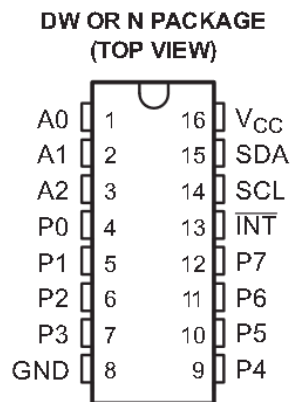DAH Checkpoint 4: Input/Output and I2C BUS

**1. Explain the purpose of the SDA, SCL and A0, A1, A2 connections to the PCF8574AN chip**



DW OR N PACKAGE
(TOP VIEW)

- SDA pin is the serial data line, connected to $V_{CC}$ through pullup resistor, and it carries data between devices
- SCL is the serial clock line, connected to $V_{CC}$ through another pullup resistor, and it ensures the sending and receiving of data is synchronised
- A0, A1 and A2 are address inputs which are used to identify the device where commands should be sent, so up to 8 devices, addressed 000 to 111 (A2 A1 A0), can share the same SDA and SCL lines but only the intended address acts on a command being sent

**2. If you were to connect the A0 pin to +3.3 V instead of ground, how would you modify your code?**

The full 7-bit address is made up of 0111 followed by what was connected to A0-2. A0-2 were all connected to ground, so the address was 0111000 which is decimal 56 or hexadecimal 38.

So, to setup the chip in code, 'mcp = PCF8574A(slave=0x38)' was used.

If instead A0 was set to 3.3V, the address would be 0111001 or hexadecimal 39.

That line of code would have to be changed to 'mcp = PCF8574A(slave=0x39)'

**3. Why is it necessary to connect the LED to the chip using negative logic, rather than positive (consider the direction of current)?**

From fig.1, the typical current that can flow into each pin P0-3 when set low ('LOW-level output current') is ~25 mA. The maximum current that can be drawn out of each pin P0-3 when set high ('HIGH-level output current') is ~300 $\mu$A or 0.3 mA. Therefore, the pins are much more effective at drawing current in and being set low, so the LEDs were best connected using negative logic, so P0-3 were set low to turn the LEDs on.

**I/Os; P0 to P7**

| | | | | | | |
|---|---|---|---|---|---|---|
| $V_{IL}$ | LOW-level input voltage | | $-0.5$ | - | $+0.3V_{DD}$ | V |
| $V_{IH}$ | HIGH-level input voltage | | $0.7V_{DD}$ | - | $V_{DD} + 0.5$ | V |
| $I_{IHL(max)}$ | maximum allowed input current through protection diode | $V_I \geq V_{DD}$ or $V_I \leq V_{SS}$ | - | - | $\pm 400$ | µA |
| $I_{OL}$ | LOW-level output current | $V_{OL} = 1$ V; $V_{DD} = 5$ V | 10 | 25 | - | mA |
| $I_{OH}$ | HIGH-level output current | $V_{OH} = V_{SS}$ | 30 | - | 300 | µA |

fig.1: PCF8574A datasheet 'static characteristics from http://www.farnell.com/datasheets/1716973.pdf