

**Problem 1: Contrastive features.** For each of the following pairs of phonemes of English, name the one feature that distinguishes the two sounds in the pair, and indicate which of the two phonemes has the plus (+) value for that feature and which one has the minus (-) value.

/b v/    /æ ε/    /v f/    /i ɪ/    /ɪ l/    /ʌ ə/    /θ t/    /u o/    /ʒ z/    /ɔ ʌ/

**Problem 2: Natural classes.** For each of the following combinations of features, determine if the feature combination describes a natural class of phonemes of English. If so, list all of the phonemes of English that fit into the natural class.

[-low  
+round]      [+voice  
+continuant]      [-tense  
-back]      [+DR  
+cont]      [+ant  
-strid]

**Problem 3: More natural classes.** For each of the following sets of phonemes, determine whether or not the phonemes form a natural class in English. If the set is a natural class, give a sufficient and minimal feature description for it that includes all of the sounds in the set and excludes all other sounds of English. If the set is *not* a natural class, determine which one phoneme of English must be *added* in order to form a natural class, and then give a sufficient and minimal feature description for the new natural class you have created. Be careful not to unnecessarily add a phoneme to a set that is already a natural class!

/i ɪ e ε æ/      /u o ɔ ʌ/      /p θ t s ʃ tʃ k/      /s z ʃ tʃ dʒ/      /e o ɑ/  
/b d g/      /m n ɪ l ŋ/      /ε ʌ ə ɔ/      /w u ʊ o ɔ/      /n ŋ/

**Problem 4: English laterals.** In English, there are two allophones of the lateral liquid phoneme /l/. One of these allophones is often called ‘clear’, and is transcribed as [l]. The other is often called ‘dark’ and is transcribed as [ɫ]. Dark [ɫ] involves a raising of the tongue body towards the velum, so it is also called velarized. Consider the following data:

[lif]	‘leaf’	[ɫɛs]	‘less’	[lut]	‘loot’
[fiɫ]	‘feel’	[sɛɫ]	‘sell’	[tuɫ]	‘tool’
[flɛʃ]	‘flesh’	[slʌm]	‘slum’	[æθlit]	‘athlete’
[ʃɛʃf]	‘shelf’	[pʌɫs]	‘pulse’	[steɫθi]	‘stealthy’
[bʌkɫ]	‘buckle’	[ɫi:ɪɪ]	‘ulterior’	[bærɫɪŋ]	‘battling’

Carefully and fully describe the environments that both of the allophones of /l/ appear in. Try to make your descriptions as general as possible, while maintaining accuracy. Be sure your proposal can account for the fact that ‘athlete’ has clear [l], but ‘stealthy’ has dark [ɫ]. Draw full syllable structures for both of these words to clarify your explanation.