**Page 108**
**Exercise a** (6 points)

[mɪska] [mɪʃka]

[sapka] [ʃapka]

[sɪla] [ʃɪla]

[sum] [ʃum]

[sudɪ] [sʲudɪ]

[posadu] [posʲadu]

**Exercise b** (1 points)

[lɪs] [lɪsʲ] [lɪʃ]

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**Exercise 1**     (20 points)
  a.  [t],[d],[s],[z]
  b.  [b],[m],[w], [v]
  c.  [k],[g]
  d.  [ɵ],[ð]
  e.  [i],[u]
  f.  [æ],[a]
  g.  [j]
  h.  [z],[ʒ],[dʒ]

**Exercise 2**     (6 points)
    a.  liquids
    b.  voiceless fricatives
    c.  glides
    d.  high tense vowels
    e.  bilabial oral stops
    f.  alveolar sonorants

**File 4.5**

**1.1 Sindhi** (24 points)

  • In Sindhi, [p], [pʰ], and [b] are (allophones of) separate phonemes.  The evidence
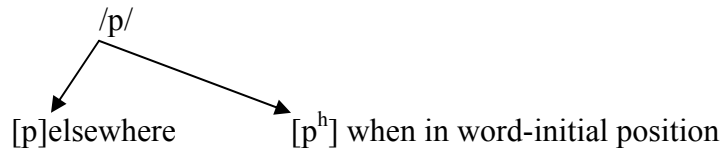    comes from the below minimal set:
        [pənu] 'leaf' [pʰənu] 'hood of snake' [bənu] 'forest'

/p/                       /pʰ/                   /b/
↓                            ↓                         ↓
[p]                          [pʰ]                   [b]

- In English the three phones are organized into two phonemes. [p] and [b] are separate phonemes as the below minimal set illustrates: [pæt] [bæt]

  On the other hand, [p] and [pʰ] are allophones of the same phoneme. The evidence comes from examining a sample of English data:

  [pʰæt]                 [spæt]
  [pʰəθɛtɪk]          [pʰap]
  [pʰasɪbəl]           [meɪpəl]

  /p/

  [p]elsewhere            [pʰ] when in word-initial position

- [p] and [pʰ] are in complementary distribution in English, but they are in contrastive distribution in Sindhi.
- [p] and [b] are in contrastive distribution in both Sindhi and English.

## 2.1 Tojolabal (16 points)

- The near minimal pair [kʔak] 'white' and [ʔakʔ] 'read' suggests that [k] and [kʔ] are separate phonemes; however, to confirm this, we might look at their environment to see whether a pattern can be discovered.
- List of environments:

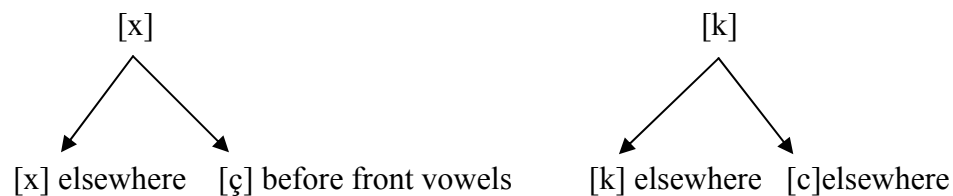  | [k] | [kʔ] |
  |---|---|
  | # __ i | # __ i |
  | # __ o | # __ a |
  | a __ a | a __ a |
  | a __ # | # __ u |
  | o __ t | |
  | s __ u | |
  | i __ a | |

- The above list confirms that [k] and [kʔ] can occur in the same environment, and their presence is not predictable. The conclusion is that [k] and [kʔ] are in contrastive distribution in Tojolabal.

**3.1 Greek**     (36 points)

- [x] and [k] are separate phonemes in Greek.  The evidence comes from the minimal pair: [kano] 'do' & [xano] 'lose

- [c] and [ç] are separate phonemes.  The evidence comes from the below minimal pair: [ceri] 'candle' & [çeri] 'hand'

- The following relationships remain unclear at this point:
  [x] and [c]
  [x] and [ç]
  [k] and [c]
  [k] and [ç]

- First, we will make a list of environments of the phones:

| [x] | [ç] | [k] | [c] |
|-----|-----|-----|-----|
| # __ a | # __ i | # __ a | # __ i |
| # __ o | # __ e | # __ o | # __ e |
| # __ r | o __ i | # __ r | o __ i |
| # __ u |  | # __ u |  |

- The above list shows that [ç] and [c] occur before front vowels.  In fact, we have velar sounds that are "fronted" (the place of articulation has moved from the velum to the palate which is more front) when they precede front vowels.  In other words, this is a case of assimilation.  As a result, there are two phonemes that are organized in the following way:

```
            [x]                                    [k]
           /   \                                  /   \
          ↓     ↓                                ↓     ↓
[x] elsewhere  [ç] before front vowels   [k] elsewhere  [c]elsewhere
```

[-voice, +velar, +stop] → [+palatal] / __ [+vowel, +front]
[-voice, +velar, +fricative] → [+palatal] / __ [+vowel, +front]

- Notice that the above-mentioned rules can be combined into one single rule that affects all voiceless velar consonants:

Palatalization rule:
[-voice, +velar] → [+palatal] / ___ [+vowel, +front]

- [x] and [ç] are allophones of the same phoneme and in complementary distribution. [k] and [c] are allophones of the same phoneme, and in complementary distribution.
- [x] and [k] are in contrastive distribution.

## 3.3 Ukranian (practice problem)

- The three pairs of sounds in are [k] & [tʃ]; [x] & [ʃ]; [ɦ] & [ʒ]
- Palatalization is the phonological process at work here
- The conditioning environment for the change is [e], which is a front vowel and causes the consonant to front as well.

## 2.3 Canadian French (practice problem)

- First we will make a list of the environments of each sound"

[t]                         [tˢ]
#__a                        u__i
#__ɛ                        #__i
#__e                        #__ɪ
#__r                        #__y
ʏ__#                        #__ʏ

- This list shows that [tˢ] occurs before [i], [ɪ], [y] and [ʏ], all high front vowels. [t] seems to occur elsewhere
- Therefore [t] and [tˢ] are in complementary distribution and allophones of the same phoneme.
- Since [t] has a more general environment, we can conclude that it is the underlying phoneme.
- The rules for the distribution of these allophones would be as follows:

[-voice
+alveolar  →  [+affricate] / __ [+high, +front]
+frictive]