, HIGH);
  digitalWrite(10, HIGH);
  digitalWrite(11, HIGH);
  digitalWrite(12, HIGH);
  delay(1000);

  digitalWrite(5, LOW); // #1
  digitalWrite(6, LOW);
  digitalWrite(7, HIGH);
  digitalWrite(8, LOW);
  digitalWrite(9, LOW);
  digitalWrite(10, LOW);
  digitalWrite(11, LOW);
  digitalWrite(12, HIGH);
  delay(1000);

  digitalWrite(5, HIGH); // #2
  digitalWrite(6, HIGH);
  digitalWrite(7, LOW);
  digitalWrite(8, HIGH);
  digitalWrite(9, HIGH);
  digitalWrite(10, LOW);
  digitalWrite(11, HIGH);
  digitalWrite(12, HIGH);
  delay(1000);
}

```

*** Now make it work for all the digits 0-9

```
void setup() {  
  // put your setup code here, to run once:  
  pinMode(5, OUTPUT);  
  pinMode(6, OUTPUT);  
  pinMode(7, OUTPUT);  
  pinMode(8, OUTPUT);  
  pinMode(9, OUTPUT);  
  pinMode(10, OUTPUT);  
  pinMode(11, OUTPUT);  
  pinMode(12, OUTPUT);  
}
```

This creates a new command called a "procedure" or "function"

```
void eight() {  
  digitalWrite(5, HIGH); // #8  
  digitalWrite(6, HIGH);  
  digitalWrite(7, HIGH);  
  digitalWrite(8, HIGH);  
  digitalWrite(9, HIGH);  
  digitalWrite(10, HIGH);  
  digitalWrite(11, HIGH);  
  digitalWrite(12, HIGH);  
}
```

CUT and paste your old code from the loop section to here

```
void one() {  
  digitalWrite(5, LOW); // #1  
  digitalWrite(6, LOW);  
  digitalWrite(7, HIGH);  
  digitalWrite(8, LOW);  
  digitalWrite(9, LOW);  
  digitalWrite(10, LOW);  
  digitalWrite(11, LOW);  
  digitalWrite(12, HIGH);  
}
```

```
void two() {  
  digitalWrite(5, HIGH); // #2  
  digitalWrite(6, HIGH);  
  digitalWrite(7, LOW);  
  digitalWrite(8, HIGH);  
  digitalWrite(9, HIGH);  
  digitalWrite(10, LOW);  
  digitalWrite(11, HIGH);  
  digitalWrite(12, HIGH);  
}
```

```
void loop() {  
  // put your main code here, to run repeatedly:  
  
  one;  
  delay(1000);  
  two;  
  delay(1000);  
  eight;  
  delay(1000);  
}
```

Notice how much easier it is to read this code and change it using procedures

*** Now make it work for all the digits 0-9