Arduino Programming Cheat Sheet

Primary source: Arduino Language Reference
https://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) { ... }
for (int i = 0; i < 10; i++) { ... }
break;     // Exit a loop immediately
continue;  // Go to next iteration
switch (var) {
  case 1:
    ...
    break;
  case 2:
    ...
    break;
  default:
    ...
}
return x;  // x must match return type
return;    // For void return type
```

Function Definitions

```
<ret. type> <name>(<params>) { ... }
e.g. int double(int x) {return x*2;}
```

Operators

General Operators

`=`	assignment		
`+`	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 subtraction
`*=`	compound multiplication
`/=`	compound division
`&=`	compound bitwise and
`|=`	compound bitwise or

Bitwise Operators

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

Pointer Access

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

Variables, Arrays, and Data

Data Types

`boolean`	true | false
`char`	-128 - 127, 'a' '$' etc.
`unsigned char`	0 - 255
`byte`	0 - 255
`int`	-32768 - 32767
`unsigned int`	0 - 65535
`word`	0 - 65535
`long`	-2147483648 - 2147483647
`unsigned long`	0 - 4294967295
`float`	-3.4028e+38 - 3.4028e+38
`double`	currently same as float
`void`	i.e., no return value

Strings

```
char str1[8] =
  {'A','r','d','u','i','n','o','\0'};
  // Includes \0 null termination
char str2[8] =
  {'A','r','d','u','i','n','o'};
  // Compiler adds null termination
char str3[] = "Arduino";
char str4[8] = "Arduino";
```

Numeric Constants

`123`	decimal
`0b01111011`	binary
`0173`	octal - base 8
`0x7B`	hexadecimal - base 16
`123U`	force unsigned
`123L`	force long
`123UL`	force unsigned long
`123.0`	force floating point
`1.23e6`	1.23*10^6 = 1230000

Qualifiers

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

Arrays

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

Built-in Functions

Pin Input/Output

(ESP32: check Board-specific pins_arduino.h)

```
Digital I/O - pins GPIO
  pinMode(pin,
    [INPUT, OUTPUT, INPUT_PULLUP])
  int digitalRead(pin)
  digitalWrite(pin, [HIGH, LOW])

Analog In - pins ADC (A0 - A19)
  int analogRead(pin)
  analogReference(
    [DEFAULT, INTERNAL, EXTERNAL])

PWM Out - pins GPIO
  analogWrite(pin, value)
```

Advanced I/O

```
tone(pin, freq_Hz)
tone(pin, freq_Hz, 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) // 0 to max-1
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(val)       byte(val)
int(val)        word(val)
long(val)       float(val)
```

External Interrupts

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

Libraries

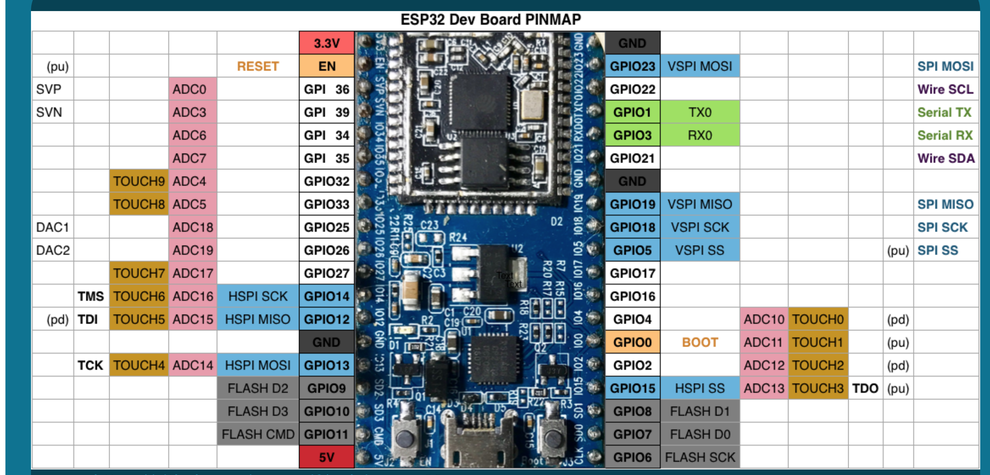
```
Serial - comm. with PC or via RX/TX
begin(long speed)  // Up to 115200
end()
int available()  // #bytes available
int read()   // -1 if none available
int peek()   // Read w/o removing
flush()
print(data)    println(data)
write(byte)    write(char * string)
write(byte * data, size)
SerialEvent()  // Called if data rdy

SoftwareSerial.h - comm. on any pin
SoftwareSerial(rxPin, txPin)
begin(long speed)  // Up to 115200
listen()       // Only 1 can listen
isListening()  // at a time.
read, peek, print, println, write
  // Equivalent to Serial library

EEPROM.h - access non-volatile memory
byte read(addr)
write(addr, byte)
EEPROM[index]  // Access as array

Servo.h - control servo motors
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.h - I²C communication
begin()     // Join a master
begin(addr) // Join a slave @ addr
requestFrom(address, count)
beginTransmission(addr) // Step 1
send(byte)              // Step 2
send(char * string)
send(byte * data, size)
endTransmission()       // Step 3
int available() // #bytes available
byte receive()  // Get next byte
onReceive(handler)
onRequest(handler)
```



source: https://github.com/espressif/arduino-esp32

NOTE: incomplete adaptations for ESP32

* Assignment of pins might be incomplete
* specific functions for ESP32 (Touch, DAC, ...) are missing

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version: 2020-05-21

source: https://github.com/4bht/Arduino-Cheat-Sheet/

Sources / Adapted from:
- Mark Liffiton (liffiton/Arduino-Cheat-Sheet)
- Gavin Smith
- Frederic Dufourg
- image pin map: espressif/arduino-esp32