

Name: \_\_\_\_\_ Student ID: \_\_\_\_\_

Peer Reviewer Name (&amp; Student ID): \_\_\_\_\_ Final Mark: \_\_\_\_\_

**1. Aliasing****[2 points]***Peer Feedback*

Can a whistle be heard over a telephone? That is, if a whistle rings at **4800 Hz** and is sampled at **8000 Hz**, then what is the dominant frequency present in the sampled signal?

**2. Lowpass Butterworth Analog Filter Response [4 points]**

Recall that amplitude response of an  $n^{\text{th}}$  order normalized lowpass Butterworth filter is given by:

$$|H(j\omega)| = \frac{1}{\sqrt{1 + \omega^{2n}}}$$

(a) For  $n=8$ , please draw the pole-zero diagram for this filter

(b) What is the DC gain of this filter (as in (a), for  $n=8$ )?

(c) At what frequency (in terms of  $\omega$ ) will the filter's output be at half-power (-3 dB)?

### 3. Ideal Response (FIR Filters)

[2 points]

Recall that the ideal, desired (zero-phase) low-pass response is given by

$$h_a(t) = \frac{1}{2T} \operatorname{sinc}\left(\frac{\pi t}{2T}\right)$$

and its discrete form is given by:

$$h[k] = Th_a(kT) = \frac{1}{2} \operatorname{sinc}\left(\frac{\pi k}{2}\right)$$

Briefly explain why this ideal low-pass filter is not physically realisable.

### 4. Filter Type Comparison

[2 points]

- (a) What is one advantage of FIR filters have over IIR filters?
- (b) What is one advantage of IIR filters have over FIR filters?