Hawaiian syllable structure

The Hawaiian language has five vowels (/a/, /e/, /i/, /o/, and /u/) and eight consonants (/p/, /m/, /n/, /l/, /k/, /h/, /w/, and /ʔ/). Any of the vowels can be lengthened (/aː/, /eː/, /iː/, /oː/, and /uː/).

A syllable in Hawaiian consists either of (1) a vowel, (2) a consonant followed by a vowel, (3) two vowels, typically pronounced as a diphthong, or (4) a consonant followed by two vowels, again typically pronounced as a diphthong. In cases (3) and (4), only fifteen of the vowel combinations are possible: /ae/, /ai/, /ao/, /au/, /aːe/, /aːi/, /aːo/, /aːu/, /ei/, /eu/, /eːi/, /eːu/, /oi/, /ou/, and /ou/. Every consonant-vowel or consonant-diphthong combination other than /wu/ actually occurs in some Hawaiian word. The combination /wu/ occurs, but only in English loan words.

Designing a finite automaton

Hawaiian is written in the Latin alphabet, using the apostrophe character to represent /ʔ/ and doubling a vowel character to indicate a long vowel. We’ll assume that spelling strictly follows the phonemic structure.

Design a finite-state machine that takes any string of characters in the thirteen-letter Hawaiian alphabet and determines whether it can occur as a syllable in Hawaiian words. You may either write out the transition table as a two-dimensional array or define the transition function in mathematical notation or in English prose, provided that you unambiguously specify the value of the transition function for every combination of arguments.

Implementing and using the automaton

Using the finite-state automaton compiler presented in class, define a procedure that implements the finite-state machine that you designed in the previous section of the assignment.

A word in Hawaiian consists of one or more syllables. Using the syllable recognizer, define and test a procedure that (a) determines whether a string of characters from the Hawaiian alphabet has the correct syllabic structure to be a Hawaiian word, and (b) if so, determines how many syllables that word would consist of. The procedure should return either the Boolean value #f, if the string is determined not to have the structure of a Hawaiian word, or else a positive integer indicating the number of syllables the procedure finds.

This procedure should “accept” strings that are not actually Hawaiian words, provided that they can be divided into syllables that have the right structure.

In some cases, a string can be divided into correctly structured Hawaiian syllables in more than one way. For instance, the string "aii" could be treated as one syllable of type 3 — a diphthong — or as two syllables of type 1. Hawaiian syllabification practices actually resolve such ambiguous cases by combining adjacent vowel characters into long vowels or diphthongs whenever possible.

For instance, the procedure should return the value 4 when given the string "ahiahi", since /ia/ is not one of the permitted diphthongs; but it should also return 4 when given "Kilauea", since /au/ is a valid diphthong. Similarly, "uai" has two syllables, /u/ and /ai/.
Submitting a solution

To submit your solution to this programming assignment, create a new directory within your home directory, copy or move the files you want to submit into that directory, and then run the command

```
/home/reseda/executables/submit-205 directory-name
```

putting the name of the directory you created in place of `directory-name`. The `submit-205` script collects the files in the directory into a single unit, encrypts that unit with a user-specific key, and e-mails the encrypted version to me.

This exercise will be due at the beginning of class on Wednesday, October 3.

I am indebted to Kim Spasaro 2014 for pointing out a typographical error in a previous version of this document.

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