AVR-Assembly Setup

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***Abstract*—This manual shows how to setup the assembly programming environment for the arduino.**

1 Components

The components required for this manual are listed in Table 1.0.

Component	Value	Quantity
Arduino	UNO	1

TABLE 1.0

2 Software Installation

1.
```
sudo apt-get install avra
    avrdude geany
```
2. Find the USB port to which arduino is connected.
```
%Finding the port

sudo dmesg | grep tty
%The output will be something
    like
[     6.153362] cdc_acm
    1-1.2:1.0: ttyACM0: USB ACM
    device
%and your port number is ttyACM0
```
3.
```
cd ~
wget https://raw.
    githubusercontent.com/gadepall
    /arduino/master/assembly/setup
    /m328Pdef/m328Pdef.inc
```
4.
```
wget https://raw.
    githubusercontent.com/gadepall
    /arduino/master/assembly/setup
    /codes/hello.asm
```
5. Open **hello.asm** in **geany**. Go to Build→Set Build Commands→Compile and type
```
avra "%f"
```
6. Then go to Build→Set Build Commands→Execute and type
```
avrdude -p atmega328p -c arduino
    -P /dev/ttyACM0 -b 115200 -U
    flash:w:%e.hex
```
7. In **hello.asm** replace **gadepall** in
```
.include "/home/gadepall/
    m328Pdef.inc"
```
with your username.
8. Connect the arduino to the computer.
9. Compile by pressing **F8**. Execute by pressing **F5**. You should see the led beside pin 13 light up.
10. Now edit **hello.asm** by modifying the line to
```
ldi r17,0b00000000
```
Save and execute. The led should turn off.
11. What do the following instructions do?
```
ldi r16,0b00100000
out DDRB,r16
```

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Solution: The Atmega328p microcontroller for the arduino board has 32 internal 8-bit registers, R0-R31. R16-R31 can be used directly for i/o. The first instruction loads an 8-bit binary number into R16. The second instruction loads the value in R16 to the DDRB register. Each bit of the DDRB register corresponds to a pin on the arduino. The second instruction declares pin 13 to be an output port. Both the instructions are equivalent to pinMode(13, OUTPUT).

12. What do the following instructions do?

```
ldi  r17,0b00100000
out  PortB,r17
```

Solution: The instructions are equivalent to digitalWrite(13).