

## Prob. 1

Surprised to see that noisy phase is inaudible until around 0 dB. At  $-10$  dB, the distortion sounds like a warbling of the speech signal.

## Prob. 2

Spectrograms are shown in Fig. 1. We can clearly see the impact of the 15dB SNR white noise across all frequencies.

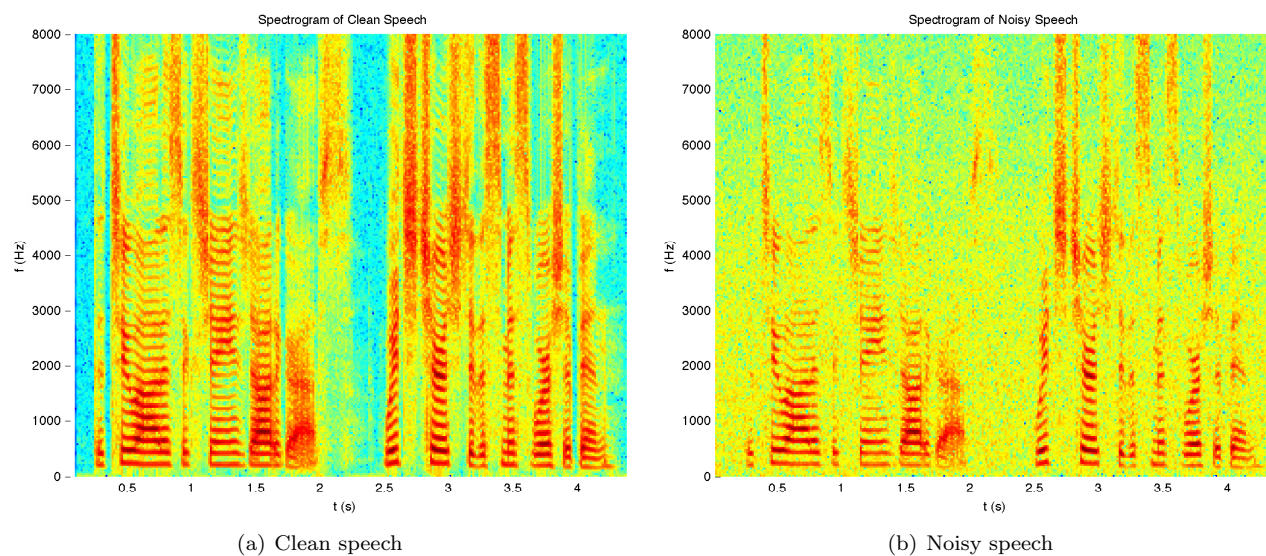


Figure 1: Prob. 2

## Prob. 3

Noisy speech signal was enhanced with spectral subtraction with oversubtraction using  $\alpha_0 = 3$ ,  $\beta = 0.005$ , and  $\tau = 0.99$ . There is a clear reduction in the broad white noise background but at the expense of introduced musical tones (artifacts).

## Prob. 4

PESQ MOS vs. SNR for noisy speech and enhanced speech (spectral subtraction with oversubtraction) is shown in Fig. 2(a). For some SNRs, we see as much as a 0.5 PESQ MOS improvement.

## Prob. 5

Noisy speech signal was enhanced with the iterative Wiener filter using  $k = 15$  and  $\tau = 0.99$ . There is a clear reduction in the broad white noise background but few artifacts are introduced. At the higher SNRs,

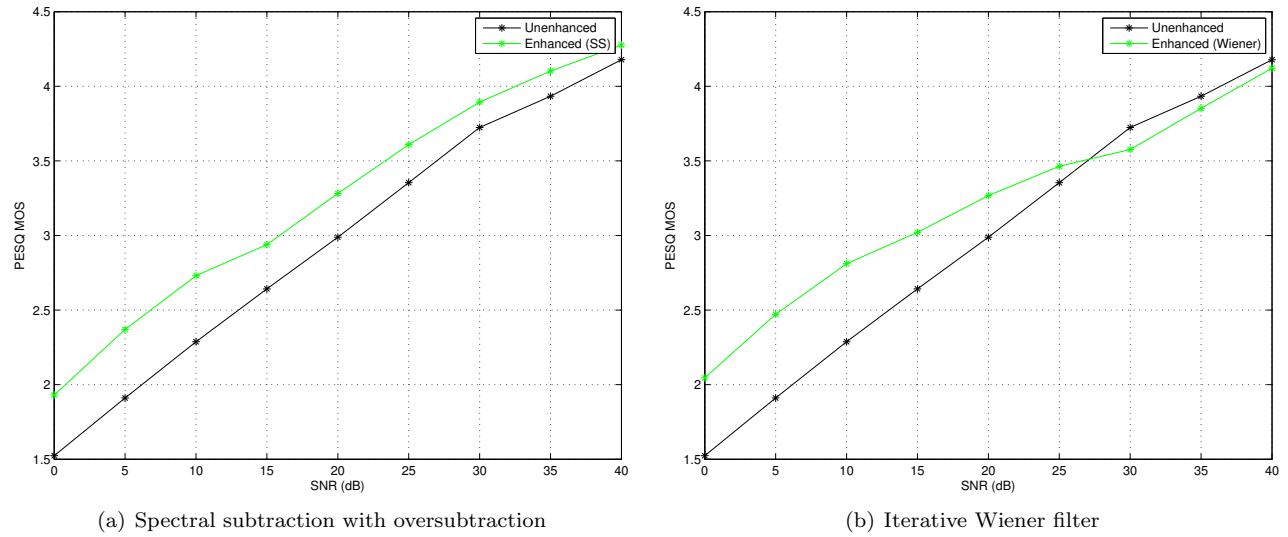


Figure 2: (a) Prob. 4 and (b) Prob. 6

there is no improvement.

## Prob. 6

PESQ MOS vs. SNR for noisy speech and enhanced speech (iterative Wiener filter) is shown in Fig. 2(b). For some SNRs, we see as much as a 0.5 PESQ MOS improvement.