EE 2905

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Homework 10

1 – Using a 10b DAC with a 3.3V reference, calculate the following values 15 pts

A) Step size

3.3/1024 = 3.223mV

B) binary DAC value for an output of 2.3v

2.3V / 3.223mV = 713.6 → 713→ 10 1100 1001

C) Output voltage if the DAC value is 0x0AA

00 1010 1010 = 170 → 170 * 3.223mV = 547.9mV to 551.1mV

2 – Using the code below – provide the following values assuming you are using our 3.3V mbed system 10 pts

```
AnalogOut mydac(A2);
…
int main(void){
…
    float foo;
    uint16_t boo;
    foo = 0.35;
    boo = 0x1234;
…
```

what will the external voltage on pin A2 be after each line

```
    mydac.write(foo);
```

0.35*3.3 = 1.155V

```
    mydac.write_u16(boo);
…
```

0x1234 = 4660 → (4660/65535)*3.3V = 235mV

3 – An artificial limb joint uses a servo motor to control the movement of the joint. A PWM signal is used to control the motor. The PWM frequency must be 50Hz, and the PWM pulse width (duty cycle) controls the angle of the motor(joint) 75 pts

PwmOut elbow_pwm(D3)
…

motor angle	pulse width
-45 °	1180us
0 °	1520us
45 °	1900us

Linear in-between

setup the motor and start at 0 °

```
elbow_pwm.period_ms(20);
elbow_pwm.write(0.076);        or      elbow_pwm.pulsewidth_us(1520)
```

write a function to shake hands – 3 shakes, +/- 10°, 0.5sec / shake(up + down)

```
void shake(void){
    int i;
    for(i = 0; i < 3; i++){
        elbow_pwm.write(0.080);    // up 10 deg        elbow_pwm.pulsewidth_us(1604)
        wait_us(500000/2);
        elbow_pwm.write(0.073);    // down 10 deg      elbow_pwm.pulsewidth_us(1457)
        wait_us(500000/2);
    }
    return;
}
```