Analog to Digital Converters

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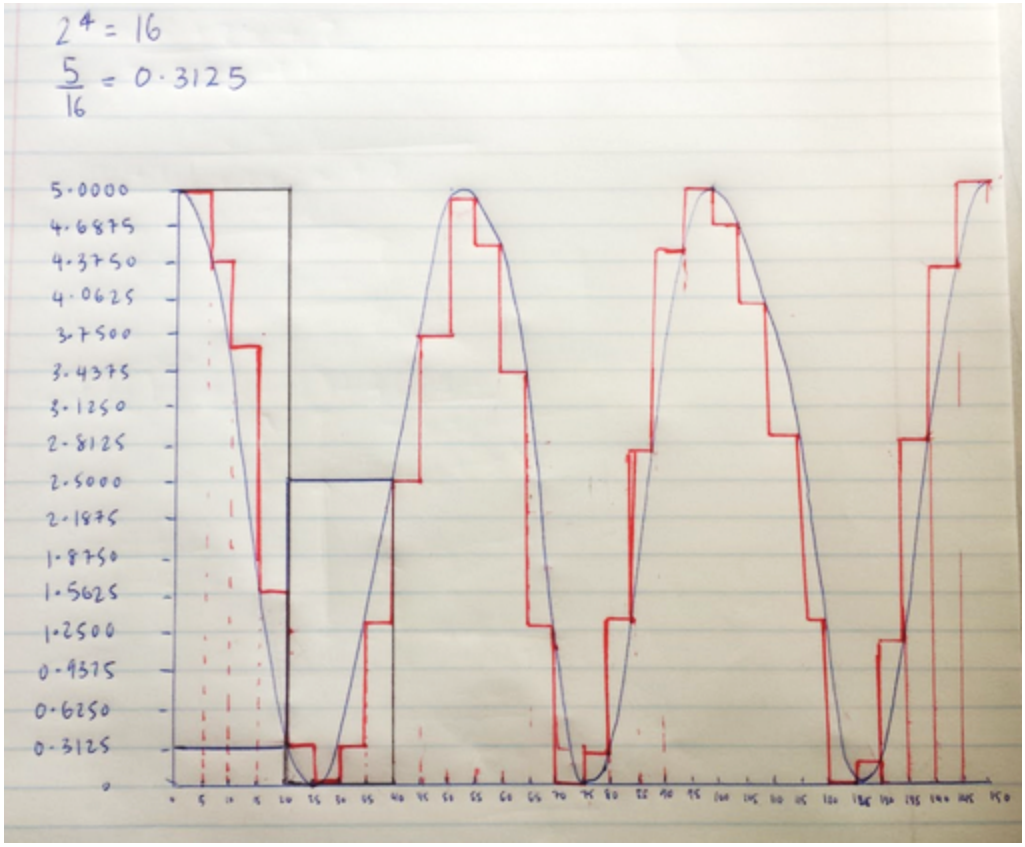
*Worked with Celine Young on the coding

Core 1
2^10 = 1024 different values
(2^9) + (2^8) + (2^7) + (2^6) + (2^5) + (2^4) + (2^3) + (2^2) + (2) + (2^0) = 1023
The values range from 1 - 1024

Core 2
5/1024 = 0.0048828125 volts
= 0.005 volts
= 5 millivolts

Core 3



(Please ignore the black lines)

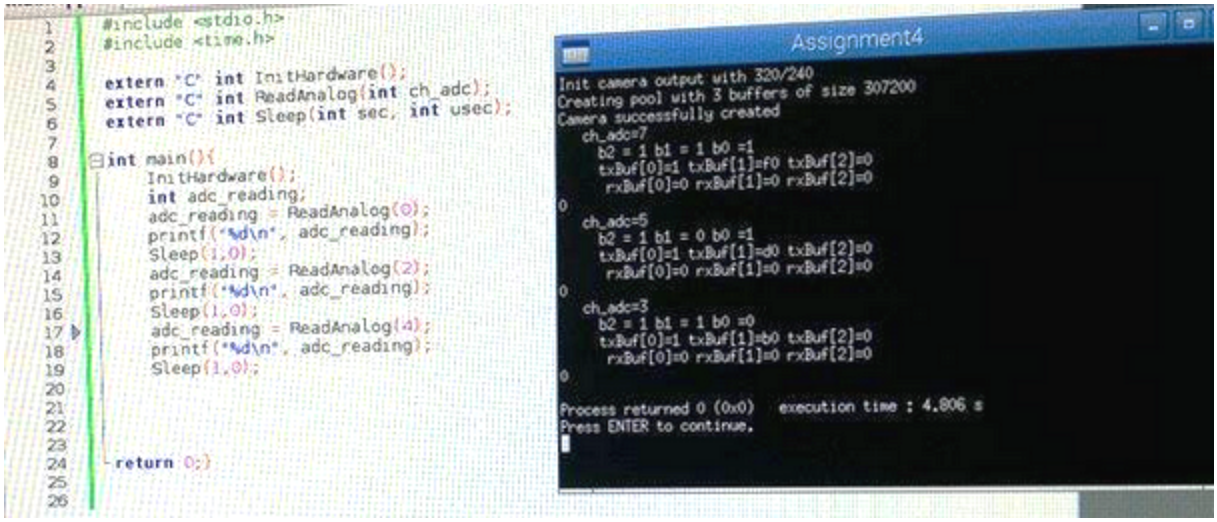
Core 4
f = 1/T
F = 1/0.05
= 20 Hz

Core 5

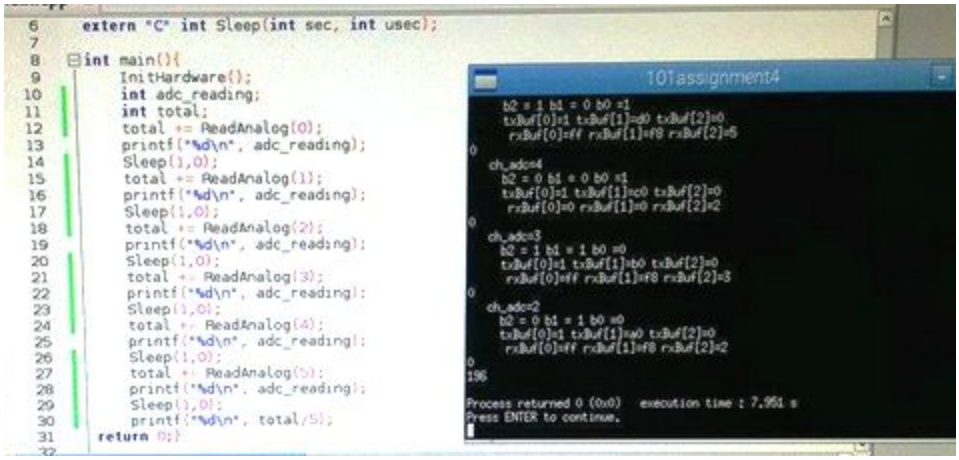
Core 6
5.25-0.25 = 5
5/(5.5-5.0) = 10
10

Core 7
If the signal to noise ratio were less than one the signal would get lost within the noise and will become hard to differentiate.

Core 8



Core 9



Completion 1

Humans can only hear between 20Hz and 20kHz. The sampling frequency must be twice that of the maximum frequency that humans can hear so this gives as two samples within one wave and this avoids distortion. This is the Nyquist theorem.

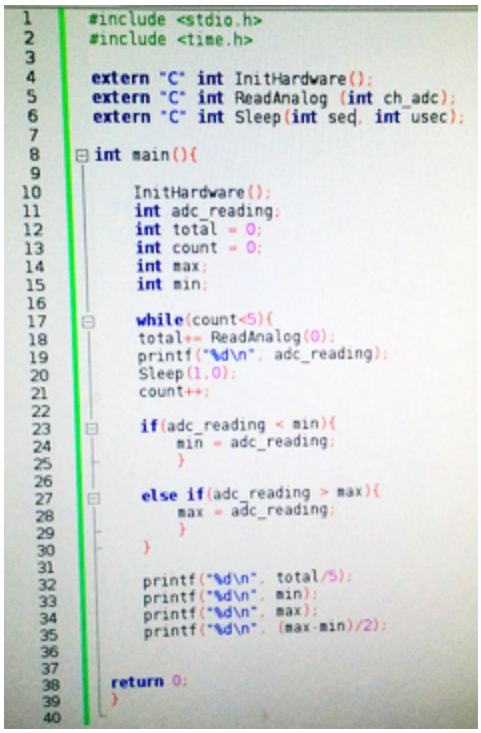
Completion 2

Pin[0] had the sensor connected to it so I expected it to have sensor values picked up from it. However small values from pin[2] and pin[4] were also detected due to the background noise.

Completion 3

The actual values I was able to output were between 3-617. This is different to the bigger range of 1-1024 I calculated in core 1. Because of this the minimum voltage change it would actually detect on an expected range of 0-5V will not be 5 millivolts it would be 8.10 millivolts.

Completion 4



```c
#include <stdio.h>
#include <time.h>

extern "C" int InitHardware();
extern "C" int ReadAnalog (int ch_adc);
extern "C" int Sleep(int sec, int usec);

int main(){

    InitHardware();
    int adc_reading;
    int total = 0;
    int count = 0;
    int max;
    int min;

    while(count<5){
    total+= ReadAnalog(0);
    printf("%d\n", adc_reading);
    Sleep(1,0);
    count++;

    if(adc_reading < min){
        min = adc_reading;
        }

    else if(adc_reading > max){
        max = adc_reading;
        }
    }

    printf("%d\n", total/5);
    printf("%d\n", min);
    printf("%d\n", max);
    printf("%d\n", (max-min)/2);


return 0;
}
```

Challenge 1

Because the maximum frequency that humans can hear is 20kHz, the minimum sample frequency will be double of that which is 40kHz.

Challenge 2

Challenge 3: BONUS MARKS