Experiential DSP 07 Solutions

Part A:

```
The estimated filter order is: 26

The length of the impulse response is: 27

The Kaiser window beta parameter is: 1.5099
```

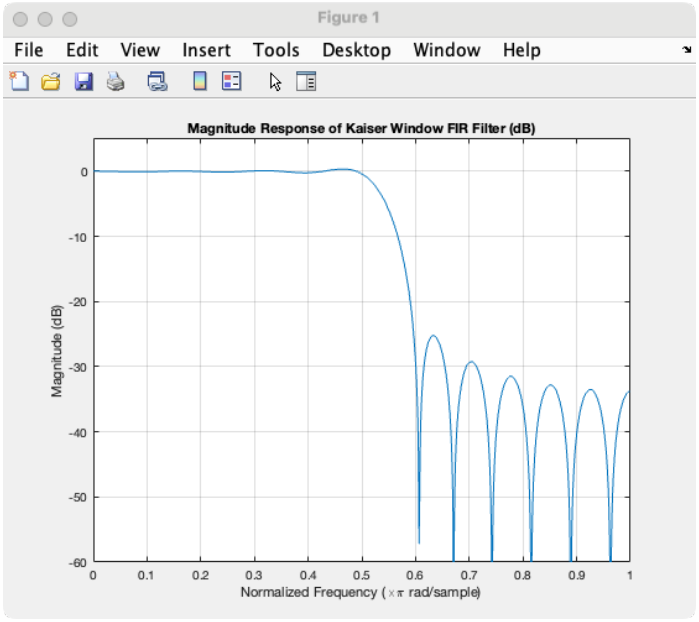

Figure 1: dB Plot of Magnitude of the Impulse Response

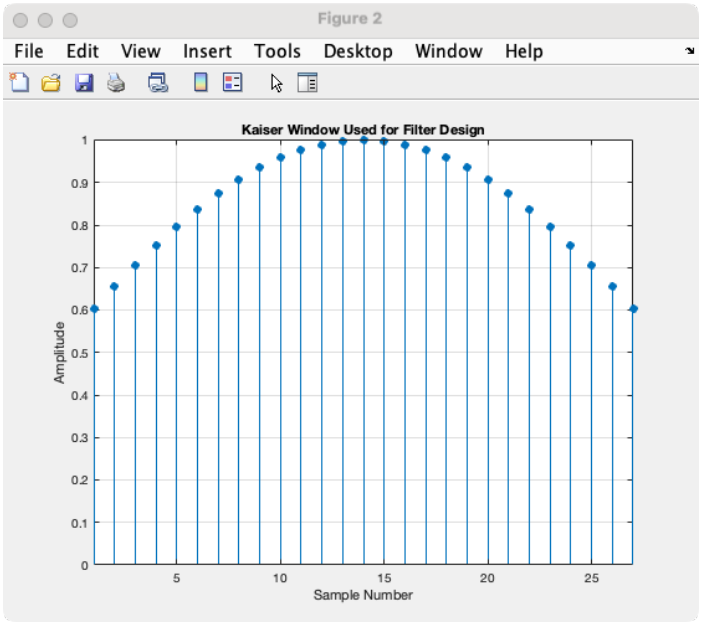

Figure 2: Stem Plot of Kasier Window

Comparison with Assignment 6:

In assignment 6, we had that the length of the impulse response was 18, but this time the length of the impulse response has increased to 27. The length of the impulse response with the Kaiser window is longer because it's a sub-optimal design technique. To meet the same strict filter specifications, it requires a higher filter order (and thus a longer length) compared to an optimal method.

Part B:

```
The estimated filter order is: 26

The length of the impulse response is: 27

The Kaiser window beta parameter is: 1.5099
```

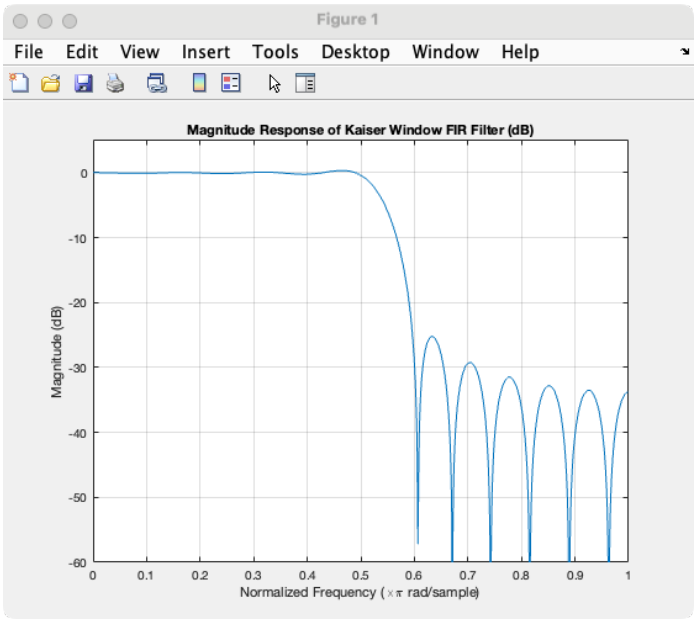

Figure 3: dB Plot of Magnitude of the Impulse Response

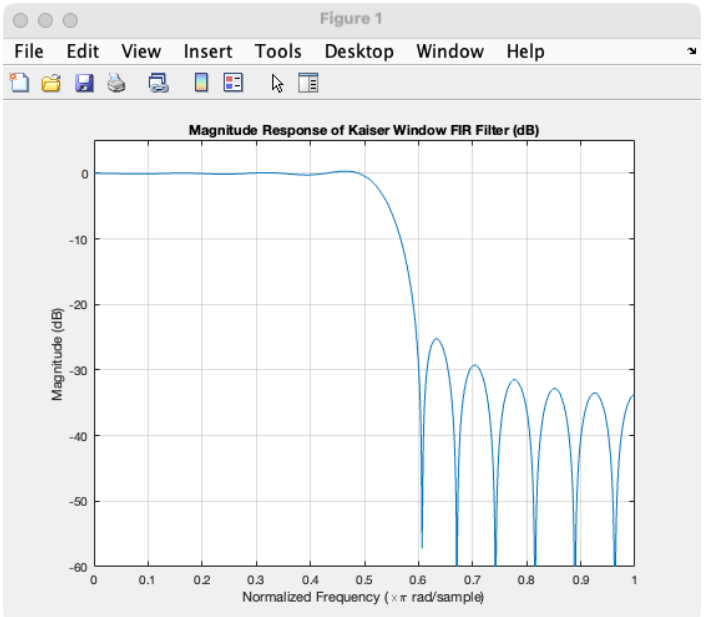

Figure 4: Stem Plot of Kasier Window

Comparison with Part A:

We don't see any difference because the Kaiser window method is constrained by the strictest tolerance, and since the stopband tolerance (dev_s = 0.05) was stricter than the passband tolerance in Part A, it's the stopband that dictates the filter's final design parameters.

Comparison with Assignment 6:

A longer impulse response is observed for the same reason as Part A.

Part C:

```
The estimated filter order is: 46

The length of the impulse response is: 47

The Kaiser window beta parameter is: 1.5099
```

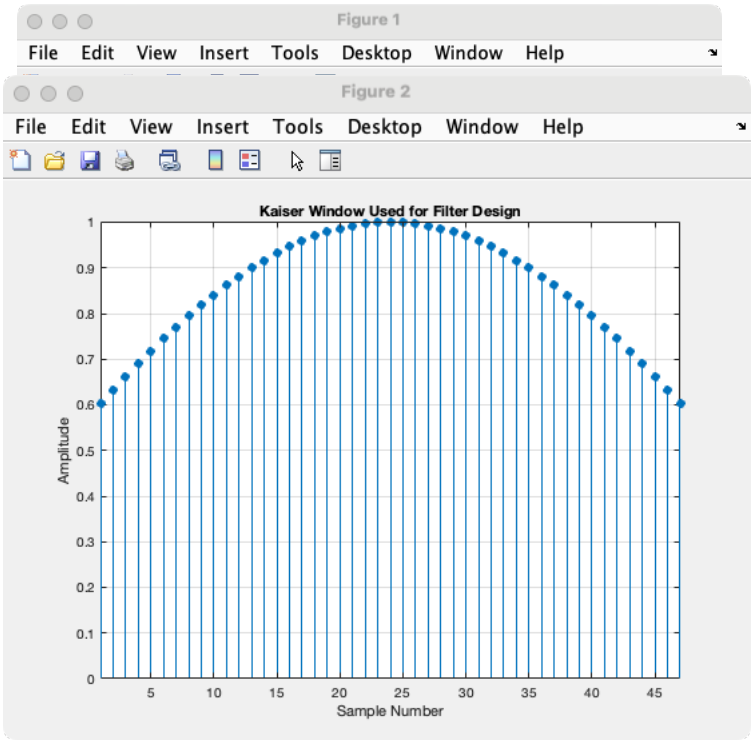

Figure 6: Stem Plot of Kasier Window

Comparison with Part B:

We see a longer impulse response because changing the stopband frequency fs from 0.6π to 0.555π makes the transition bandwidth much narrower.

A filter needs a higher order (and therefore a longer impulse response) to create a steeper, more abrupt transition between the passband and the stopband. By moving the stopband closer to the passband, you are demanding a much sharper "cliff," which requires a more complex and longer filter to achieve.

Comparison with Assignment 6:

Same reasoning as Parts A and B.