

Note: Please answer in clear, legible hand-writing on A4 sheets. You should not need more than 2 or 3 pages to answer Q1, and 1 page for Q2. This is a closed-book test; you do not need a calculator.

1. Consider the English word “shaggy” uttered by an adult male speaker.
  - (a) What is the sequence of phones in the utterance. Provide the voicing, manner and place of articulation of each. (2)
  - (b) Assuming that the duration of the utterance is 500 ms (i.e. 0.5 s), draw a rough labeled sketch of the short-time energy versus time that would be obtained with a 10 ms rectangular sliding window. Indicate the phone boundaries assumed in your sketch. (1)
  - (c) Make the similar sketch as above but now for zero-crossing-rate (i.e. number of zero-crossings in 10 ms intervals). (1)
  - (d) Describe qualitatively, but clearly, the acoustic characteristics of each phone segment that you expect to observe in a spectrogram (consider both wideband and narrowband spectrograms). (4)
  - (e) Next, consider the same word uttered by a female speaker. List only the precise differences you expect to find in the acoustic characteristics with respect to those observed in part (d). (2)
  - (f) Finally, consider the same word now uttered as a whisper by the same male speaker. List the precise differences you expect to find in the acoustic characteristics with respect to those observed in part (d). What is the perceived word in the whisper mode? (2)