# Arduino Programming Cheat Sheet

Primary source: Arduino Language Reference
http://arduino.cc/en/Reference/

## Structure & Flow

### Basic Program Structure

```
void setup() {
  // runs once when sketch starts
}
void loop() {
  // runs repeatedly
}
```

### Control Structures

```
if (x < 5) { ... } else { ... }
while (x < 5) { ... }
do { ... } while ( x < 5);
for (int i = 0; i < 10; i++) { ... }
break;  // exit a loop immediately
continue;  // go to next iteration
switch (myVar) {
   case 1:
     ...
     break;
   case 2:
     ...
     break;
   default:
     ...
}
return x; // just return; for voids
```

## Operators

### General Operators

```
=   (assignment operator)
+   (add)          -   (subtract)
*   (multiply)     /   (divide)
%   (modulo)
==  (equal to)     !=  (not equal to)
<   (less than)    >   (greater than)
<=  (less than or equal to)
>=  (greater than or equal to)
&&  (and)     ||  (or)     !  (not)
```

### Compound Operators

```
++  (increment)
--  (decrement)
+=  (compound addition)
-=  (compound substraction)
*=  (compound multiplication)
/=  (compound division)
&=  (compound bitwise and)
|=  (compound bitwise or)
```

### Bitwise Operators

```
&  (bitwise and)     |  (bitwise or)
^  (bitwise xor)     ~  (bitwise not)
<< (shift left)     >> (shift right)
```

## Variables, Arrays, and Data

### Data types

```
void
boolean   (0, 1, true, false)
char      (e.g. 'a'  -128 to 127)
int       (-32768 to 32767)
long      (-2147483648 to 2147483647)
unsigned char  (0 to 255)
byte           (0 to 255)
unsigned int   (0 to 65535)
word           (0 to 65535)
unsigned long  (0 to 4294967295)
float     (-3.4028e+38 to 3.4028e+38)
double    (currently same as float)
```

### Qualifiers

```
static    (persists between calls)
volatile  (in RAM (nice for ISR))
const     (make read only)
PROGMEM   (in flash)
```

### Arrays

```
int myInts[6]; // array of 6 ints
int myPins[]={2, 4, 8, 3, 6};
int mySensVals[6]={2, 4, -8, 3, 2};
myInts[0]=42;  // assigning first
               // index of myInts
myInts[6]=12;  // ERROR! Indexes
               // are 0 though 5
```

### Constants

```
HIGH  | LOW
INPUT | OUTPUT
true  | false
143         (Decimal)
0173        (Octal - base 8)
0b11011111  (Binary)
0x7B        (Hexadecimal - base 16)
7U          (force unsigned)
10L         (force long)
15UL        (force long unsigned)
10.0        (force floating point)
2.4e5       (2.4*10^5 = 240000)
```

### Pointer Access

```
&  (reference: get a pointer)
*  (dereference: follow a pointer)
```

### Strings

```
char S1[8] =
 {'A','r','d','u','i','n','o'};
 // unterminated string; may crash
char S2[8] =
 {'A','r','d','u','i','n','o','\0'};
 // includes \0 null termination
char S3[]="Arduino";
char S4[8]="Arduino";
```

## Built-in Functions

### Pin Input/Output

```
Digital I/O (pins: 0-13 A0-A5)
  pinMode(pin,[INPUT, OUTPUT])
  int digitalread(pin)
  digitalWrite(pin, value)
    // Write HIGH to an input to
    // enable pull-up resistors
Analog In (pins: 0-5)
  int analogRead(pin)
  analogReference(
    [DEFAULT, INTERNAL, EXTERNAL])
PWM Out (pins: 3 5 6 9 10 11)
  analogWrite(pin, value)
```

### Advanced I/O

```
tone(pin, freqhz)
tone(pin, freqhz, duration_ms)
noTone(pin)
shiftOut(dataPin, clockPin,
  [MSBFIRST,LSBFIRST], value)
unsigned long pulseIn(pin,
  [HIGH,LOW])
```

### Time

```
unsigned long millis()
  // overflows at 50 days
unsigned long micros()
  // overflows at 70 minutes
delay(msec)
delayMicroseconds(usec)
```

### Math

```
min(x, y)   max(x, y)   abs(x)
sin(rad)    cos(rad)    tan(rad)
sqrt(x)     pow(base, exponent)
constrain(x, minval, maxval)
map(val, fromL, fromH, toL, toH)
```

### Random Numbers

```
randomSeed(seed) // long or int
long random(max)
long random(min, max)
```

### Bits and Bytes

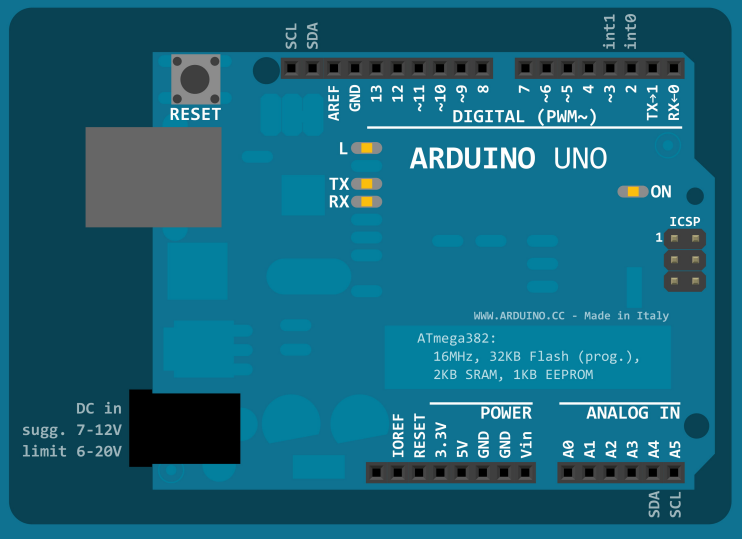
```
lowByte(x)    highByte(x)
bitRead(x, bitn)
bitWrite(x, bitn, bit)
bitSet(x, bitn)
bitClear(x, bitn)
bit(bitn)  // bitn: 0=LSB 7=MSB
```

### Type Conversions

```
char()        byte()
int()         word()
long()        float()
```

### External Interrupts

```
attachInterrupt(interrupt, func,
 [LOW, CHANGE, RISING, FALLING])
detachInterrupt(interrupt)
interrupts()
noInterrupts()
```




## Libraries

### Serial (communicate with PC or via RX/TX)

```
begin(long Speed) // up to 115200
end()
int available() // #bytes available
byte read() // -1 if none available
byte peek()
flush()
print(myData)
println(myData)
write(myBytes)
SerialEvent() // called if data rdy
```

### SoftwareSerial (serial comm. on any pins)

```
  (#include <softwareSerial.h>)
SoftwareSerial(rxPin, txPin)
begin(long Speed) // up to 115200
listen()       // Only 1 can listen
isListening() // at a time.
read, peek, print, println, write
  // all like in Serial library
```

### EEPROM (#include <EEPROM.h>)

```
byte read(intAddr)
write(intAddr, myByte)
```

### Servo (#include <Servo.h>)

```
attach(pin, [min_uS, max_uS])
write(angle)  // 0 to 180
writeMicroseconds(uS)
   // 1000-2000; 1500 is midpoint
int read()    // 0 to 180
bool attached()
detach()
```

### Wire (I²C comm.) (#include <Wire.h>)

```
begin()       // join a master
begin(addr) // join a slave @ addr
requestFrom(address, count)
beginTransmission(addr) // Step 1
send(myByte)            // Step 2
send(char * mystring)
send(byte * data, size)
endTransmission()       // Step 3
int available() // #bytes available
byte receive()  // get next byte
onReceive(handler)
onRequest(handler)
```



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Adapted from:
- Original by Gavin Smith
- SVG version by Frederic Dufourg
- Arduino board drawing original by Fritzing.org