dsPIC33: Exercise

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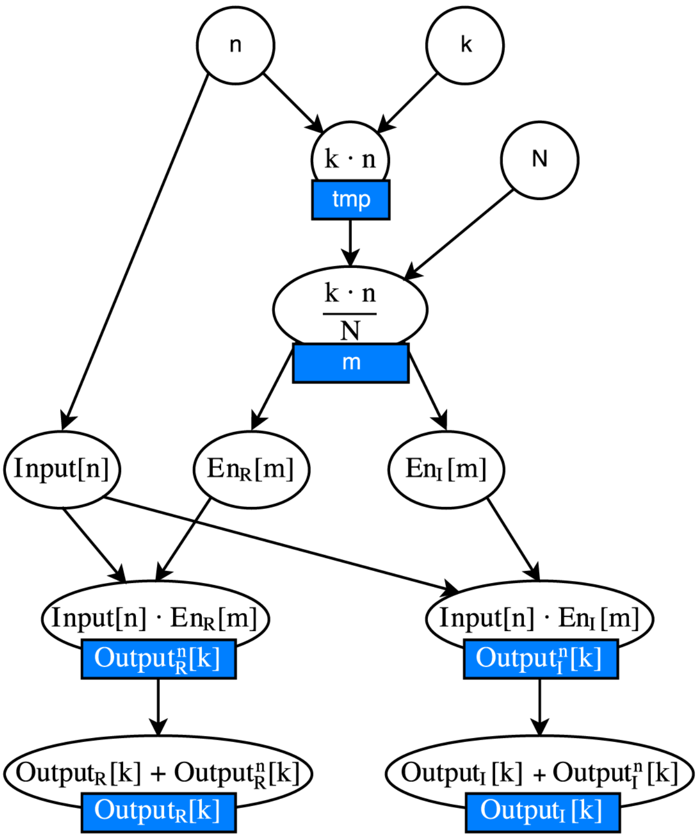
1 Question 1



2 Question 2

2.1 Computation of the value m

```
INT16U unsigned16temp;
unsigned16temp = (k * n);
```

```
m = (INT8U) (unsigned16temp / (INT16U) N);
```

If we directly do the computation $m = k * n/N$ we would get a wrong result. In fact the multiplication would be too big and some of the result could overflow and be wrong. To solve that problem, we use a intermediate variable of 16bit to store the result of the multiplication. We then do the division and then cast it back to 8 bits. The cast should be correct because the result of the division (m) should stands on 8 bits if the inputs are correct.

2.2 Computation of the real part

`signed16temp_r = (INT16S)input[n] * (INT16S) en_r[m];`
First we cast the two 8 bits fixed point integer to two 16 bits fixed point integer and then do the multiplication as shown in the *example2.c*. We put the result in a 16bits integer so the result would be correct.
`signed8temp = (signed16temp_r+128) >> 8;`
Then we are required to put the result in a 8 bits register, so to get better result we first round it and then do the shift to only keep the most significant bits.
`signed16temp_r = (INT16S) signed8temp + (INT16S) output_r[k];`
At last we add the element of the sum to a temporary 16 bits register. We use a 16 bits temporary variable because the addition of two number on 8 bits could overflow.

2.3 Computation of the imaginary part

Actually it is the same as the real part with other variables.

3 Question 3

3.1 Computation of the value m

`unsigned16temp = (k * n);`
Since we do INT16 = INT8 * INT8 no overflow will occur. Let's take a look at a borderline case : $1111\ 1111 * 1111\ 1111 = 1111\ 1110\ 0000\ 0001$. There is no information lost so the accuracy is maximum.
`m = (INT8U) (unsigned16temp / (INT16U) N);`
If the input are in there correct range, no overflow will occur because m must be between 0 and 127 included, so it is ok to cast it to a 8 bit integer. Some precision can be lost during the division since the result is a integer all the time. Plus it loose the decimal, so for instance 1.9 will be 1 if interpreted as an integer instead of 2 for the nearest integer. Let's take a look at another (non-trivial) borderline case : $0000\ 0001 * 0000\ 0001\ /\ N = 0000\ 0000\ 0000\ 0001/128 \Leftrightarrow 0000\ 0000\ 0000\ 0001 \gg 8 = 0000\ 0000$.

3.2 Computation of the real part

3.3 Computation of the imaginary part

`INT16S`= INT8S * INT8S

4 Question 4

The more the frequency grows, the nearest the sample are. So that mean that two sample will have almost the same value. From a certain point, we might see that the sample will have the same value.