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A CASE HISTORY IN COMPUTER EXPLORATION OF FAST SPEECH RULES

Douglas B. Moran
[illegible]t. of Computer & Communication Sciences
University of Michigan
Ann Arbor, Michigan

Abstract

In conversational speech, words run together and interact causing thei phonological forms to differ from their citation forms. Fast speech rules attempt to describe these changes as speech becomes faster and more casual.

In developing any set of phonological rules, computerized grammar testers are a useful and important aid. They necessitate a precise, consistent formulation of the rules and allow the generation of sample derivations. In applying these rules to a diverse set of utterances, we can first confirm that the rules really do apply where we expect them to, and then experiment with various rule orderings to observe their effects.

The Phonological Grammar Tester of Friedman and Morin was used to test two sets of fast speech rules from the ARPA Speech Understanding Research community. Working with these rules led to certain observations about the interactions and nature of fast speech rules in general. In addition to testing these two sets of fast speech rules, we were also interested in the problems of testing such a grammar with this program.

Appendices include an overview of the grammar tester and final output from our testing.

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A Case History in Computer Exploration of Fast Speech Rules

Douglas B. Moran

The University of Michigan

Introduction

In developing any set of phonological rules, computerized grammar testers are a useful and important aid. They necessitate a precise, consistent formulation of the rules and allow the generation of sample derivations. In applying these rules to a diverse set of utterances, we can first confirm that the rules really do apply where we expect them to, and then experiment with various rule orderings to observe their effects.

Traditional phonological rules describe transitions from the underlying form to the surface form of a word. However, in casual (fast) speech, words are not distinct, independent units, but run together and interact. Fast speech rules attempt to describe these changes that occur as speech becomes faster and more casual (4, 8, 9).

This is a case history of the examination of two particular sets of rules on the Phonological Grammar Tester (PGT) of Friedman and Morin (3). An overview is given in Appendix A and a sample of the output in Appendix B. In addition to testing these two sets of fast speech rules, we were also interested in the problems of testing such a grammar with this program.

Testing the Fast Speech Rules

For our first test, we chose the fast speech rules of Neu (6) as the best available set of rules given in a reasonably consistent notation. The rules were given in two formats: one using phonemes and the other using distinctive features. The first task was to adjust the notation into a machine usable form. For the purposes of this test, we used the feature system of Chomsky and Halle (1), with three types of boundaries: syllable (+), morpheme (#) and word (##). For example, the features anterior and coronal had to be substituted for place of articulation. Also, the rules had to be modified so that each feature had the same type of value (integer, binary, or marked-unmarked) throughout the grammar. For example, in the PGT, 1stress, is not equal to +stress and is less than -stress, which could cause many unexpected problems in the grammar. Another minor problem was determining whether a C in the rules meant not a vowel, [+cons], or [+cons -vocal].

Sample derivations were given with the rules, and these were used as a first test. We quickly found a number of small problems, most being that the rule had been incorrectly or incompletely stated. For example, Geminate Reduction and Alveolar Flapping would not apply across the word boundary in "want to", while the p in "captain" blocked the application of Glottalization.

More sample words were taken from Neu and several more small

errors were found, such as Nasal Consonant Deletion bleeding Transitional Stop Insertion and thereby indicating that it should be ordered after Transtop. We still had some unresolved problems, such as "Is /f e d ə l/ a proper fast speech form of 'federal'?", when the revisions and additions (7) arrived. Many of these revisions corresponded to our solutions of problems encountered during testing of these rules. The final form of this first set is given in Appendix C.

Since there was little obvious order in the rules, graphing the partial ordering given was very helpful in exploring the rule ordering. The partial ordering given with the rules, Figure 1, was quickly refined to that in Figure 2 by testing the sample derivations.

In these new rules, particular attention was paid to the presence and position of syllable, morpheme and word boundaries in the environments for which the rules should apply. Other fast speech rules from members of the ARPA Speech Understanding Research (SUR) community (11, 12, 13) were used as references, especially in respect to boundary position, in implementing these new rules. In testing the rules, most of the problems involved the positioning and presence of boundaries.

The second Dental Deletion rule was dropped from the grammar because it appeared to duplicate the effect of assimilating an alveolar flapped t to the preceding n.

We had few transcriptions of fast speech forms, so in

LINEARIZED

1. VOWEL REDUCTION
2. SCHWA DELETION
3. <ING> REDUCTION
4. SYLLABICIZING
5. RUH-REDUCTION
6. RUH-LESSNESS
7. NASALIZED VOWELS
8. NASAL CONSONANT DELETION
9. DENTAL DELETION
10. ALVEOLAR FLAPPING
11. GLOTTAL STOP FORMATION
12. PALATALIZATION
13. ASSIMILATION
14. TRANSITIONAL STOP INSERTION
15. GEMINATE REDUCTION
16. DARK [L]
17. [R]-FLAPPING
18. [R]-DEVOICING

GRAPH OF PARTIAL ORDERING

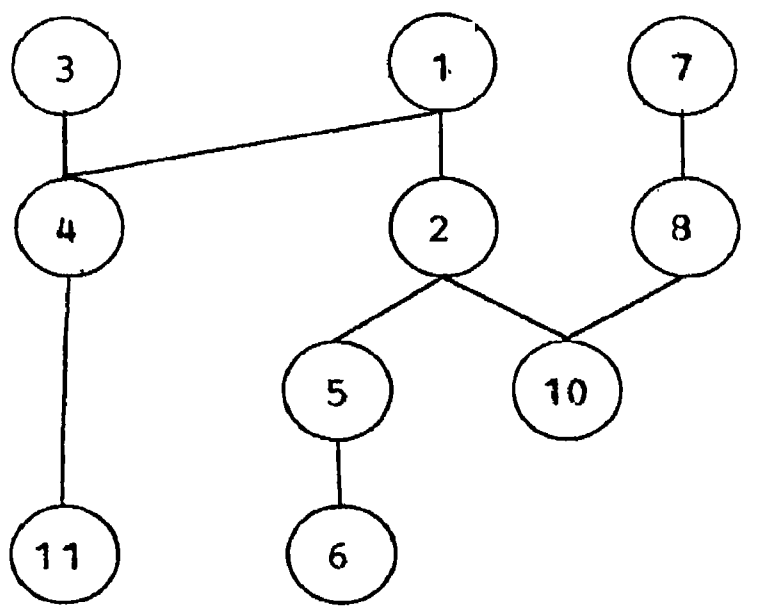

FIGURE 1. INITIAL RULE ORDERING

LINEARIZED

1. VOWEL REDUCTION
2. SCHWA DELETION
3. <ING> REDUCTION
4. SYLLABICIZING
5. RUH-REDUCTION
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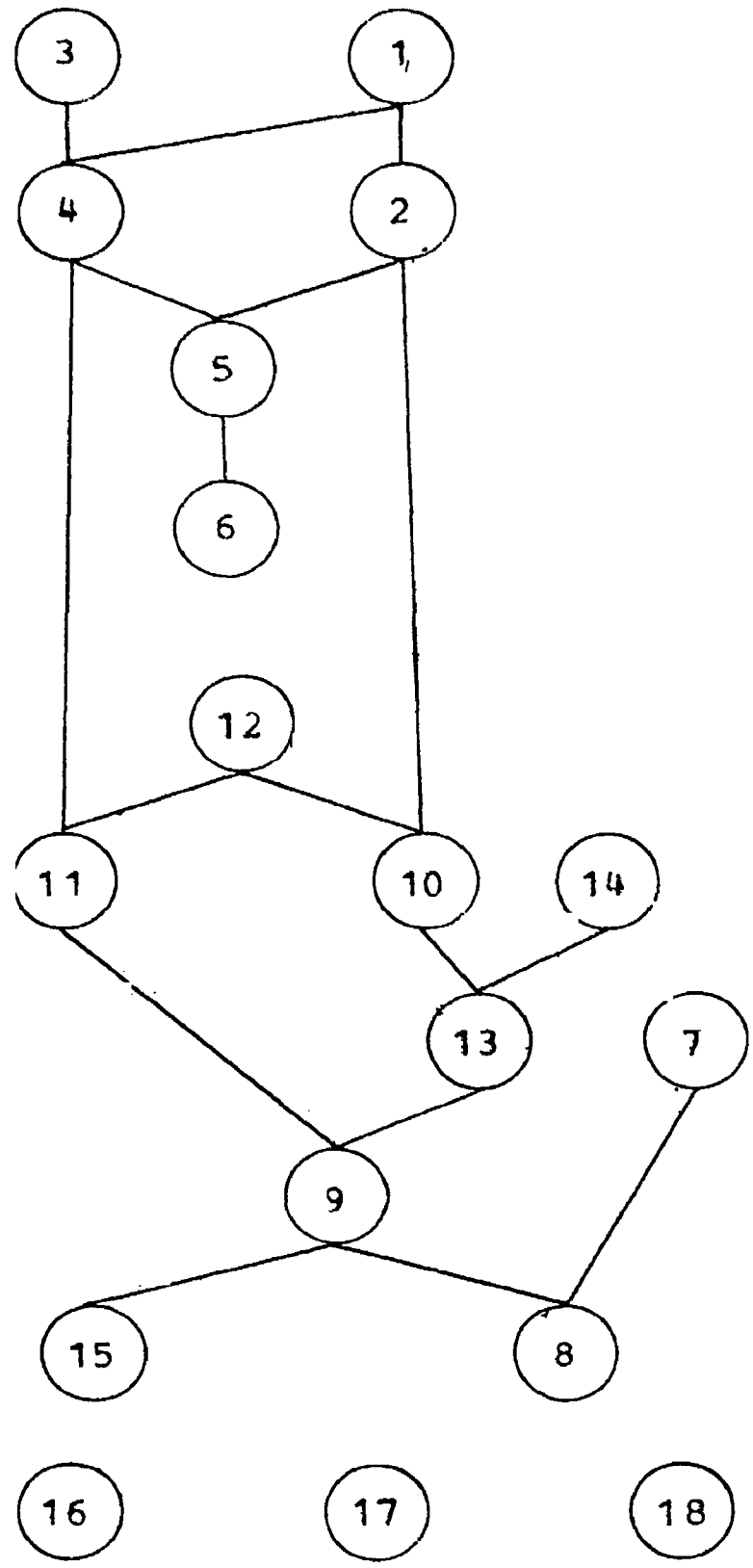

FIGURE 2. FINAL RULE ORDERING

testing these rules a major problem was in determining what did and did not constitute proper fast speech forms. In slow speech, it is fairly easy to break up the utterance into a sequence of phonemes, but in fast speech, the utterance is more continuous and it is harder to decide what is a segment and where the segments begin and end. For example, the palatalization rules produce the following derivation:

(a). /did##yu/

(b). /di##ǰyu/

(c). /di##ǰu/

We are not inclined to believe that an intermediate form /did##ǰyu/ exists between steps (a) and (b) in this derivation. I think that (b) is a true intermediate form, existing in slower, casual speech, but not in fast speech.

Our best evidence indicated that the RUH is the same as the syllabic "r", thus raising the problem of ordering the Syllabicizing and Ruh-reduction rules. Are the proper forms /g u v + n r/ and /f e d + r l/ or, more likely, /g u v + n r̩/ and /f e d + r l/? Or, could it possibly be /g u v + n r/ and /f e d + r l/, with the Syllabicizing rule not deleting the schwa, but making it very short and possibly devoicing it?

Another disturbing result of the testing was the application of rules across deleted segments. For example, after <u>governor</u> has been reduced to /g u v + n r/, Progressive Assimilation applies, producing /g u v + m r/. Similarly, <u>sanity clause</u> becomes /s ae n + t ə .../ which becomes /s ae n + ʃ ə .../,

closing in on a fast speech form of Santa_Claus. The final form of the second set of rules and the output are given in Appendix D.

Suggested_Modifications_to_the_PGT

The PGT was written for the testing of traditional phonological grammars which take an underlying form to a surface form, and thus fast speech rules present several unforeseen problems.

Fast speech rules do not constitute a complete grammar, but are instead interspersed, among the traditional rules. In producing an intermediate or surface form for input to the grammar, the use of diacritics would produce a simpler and more economical representation of the input For example, in the present system, it is necessary to give a separate definition for each stress assignment for each vowel, instead of defining each vowel once and assigning the stress through the use of diacritics.

Syllabification appears to occur before some of the rules, and after others. To avoid having to insert rules for syllabification or having the rules preceding syllabification ignore syllable boundaries in the input, the PGT should have a "human intervention" rule which would allow the user to change the tree as part of the derivation, simulating the effect of the

"missing" rules. "Human intervention" rules could be used to postpone writing rules, either to a later session or indefinitely if the rules are too hard to write or if they are outside the scope of the problem.

Another problem arises from most, if not all, fast speech rules being optional. The present system generates a single derivation using a random number generator to decide whether or not to apply optional rules. As a result, to obtain a good test of the effect of an optional rule in the grammar, we have to do two tests, one with the rule obligatory and one without the rule. With a large number of optional rules operating on a non-trivial set of test data, having to test each possible rule combination individually would be a staggering task. A more satisfactory method would be for the PGT to produce a set of derivations such that any time an optional rule can apply, the PGT produces a derivation for the case where the rule was applied and one for the case where it wasn't. Cohen and Mercer (2) have implemented such a feature in their rule tester by storing the result of the application of a rule as a directed graph. Subsequent rules are applied to all paths through the graph, producing a new graph.

In considering the problem of when an optional rule should be applied, we are considering <u>performance</u> (10). To this end, we might be better served by having the variable rules of Labov (5) in addition to traditional phonological rules. Instead of the all-or-nothing matching of normal rules, variable rules employ incremental matching, with the likelihood of the rule being

applied being a function of the degree of match, the rate of speech, and the nature of the conversation (e.g. Is it formal or casual?). For example, for the Progressive Assimilation rule for point of articulation (PROARTIC), /s ʊ f n/ (soften) becomes /s ø f m/ only in very fast speech, but /p r + f y u + ž n/ (profusion) becomes /p r + f y u + ž ñ/ in most fast speech. In addition, for each variable rule applied, the PGT should use the associated probability to produce a final probability for each derivation. Unfortunately, the implementation of variable rules would necessitate major changes to the PGT.

Convenient, but not necessary, would be the ability to make a rule "blind" to certain types of nodes. For example, Chomsky and Halle (1) allow some boundary symbols to be invisible to their phonological rules. In some cases, this ability might be able to fulfill the function of a "human intervention" rule.

Observations about Fast Speech Rules

Testing the fast speech rules led to certain insights into the interactions of the rules. The most vexing problems were with the representation of boundaries. The use of +, #, and ## seems artificial and cumbersome. A more natural approach seems to be to assign the boundaries varying degrees of strength, and then allow the phonological rules to operate on the strength assignments. Consider the problem of "John's going to work" becoming the fast speech form "John's gonna work" in the case

where going is an auxiliary but not in the case where it is the verb. Rather than having the phonological rule sensitive to the syntax, it seems much cleaner to have it sensitive to the boundary strength between going and to. To this end, we must allow the syntax to influence the initial assignments of boundary strength. The use of boundary strengths also seems to solve the problem, of how boundaries are reduced. For example, in reducing want to to wanna should the word boundary be reduced to a morpheme or a syllable boundary?

Another use of boundary strengths might be to mark the position of segments deleted from a word by strengthening the neighboring boundary. For example, when governor is reduced to gov'ner, the v is lengthened, indicating the possible presence of a stronger then normal syllable boundary. This stronger boundary would then prevent the v from changihg the n to an m under Progressive Assimilation. An alternative is to have a "strong syllable" boundary symbol which would be "stronger" than a "weak word" boundary symbol, but this would be messy and unnatural.

It would probably be more productive to represent fast speech forms with phonemes utilizing multi-valued (1 through 7 instead of + and -) features. Giving the segments length attributes would allow segments to be deleted by a combination of rules which reduce segment lengths. Also, in comparing forms, a very short segment could be considered to be deleted.

Fast speech rules seem to be selective as to the words to

which they can apply. Zwicky (14) gives examples and counter-examples for various fast speech rules. However, it seems that the counter-examples are words which do not frequently occur in casual speech, while the examples were common. This point was illustrated when , in an early run, that Schwa Deletion produced /k ae n ɨ g r u/ from "kangaroo". At first, this fast speech form was unacceptable, but with use, it became more and more acceptable. Interestingly enough, a small random polling seemed to indicate that this form is acceptable "if you're an Australian". That fast speech rules apply to what is common in the speaker's vocabulary is also evidenced by the heavy application of fast speech rules to local names.

The similarity of the Palatization rules in this fast speech grammar and in normal English (1) raises the question of "What are fast speech rules?". If normal rules are restricted versions of the more general processes which also account for the fast speech forms (14), then we must be careful in using slow speech surface forms to test the fast speech rules. For example, part of the data covered by the Schwa Deletion rule might actually result from schwas being <u>inserted</u> between consonants in slow speech forms.

Acknowledgments

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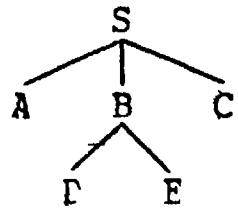
Appendix A - Using the Phonological Grammar Tester

In the PGT, the phonological rules are treated as a transformational grammar which operates on trees whose terminal nodes are usually phonemes and boundary symbols. While most phonological rules will use only these terminal nodes, it may be desirable, or even necessary, to have the rule sensitive to the syntax, which could indicated by the non-terminal nodes.

Trees can be linearized by using "<" and ">" to enclose a left to right listing of sibling nodes, such that a description of each non-terminal node's descendants is appended to its name. thus:



becomes S<A B<D E> C>.

In defining the grammar, rules are stated in one of two forms. The more general transformational rule format has two parts:

the structural description, which must match the tree exactly for the rule to apply, and

the structural change, which describes the effect of the rule upon the tree.

Since these phonolcgical rules use only the immediate context, the SD's begin and end with the unbounded skip symbol "%". Bounded skips are linearized by prefixing the symbol with its bound, thus C_0 becomes '0'C. Choices are linearized by

separating them with commas and enclosing them in parentheses. An optional part of the structural description is enclosed in parentheses. Nodes used in the structural change are referenced by an integer prefix.

If only one node is to be erased, changed or inserted, the second form of the rule, which resembles that traditionally used in phonology, can be used.

Example: VOWEL NASALIZATION

$$V \Rightarrow [+\text{nasal}] / \left(\left\{ \begin{matrix} + \\ \# \end{matrix} \right\} \right) \left\{ \begin{matrix} [m] \\ [n] \\ [\eta] \end{matrix} \right\}$$

```
TRANS NASVOW.
 SD % 1'V ((+, #)) '|+CONS -VOCAL +NASAL| %.
 SC. |+NASAL| MERGEF 1.

RULE NASVOW.
 V => |+NASAL|/<% _ ((+, #)) '|+CONS -VOCAL +NASAL| %>.
```

The rules can either be obligatory or optional and can have one of three modes of application: single, simultaneous, or repetitive. The PGT also contains provision for a control program which will direct the order in which the rules are tried, with the default being that the rules are tried once in the order given.

Unfortunately, no systematic procedure for testing grammars

with the PGT has been developed, nor has a procedure for acquiring an appropriate input set. Our procedure has been to adjust the grammar while trying to obtain the sample derivations given with the rules.

Appendix B - Sample Output

Note: explanations are in lower case.

```
   "INTRODUCTION:"  S<'MB N<'MB 'II2 'N 'SB 'T 'R 'O3 'SB 'D 'UH1 'K
                            'SB 'SH 'EH2 'N 'MB> 'MB>.
echoes the input
TREE READ BY PTRIN *
 1 S          2 #
              3 N          4 #
                           5 II/2/
                           6 N
                           7 +
                           8 T
                           9 R
                          10 O/3/
                          11 +
                          12 D
                          13 JH/1/
                          14 K
                          15 +
                          16 SH
                          17 EH/2/
                          18 N
                          19 #
             20 #

          # # II/2/ N + T R O/3/ + D UH/1/ K + SH EH/2/ N # #
 output the form in tree and linear form

*****     TRANSFORMATIONS     *****
SCAN CALLED AT     1     I
  start scanning on top "S" node

ANTEST CALLED FOR    1"REDVOW  "(AACC)     ,SD=  2. RES=  6. TOP=   1:S
  attempt to apply rule redvow to form

ANTEST RETURNS ** 1**
  rule redvow has matched once
   absence of this message indicates that the rule did not apply

CHANGE. HAVE CSEXCH FOR  MERGEF   IN     10
  merge features into node 10 (making it a schwa)

ANTEST CALLED FOR    2"SCHWDA  "(AACC)     ,SD=  3. RES=  7. TOP=   1:S
ANTEST CALLED FOR    3"SCHWDB  "(AACC)     ,SD=  4. RES=  9. TOP=   1:S
ANTEST CALLED FOR    4"ING     "(AACC)     ,SD=  5. RES=  0. TOP=   1:S
ANTEST CALLED FOR    5"SYLLAB  "(AACC)     ,SD=  6. RES= 11. TOP=   1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE       0   17
  erase node 17

CHANGE. HAVE CSEXCH FOR  MERGEF   IN     18
```

```
ANTEST CALLED FOR    6"RUHRED  "(AACC)     ,SD=  7. RES= 13. TOP=   1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MOVEF    IN      9
  move features to node 9 from some unspecified node (10)

CHANGE. CALL ELEMOP FOR  ERASE       0    10
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      9
ANTEST CALLED FOR    7"RUHLESS "(AACC)     ,SD=  8. RES= 15. TOP=   1:S
ANTEST CALLED FOR    8"NASVOW  "(AACC)     ,SD=  9. RES=  0. TOP=   1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      5
ANTEST CALLED FOR    9"TRANSTOP"(AACC)     ,SD= 10. RES= 16. TOP=   1:S
ANTEST CALLED FOR   10"PALAT1  "(AACC)     ,SD= 11. RES= 17. TOP=   1:S
ANTEST CALLED FOR   11"PALAT2  "(AACC)     ,SD= 12. RES=  0. TOP=   1:S
ANTEST CALLED FOR   12"PALAT3  "(AACC)     ,SD= 13. RES=  0. TOP=   1:S
ANTEST CALLED FOR   13"ALFLAP  "(AACC)     ,SD= 14. RES= 18. TOP=   1:S
ANTEST CALLED FOR   14"GLOT    "(AACC)     ,SD= 15. RES=  0. TOP=   1:S
ANTEST CALLED FOR   15"DENDELD "(AACC)     ,SD= 16. RES= 20. TOP=   1:S
ANTEST CALLED FOR   16"DENDELI1"(AACC)     ,SD= 17. RES= 21. TOP=   1:S
ANTEST CALLED FOR   17"DENDELT3"(AACC)     ,SD= 18. RES=  0. TOP=   1:S
ANTEST CALLED FOR   18"REGVOICE"(AACC)     ,SD= 19. RES= 22. TOP=   1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      6
ANTEST CALLED FOR   19"REGARTIC"(AACC)     ,SD= 20. RES= 23. TOP=   1:S
ANTEST CALLED FOR   20"PROVOICE"(AACC)     ,SD= 21. RES= 24. TOP=   1:S
ANTEST CALLED FOR   21"PROARTIC"(AACC)     ,SD= 22. RES= 25. TOP=   1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN     18
ANTEST CALLED FOR   22"GEMRED  "(AACC)     ,SD= 23. RES= 26. TOP=   1:S
ANTEST CALLED FOR   23"NASRED  "(AACC)     ,SD= 24. RES=  0. TOP=   1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE       0     6
ANTEST CALLED FOR   24"DARKL   "(AACC)     ,SD= 25. RES=  0. TOP=   1:S
ANTEST CALLED FOR   25"RFLAP   "(AACC)     ,SD= 26. RES=  0. TOP=   1:S
ANTEST CALLED FOR   26"RDEVOICE"(AACC)     ,SD= 27. RES=  0. TOP=   1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      9
SCAN CALLED AT     2
  tries to scan on embedded "S" node, but finding none, stops.


TRANSFORMATIONS WHICH HAVE APPLIED ARE
                1          1  REDVOW
                2          5  SYLLAB
                3          6  RUHRED
                4          8  NASVOW
                5         18  REGVOICE
                6         21  PROARTIC
                7         23  NASRED
```

```
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 II>/2/
                           7 +
                           8 T
                           9 RDV/3/
                          11 +
                          12 D
                          13 UH/1/
                          14 K
                          15 +
                          16 SH
                          18 NPAS/2/
                          19 #
             20 #

        # # II>/2/ + T RDV/3/ + D UH/1/ K + SH NPAS/2/ # #
 output the result in tree and linear form


 9 RDV/3/   ]-LOW +BACK -ROUND +RETROF|
    these features were associated with node 9 in addition to those
    given to define the symbol "NPAS" and the diacritc "/2/"

18 NPAS/2/ |-LOW -BACK -ROUND|
```

Appendix C - First Set of Rules

```
"NEW- JULY 11, 1973"
PHONLEXICON
 FEATURES
 give the features used
 CONS VOCAL SON CONT
 LOW HIGH BACK ROUND ANT COR
 TENSE VOICE STRID
 DELREL NASAL RETROF
 STRESS GLOTTAL PALAT

 VARIABLE
 define the symbols used in the rules and in the input
  C=|+CONS -VOCAL|,
  V=|-CONS +VOCAL|,
 "OBSTRUENTS"
  "STOPS"
    P=   |+CONS -VOCAL -SON -CONT +ANT -COR -VOICE -STRID -DELREL|,
    B=   |+CONS -VOCAL -SON -CONT +ANT -COR +VOICE -STRID -DELREL|,
    T=   |+CONS -VOCAL -SON -CONT +ANT +COR -VOICE -STRID -DELREL|,
    D=   |+CONS -VOCAL -SON -CONT +ANT +COR +VOICE -STRID -DELREL|,
    K=   |+CONS -VOCAL -SON -CONT -ANT -COR -VOICE -STRID -DELREL|,
    G=   |+CONS -VOCAL -SON -CONT -ANT -COR +VOICE -STRID -DELREL|,
  "FRICATIVES"
    VV=  |+CONS -VOCAL -SON +CONT +ANT -COR +VOICE +STRID|,
    F=   |+CONS -VOCAL -SON +CONT +ANT -COR -VOICE +STRID|,
    THV= |+CONS -VOCAL -SON +CONT +ANT +COR +VOICE -STRID|,
    THU= |+CONS -VOCAL -SON +CONT +ANT +COR -VOICE -STRID|,
    Z=   |+CONS -VOCAL -SON +CONT +ANT +COR +VOICE +STRID|,
    S=   |+CONS -VOCAL -SON +CONT +ANT +COR -VOICE +STRID|,
    ZH=  |+CONS -VOCAL -SON +CONT -ANT -COR +VOICE +STRID|,
    SH=  |+CONS -VOCAL -SON +CONT -ANT -COR -VOICE +STRID|,
  "AFFRICATES"
    JH=  |+CONS -VOCAL -SON -CONT +ANT +COR +VOICE +STRID +DELREL|,
    CH=  |+CONS -VOCAL -SON -CONT +ANT +COR -VOICE +STRID +DELREL|,
 "NASALS"
    M=   |+CONS -VOCAL +SON -CONT +ANT -COR +VOICE -STRID +NASAL|,
    N=   |+CONS -VOCAL +SON -CONT +ANT +COR +VOICE -STRID +NASAL|,
    NG=  |+CONS -VOCAL +SON -CONT -ANT -COR +VOICE -STRID +NASAL|,
 "LIQUIDS"
    L=   |+CONS +VOCAL +SON +CONT +ANT +COR +VOICE -STRID|,
    R=   |+CONS +VOCAL +SON +CONT -ANT +COR +VOICE -STRID|,
 "VOWELS"
    I=   |-CONS +VOCAL -LOW +HIGH -BACK -ROUND +TENSE|,
    I1=  |-CONS +VOCAL -LOW +HIGH -BACK -ROUND +TENSE 1STRESS|,
    I2=  |-CONS +VOCAL -LOW +HIGH -BACK -ROUND +TENSE 2STRESS|,
    I3=  |-CONS +VOCAL -LOW +HIGH -BACK -ROUND +TENSE 3STRESS|,
    II=  |-CONS +VOCAL -LOW +HIGH -BACK -ROUND -TENSE|,
    II1= |-CONS +VOCAL -LOW +HIGH -BACK -ROUND -TENSE 1STRESS|,
    II2= |-CONS +VOCAL -LOW +HIGH -BACK -ROUND -TENSE 2STRESS|,
    II3= |-CONS +VOCAL -LOW +HIGH -BACK -ROUND -TENSE 3STRESS|,
```

```
E=   |-CONS +VOCAL -LOW -HIGH -BACK -ROUND +TENSE|
E1=  |-CONS +VOCAL -LOW -HIGH -BACK -ROUND +TENSE 1STRESS|,
E2=  |-CONS +VOCAL -LOW -HIGH -BACK -ROUND +TENSE 2STRESS|,
E3=  |-CONS +VOCAL -LOW -HIGH -BACK -ROUND +TENSE 3STRESS|,
EE=  |-CONS +VOCAL -LOW -HIGH -BACK -ROUND -TENSE
EE1= |-CONS +VOCAL -LOW -HIGH -BACK -ROUND -TENSE 1STRESS|,
EE2= |-CONS +VOCAL -LOW -HIGH -BACK -ROUND -TENSE 2STRESS|,
EE3= |-CONS +VOCAL -LOW -HIGH -BACK -ROUND -TENSE 3STRESS|,
AE=  |-CONS +VOCAL +LOW -HIGH -BACK -ROUND
AE1= |-CONS +VOCAL +LOW -HIGH -BACK -ROUND 1STRESS|,
AE2= |-CONS +VOCAL +LOW -HIGH -BACK -ROUND 2STRESS|,
AE3= |-CONS +VOCAL +LOW -HIGH -BACK -ROUND 3STRESS|,
IR=  |-CONS +VOCAL -LOW +HIGH +BACK -ROUND +RETROF|,
IR1= |-CONS +VOCAL -LOW +HIGH +BACK -ROUND +RETROF 1STRESS|,
IR2= |-CONS +VOCAL -LOW +HIGH +BACK -ROUND +RETROF 2STRESS|,
IR3= |-CONS +VOCAL -LOW +HIGH +BACK -ROUND +RETROF 3STRESS|,
IH=  |-CONS +VOCAL -LOW +HIGH +BACK -ROUND|
IH1= |-CONS +VOCAL -LOW +HIGH +BACK -ROUND 1STRESS|,
IH2= |-CONS +VOCAL -LOW +HIGH +BACK -ROUND 2STRESS|,
IH3= |-CONS +VOCAL -LOW +HIGH +BACK -ROUND 3STRESS|,
ER=  |-CONS +VOCAL -LOW -HIGH +BACK -ROUND +RETROF|,
ER1= |-CONS +VOCAL -LOW -HIGH +BACK -ROUND +RETROF 1STRESS|,
ER2= |-CONS +VOCAL -LOW -HIGH +BACK -ROUND +RETROF 2STRESS|,
ER3= |-CONS +VOCAL -LOW -HIGH +BACK -ROUND +RETROF 3STRESS|,
EH=  |-CONS +VOCAL -LOW -HIGH +BACK -ROUND
EH1= |-CONS +VOCAL -LOW -HIGH +BACK -ROUND 1STRESS|,
EH2= |-CONS +VOCAL -LOW -HIGH +BACK -ROUND 2STRESS|,
EH3= |-CONS +VOCAL -LOW -HIGH +BACK -ROUND 3STRESS|,
UH=  |-CONS +VOCAL +LOW -HIGH +BACK -ROUND|
UH1= |-CONS +VOCAL +LOW -HIGH +BACK -ROUND 1STRESS|,
UH2= |-CONS +VOCAL +LOW -HIGH +BACK -ROUND 2STRESS|,
UH3= |-CONS +VOCAL +LOW -HIGH +BACK -ROUND 3STRESS|,
U=   |-CONS +VOCAL -LOW +HIGH +BACK +ROUND +TENSE|,
U1=  |-CONS +VOCAL -LOW +HIGH +BACK +ROUND +TENSE 1STRESS|,
U2=  |-CONS +VOCAL -LOW +HIGH +BACK +ROUND +TENSE 2STRESS|,
U3=  |-CONS +VOCAL -LOW +HIGH +BACK +ROUND +TENSE 3STRESS|,
UU=  |-CONS +VOCAL -LOW +HIGH +BACK +ROUND -TENSE|
UU1= |-CONS +VOCAL -LOW +HIGH +BACK +ROUND -TENSE 1STRESS|,
UU2= |-CONS +VOCAL -LOW +HIGH +BACK +ROUND -TENSE 2STRESS|,
UU3= |-CONS +VOCAL -LOW +HIGH +BACK +ROUND -TENSE 3STRESS|,
O=   |-CONS +VOCAL -LOW -HIGH +BACK +ROUND +TENSE|
O1=  |-CONS +VOCAL -LOW -HIGH +BACK +ROUND +TENSE 1STRESS|,
O2=  |-CONS +VOCAL -LOW -HIGH +BACK +ROUND +TENSE 2STRESS|,
O3=  |-CONS +VOCAL -LOW -HIGH +BACK +ROUND +TENSE 3STRESS|,
OO=  |-CONS +VOCAL -LOW -HIGH +BACK +ROUND -TENSE|,
OO1= |-CONS +VOCAL -LOW -HIGH +BACK +ROUND -TENSE 1STRESS|,
OO2= |-CONS +VOCAL -LOW -HIGH +BACK +ROUND -TENSE 2STRESS|,
OO3= |-CONS +VOCAL -LOW -HIGH +BACK +ROUND -TENSE 3STRESS|,
A=   |-CONS +VOCAL +LOW -HIGH +BACK +ROUND|,
A1=  |-CONS +VOCAL +LOW -HIGH +BACK +ROUND 1STRESS|,
A2=  |-CONS +VOCAL +LOW -HIGH +BACK +ROUND 2STRESS|,
A3=  |-CONS +VOCAL +LOW -HIGH +BACK +ROUND 3STRESS|,
     SCHWA=EH | IH,
     RUH=ER | IR,
```

```
"SEMIVOWELS"
  W=|-CONS -VOCAL -LOW +BACK +ROUND|,
  Y=|-CONS -VOCAL -LOW -BACK -ROUND|.
PHONUNIT
  define the output symbols, using features or the symbols above
    P=P, T=T, K=K, B=B, D=D, G=G, M=M, N=N, NG=NG,
    VV=VV, F=F, THV=THV, THU=THU, Z=Z, S=S, ZH=ZH, SH=SH, CH=CH, JH=JH,
    I=I, II=II, E=E, EE=EE, AE=AE, ER=ER, EH=EH, UH=UH, U=U, UU=UU,
     O=O, OO=OO,  A=A, W=W, Y=Y, R=R, L=L, IH=IH, IR=IR,
    RUH= |-CONS +VOCAL -LOW +BACK -ROUND +RETROF|,
     CHWA= |-CONS +VOCAL -LOW +BACK -ROUND|

 DIACRITIC
 define diacritics used in the output
  >=|+NASAL|,
  /1/=|1STRESS|,
  /2/=|2STRESS|,
  /3/=|3STRESS|,
  /4/=|4STRESS|.

 $END

TRANSFORMATIONS
 IMPLICIT AACC.
   Give the rules. Unless specified, the mode of application
   is simultaneous (vs. single, AC, or repetitive, ACAC).

"UNSTRESSED VOWEL REDUCTION- (A) IN POLYSYLLABLES"
RULE 1 REDVOW1A .
 |-CONS +VOCAL (ALPHA)STRESS|  =>
     |-LOW -ROUND +BACK|
 /<% _ 'C '|-CONS +VOCAL (BETA)STRESS| %, WHERE ALPHA > BETA>.

"UNSTRESSED VOWEL REDUCTION- (B) IN MONOSYLLABLES"
TRANS REDVOW1B.
  SD % # # '0'C 5'V '0'C # # %,
     WHERE  5 NINC1 |1STRESS|.
   SC ('|-CONS +VOCAL -LOW -HIGH +BACK -ROUND 4STRESS|)  SUBSE 5.

"GEMINATE REDUCTION"
TRANS 2 GEMRED.
  SD % 1'|+CONS| (3# (4#)) 2* %, WHERE 1 EQ 2.
  SC ERASE 2, ERASE 4.


"SCHWA DELETION
 RULE 3 SCHWDA.
  SCHWA => */<% 'V '1'C _|(ALPHA)STRESS|
              '|+COR +SON| '|-CONS +VOCAL (BETA)STRESS| %,
      WHERE ALPHA > BETA >.

 RULE SCHWDB
  SCHWA => */<% '|-CONS +VOCAL 1STRESS| _ '|+COR +SON| %>.
```

```
"DENTAL DELETION"
 RULE 5 DENDELA.
  D => */<% '|+ANT +COR +SCN| _  # # %>.
 RULE DENDELB.
  T => */<% '|+COR +NASAL| _ # # %>.
 RULE DENDELC.
  T => */<% '|+ANT +CONT +STRID -VOICE| _ # %>.

"INTRODUCTION OF TRANSITIONAL STOPS"
 TRANS 6 TRANSTOP.
  SD % 1'|+CONS -VOCAL +NASAL (NU)ANT (MU)COR|
       '|-SON (BETA)VOICE (EPSI)ANT (LAMBDA)COR (ALPHA)CONT| %,
     WHERE (ALPHA><-) | (NU><EPSI) | (MU><LAMBDA).
  SC ('|+CONS -VOCAL -SON -CONT (NU)ANT (MU)COR (BETA)VOICE -STRID
     -DELREL|) ADRIS 1.

"PALATALIZATION"
 TRANS 7 PALATA.
  SD % 1'|+ANT +COR -SON -CONT (ALPHA)VOICE| (2#) #
       3'|-CONS -VOCAL -BACK| 'V %.
  SC ERASE 2, ERASE 3, |+PALAT| MERGEF 1.
 RULE PALATB.
  |+PALAT| => |+STRID +DELREL|.
 TRANS PALATC OB.
  SD % 1'|+PALAT| %.
  SC |+PALAT| ERASEF 1.

"SYLLABICIZING"
 TRANS 8 SYLLAB.
  SD % '|+CONS -VOCAL (ALPHA)ANT (BETA)COR| (#)
       1'|-CONS +VOCAL +BACK -LOW -ROUND (GAMMA)STRESS|
       2'|+CONS (MU)VOCAL (ALPHA)ANT (BETA)COR (NU)NASAL| %,
     WHERE (GAMMA > 1) & ((MU = +) | ((ALPHA = +) & (NU = +))).
  SC ERASE 1, |+VOCAL| MERGEF 2.

"NASALIZED VOWELS"
 RULE 9 NASVOW.
  V => |+NASAL|/<% _ '|+CONS -VOCAL +NASAL| %>.

"NASAL REDUCTION"
  "MUST FOLLOW 9 NASVOW"
 RULE 10 NASRED.
  |+CONS -VOCAL +NASAL| => *
    /<% '|-CONS +VOCAL +NASAL| _ 'C %>.

"ALVEOLAR FLAPPING"
"MUST FOLLOW 10 NASRED FOR 'WANT TO' "
"MUST FOLLOW 3 SCHWD TO AVOID '*FEDERAL'"
RULE 4 ALFLAP
  |+ANT +COR -SON -DELREL|
   => |+CONT +SON +DELREL|
  /<% '|-CONS +VOCAL (ALPHA)STRESS|
       ('|-ANT +COR +SON +CONT|)
       _ (#) '|-CONS +VOCAL (BETA)STRESS| %,
    WHERE ALPHA < BETA >.
```

```
"GLOTTALIZATION"
 RULE 11 GLOT.
  T => |+GLOTTAL|
    /<% '|-CONS +VOCAL 1STRESS| '0'C _ 'SCHWA
        '|+ANT +COR +SON -STRID +VOICE| %>.

"RUH-REDUCTION"
TRANS 12 RUHRED.
 SD % *<# % ('|-CONS +VOCAL (BETA)STRESS| % 1'R
             2'|-CONS +VOCAL -LOW -ROUND +BACK (ALPHA)STRESS| *,
             * % 1'R 2'|-CONS +VOCAL -LOW +BACK -ROUND (ALPHA)STRESS|
             % '|-CONS +VOCAL (BETA)STRESS|)
        % # > %
    WHERE ALPHA > BETA
 SC ERASE 1
    |+RETROF| MERGEF 2.

"RUH-LESSNESS"
"MUST FOLLOW RUH-RED"
 RULE 13 RUHLESS.
  RUH => |-RETROF|
      /<% 'C _| (ALPHA)STRESS| 'C %  WHERE ALPHA > 1>.

"REGRESSIVE ASSIMILATION (FOR NASALS ONLY)"
 TRANS 14 REGASS.
  SD % 1'|+CONS -VOCAL +NASAL| (#)
       '|+CONS -VOCAL (ALPHA)ANT (BETA)COR| %.
  SC |(ALPHA)ANT (BETA)COR| MERGEF 1.

"PROGRESSIVE ASSIMILATION"
 RULE 15 PROGASS.
  |+CONS -VOCAL (ALPHA)VOICE| => |(BETA)VOICE|
      /<% '|(BETA)VOICE| (#) _ %>.

"<-ING>"
"CONDITION: NO ADDITIONAL ##"
 TRANS 16 ING.
  SD % *<# %  '|-CONS +VOCAL 1STRESS| % 1'|-CONS +VOCAL +HIGH -BACK|
              2'|+CONS -VOCAL +NASAL -ANT| #> %.
  SC |+ANT +COR| MERGEF 2,
     |-ROUND -LOW +BACK| MERGEF 1.

CP I.
control program - cycle through the rules once in the given order
$ENDTRA $MAIN FTRIN TRAN.
```

```
KAMPLES FROM NEU"
     S<# V<# 'W 'A1 'N 'T #> P<# 'T 'U2 #> #>.
     S<# N<# 'P 'R 'O2 'F 'U1 'ZH 'EH3 'N #> #>.
     S<# N<# 'G 'UH1 'VV 'ER3 'N 'ER2 #> #>.
     S<# N<# 'K 'AE1 'P 'T 'EH2 'N #> #>.
     S<# N<# 'F 'EE1 'D 'EH3 'R 'EH2 'L #> #>.

ORDS FROM NEU"
     S<# ADJ<# 'L 'EE1 'F 'T #> PREP<# 'T 'U2 #> #>.
     S<# N<# 'R 'EE1 'F 'EH3 'R 'EH2 'N 'S 'EH3 'Z #> #>.
     S<# N<# 'CH 'A1 'K 'O3 'L 'EH2 'T #> #>.
     S<# N<# 'D 'OO1 'EH3 'R 'I2 #> #>.
     S<# CONJ<# 'AE1 'N 'D #> #>.
     S<# N<# 'F 'R 'UH1 'N 'T #> #>.
     S<# V<# 'S 'OO1 'F 'T # 'EH2 'N #> #>.
     S<# N<# 'UH1 'T 'ER3 'EH2 'N 'S #> #>.
     S<# V<# 'D 'R 'EE1 'M 'T #> #>.
     S<# V<# 'R 'II1 'NG # 'D #> #>.
     S<# V<# 'D 'II1 'D #> PRON<# 'Y 'U1 #> #>.
     S<# V<# 'I1 'T #> POSS<# 'Y 'ER2 #> #>.
     S<# N<# 'S 'AE1 'M 'P 'EH2 'L 'Z #> #>.
     S<# N<# 'S 'UH1 'D 'EH3 'N # 'L 'I2 #> #>.
     S<# V<# 'K 'AE1 'M 'P 'II2 'NG #> #>.
     S<# N<# 'K 'AE2 'NG 'G 'EH3 'R 'U1 #> #>.
     S<# N<# 'K 'A1 'T 'EH2 'N #> #>.
N-"  S<# N<# 'II2 'N 'T 'R 'O3 'D 'UH1 'K 'SH 'EH2 'N #> #>.
     S<# V<# 'S 'E1 'II2 'NG #> #>.
     S<# N<# 'N 'UH1 'THU 'II2 'NG #> #>.
```

Appendix D - Final Rules with Edited Output

Lines indicating that the rule did not apply have been deleted.

```
"NEU- FEBRUARY 5, 1974"
PHONLEXICON
 FEATURES
 CONS VOCAL SON CONT
 LOW HIGH BACK ROUND ANT COR
 TENSE VOICE STRID
 NASAL RETROF
 STRESS GLOTTAL LONG
 SYLBND MORBND

 VARIABLE
  V  =|-CONS +VOCAL|,
  CON=|+CONS -VOCAL|,
  C  =|+CONS|,
  NV =|+CONS| | |-CONS -VOCAL|,
  SB =|+SYLBND|,
  MB =|+MORBND|,
  NV1=C | |-CONS -VOCAL| | SB,
  NV2=C | |-CONS -VOCAL| | SB | MB,
  BND=MB | SB,
 "OBSTRUENTS"
  "STOPS"
  P  =|+CONS -VOCAL -SON -CONT +ANT -COR -VOICE -STRID|,
  B  =|+CONS -VOCAL -SON -CONT +ANT -COR +VOICE -STRID|,
  T  =|+CONS -VOCAL -SON -CONT +ANT +COR -VOICE -STRID|,
  D  =|+CONS -VOCAL -SON -CONT +ANT +COR +VOICE -STRID|,
  K  =|+CONS -VOCAL -SON -CONT -ANT -COR -VOICE -STRID|,
  G  =|+CONS -VOCAL -SON -CONT -ANT -COR +VOICE -STRID|,
 "FRICATIVES"
  VV =|+CONS -VOCAL -SON +CONT +ANT -COR +VOICE +STRID|,
  F  =|+CONS -VOCAL -SON +CONT +ANT -COR -VOICE +STRID|,
  THV=|+CONS -VOCAL -SON +CONT +ANT +COR +VOICE -STRID|,
  THU=|+CONS -VOCAL -SON +CONT +ANT +COR -VOICE -STRID|,
  Z  =|+CONS -VOCAL -SON +CONT +ANT +COR +VOICE +STRID|,
  S  =|+CONS -VOCAL -SON +CONT +ANT +COR -VOICE +STRID|,
  ZH =|+CONS -VOCAL -SON +CONT -ANT +COR +VOICE +STRID|,
  SH =|+CONS -VOCAL -SON +CONT -ANT +COR -VOICE +STRID|,
 "AFFRICATES"
  JH =|+CONS -VOCAL -SON -CONT -ANT +COR +VOICE +STRID|,
  CH =|+CONS -VOCAL -SON -CONT -ANT +COR -VOICE +STRID|,
"NASALS"
  M  =|+CONS -VOCAL +SON -CONT +ANT -COR +VOICE -STRID +NASAL|,
  N  =|+CONS -VOCAL +SON -CONT +ANT +COR +VOICE -STRID +NASAL|,
  NPA=|+CONS -VOCAL +SON -CONT -ANT +COR +VOICE -STRID +NASAL|,
  NG =|+CONS -VOCAL +SON -CONT -ANT -COR +VOICE -STRID +NASAL|,
"LIQUIDS"
  L  =|+CONS +VOCAL +SON +CONT +ANT +COR +VOICE -STRID|,
  R  =|+CONS +VOCAL +SON +CONT -ANT +COR +VOICE -STRID|,
"SEMIVOWELS"
  W  =|-CONS -VOCAL -LOW +BACK +ROUND|,
  Y  =|-CONS -VOCAL -LOW -BACK -ROUND|,
```

```
"VOWELS"
   I  =|-CONS +VOCAL -LOW +HIGH -BACK -ROUND +TENSE|,
   I1 =|-CONS +VOCAL -LOW +HIGH -BACK -ROUND +TENSE 1STRESS|,
   I2 =|-CONS +VOCAL -LOW +HIGH -BACK -ROUND +TENSE 2STRESS|,
   I3 =|-CONS +VOCAL -LOW +HIGH -BACK -ROUND +TENSE 3STRESS|,
   II =|-CONS +VOCAL -LOW +HIGH -BACK -ROUND -TENSE|,
   II1=|-CONS +VOCAL -LOW +HIGH -BACK -ROUND -TENSE 1STRESS|,
   II2=|-CONS +VOCAL -LOW +HIGH -BACK -ROUND -TENSE 2STRESS|,
   II3=|-CONS +VOCAL -LOW +HIGH -BACK -ROUND -TENSE 3STRESS|,
   E  =|-CONS +VOCAL -LOW -HIGH -BACK -ROUND +TENSE|,
   E1 =|-CONS +VOCAL -LOW -HIGH -BACK -ROUND +TENSE 1STRESS|,
   E2 =|-CONS +VOCAL -LOW -HIGH -BACK -ROUND +TENSE 2STRESS|,
   E3 =|-CONS +VOCAL -LOW -HIGH -BACK -ROUND +TENSE 3STRESS|,
   EE =|-CONS +VOCAL -LOW -HIGH -BACK -ROUND -TENSE|,
   EE1=|-CONS +VOCAL -LOW -HIGH -BACK -ROUND -TENSE 1STRESS|,
   EE2=|-CONS +VOCAL -LOW -HIGH -BACK -ROUND -TENSE 2STRESS|,
   EE3=|-CONS +VOCAL -LOW -HIGH -BACK -ROUND -TENSE 3STRESS|,
   AE =|-CONS +VOCAL +LOW -HIGH -BACK -ROUND|,
   AE1=|-CONS +VOCAL +LOW -HIGH -BACK -ROUND 1STRESS|,
   AE2=|-CONS +VOCAL +LOW -HIGH -BACK -ROUND 2STRESS|,
   AE3=|-CONS +VOCAL +LOW -HIGH -BACK -ROUND 3STRESS|,
   IR =|-CONS +VOCAL -LOW +HIGH +BACK -ROUND +RETROF|,
   IR1=|-CONS +VOCAL -LOW +HIGH +BACK -ROUND +RETROF 1STRESS|,
   IR2=|-CONS +VOCAL -LOW +HIGH +BACK -ROUND +RETROF 2STRESS|,
   IR3=|-CONS +VOCAL -LOW +HIGH +BACK -ROUND +RETROF 3STRESS|,
   IH =|-CONS +VOCAL -LOW +HIGH +BACK -ROUND|,
   IH1=|-CONS +VOCAL -LOW +HIGH +BACK -ROUND 1STRESS|,
   IH2=|-CONS +VOCAL -LOW +HIGH +BACK -ROUND 2STRESS|,
   IH3=|-CONS +VOCAL -LOW +HIGH +BACK -ROUND 3STRESS|,
   ER =|-CONS +VOCAL -LOW -HIGH +BACK -ROUND +RETROF|,
   ER1=|-CONS +VOCAL -LOW -HIGH +BACK -ROUND +RETROF 1STRESS|,
   ER2=|-CONS +VOCAL -LOW -HIGH +BACK -ROUND +RETROF 2STRESS|,
   ER3=|-CONS +VOCAL -LOW -HIGH +BACK -ROUND +RETROF 3STRESS|,
   EH =|-CONS +VOCAL -LOW -HIGH +BACK -ROUND|,
   EH1=|-CONS +VOCAL -LOW -HIGH +BACK -ROUND 1STRESS|,
   EH2=|-CONS +VOCAL -LOW -HIGH +BACK -ROUND 2STRESS|,
   EH3=|-CONS +VOCAL -LOW -HIGH +BACK -ROUND 3STRESS|,
   UH =|-CONS +VOCAL +LOW -HIGH +BACK -ROUND|,
   UH1=|-CONS +VOCAL +LOW -HIGH +BACK -ROUND 1STRESS|,
   UH2=|-CONS +VOCAL +LOW -HIGH +BACK -ROUND 2STRESS|,
   UH3=|-CONS +VOCAL +LOW -HIGH +BACK -ROUND 3STRESS|,
   U  =|-CONS +VOCAL -LOW +HIGH +BACK +ROUND +TENSE|,
   U1 =|-CONS +VOCAL -LOW +HIGH +BACK +ROUND +TENSE 1STRESS|,
   U2 =|-CONS +VOCAL -LOW +HIGH +BACK +ROUND +TENSE 2STRESS|,
   U3 =|-CONS +VOCAL -LOW +HIGH +BACK +ROUND +TENSE 3STRESS|,
   UU =|-CONS +VOCAL -LOW +HIGH +BACK +ROUND -TENSE|,
   UU1=|-CONS +VOCAL -LOW +HIGH +BACK +ROUND -TENSE 1STRESS|,
   UU2=|-CONS +VOCAL -LOW +HIGH +BACK +ROUND -TENSE 2STRESS|,
   UU3=|-CONS +VOCAL -LOW +HIGH +BACK +ROUND -TENSE 3STRESS|,
   O  =|-CONS +VOCAL -LOW -HIGH +BACK +ROUND +TENSE|,
   O1 =|-CONS +VOCAL -LOW -HIGH +BACK +ROUND +TENSE 1STRESS|,
   O2 =|-CONS +VOCAL -LOW -HIGH +BACK +ROUND +TENSE 2STRESS|,
   O3 =|-CONS +VOCAL -LOW -HIGH +BACK +ROUND +TENSE 3STRESS|,
```

```
   OC =|-CONS +VOCAL -LOW -HIGH +BACK +ROUND -TENSE|,
   OO1=|-CONS +VOCAL -LOW -HIGH +BACK +ROUND -TENSE 1STRESS|,
   OO2=|-CONS +VOCAL -LOW -HIGH +BACK +ROUND -TENSE 2STRESS|,
   OO3=|-CONS +VOCAL -LOW -HIGH +BACK +ROUND -TENSE 3STRESS|,
   A  =|-CONS +VOCAL +LOW -HIGH +BACK +ROUND|,
   A1 =|-CONS +VOCAL +LOW -HIGH +BACK +ROUND 1STRESS|,
   A2 =|-CONS +VOCAL +LOW -HIGH +BACK +ROUND 2STRESS|,
   A3 =|-CONS +VOCAL +LOW -HIGH +BACK +ROUND 3STRESS|,
       SCHWA=EH | IH,
   RUH=|+CONS +VOCAL +SON +CONT -ANT +COR +VOICE -STRID -LOW -BACK
                                                    -ROUND|,

PHONUNIT
   P=P, T=T, K=K, B=B, D=D, G=G, M=M, N=N, NG=NG,
   VV=VV, F=F, THV=THV, THU=THU, Z=Z, S=S, ZH=ZH, SH=SH, CH=CH, JH=JH,
   I=I, II=II, E=E, EE=EE, AE=AE, ER=ER, EH=EH, UH=UH, U=U, UU=UU,
    O=O, OO=OO,  A=A, W=W, Y=Y, R=R, L=L, IH=IH, IR=IR,
   SCHWA= |-CONS +VOCAL -LOW +BACK -ROUND|,
  "ALVEOLAR FLAPS"
   TAF=|+CONS -VOCAL +SON +CONT +ANT +COR -VOICE -STRID|,
   DAF=|+CONS -VOCAL +SON +CONT +ANT +COR +VOICE -STRID|,
  "GLOTTAL STOP"
   GS =|-CONS -VOCAL -SON -CONT -ANT -COR -VOICE -STRID +GLOTTAL|,
  "SYLLABICS"
   MS =|+CONS +VOCAL +SON -CONT +ANT -COR +VOICE -STRID +NASAL|,
   NS =|+CONS +VOCAL +SON -CONT +ANT +COR +VOICE -STRID +NASAL|,
   NGS=|+CONS +VOCAL +SON -CONT -ANT -COR +VOICE -STRID +NASAL|,
   "SYLLABIC PALATO-ALVEOLAR [N]"
   NPAS=|+CONS +VOCAL +SON -CONT -ANT +COR +VOICE -STRID +NASAL|,
  "DEVOICED [R]"
   RDV=|+CONS +VOCAL +SON +CONT -ANT +COR -VOICE -STRID|,
  "DARK [L]"
   DL =|+CONS +VOCAL +SON +CONT -ANT -COR +VOICE -STRID|.

   #=MB,
   +=SB.
 DIACRITIC
  >=|+NASAL|,
  /1/=|1STRESS|,
  /2/=|2STRESS|,
  /3/=|3STRESS|,
  /4/=|4STRESS|.

 $END

TRANSFORMATIONS
 IMPLICIT AACC.

"VOWEL REDUCTION"
 RULE 1 REDVOW.
  |-CONS +VOCAL (ALPHA)STRESS| => |-LOW -ROUND +BACK -TENSE|/
    <% _ ('1'NV ('BND ('BND)), 'BND ('BND) '0'NV)
      '|-CONS +VOCAL (BETA)STRESS|' %, WHERE ALPHA > BETA>.
```

```
"SCHWA DELETION"
 TRANS 2 SCHWDA.
  SD % 'MB '1'NV1 1'|-CONS +VOCAL -LOW +BACK -ROUND (GAMMA)STRESS|
     2('|+SON|) 3('SB) '|+SON| 4(('SB)('MB))
     '|-CONS +VOCAL (BETA)STRFSS| %, WHERE BETA < GAMMA.
  SC FRASE 1, FRASE 2, ,
     IF <NNUL 3> THEN <ERASE 3> ELSE <ERASE 4>.
 TRANS SCHWDB.
  SD % '|-CONS +VOCAL (ALPHA)STRESS| '1'NV1
     1'|-CONS +VOCAL -LOW +BACK -ROUND (GAMMA)STRESS| 2('|*SON|)
     3('SB) '|+SON| (4('SB) 5('MB)) '|-CONS +VOCAL (BETA)STRESS| %,
    WHERE ((ALPHA < BETA) & (BETA < GAMMA)).
  SC ERASE 1, ERASE 2,
     IF <NNUL 3> THEN <ERASE 3> ELSE <ERASE 4, ERASE 5>

"<-ING>"
 TRANS 3 ING.
  SD % *<% 'BND 1'|-CONS +VOCAL +HIGH -BACK|
                2'|+CONS -VOCAL +NASAL -ANT| 'MB> %.
  SC |+ANT +COR| MERGEF 2,
     |-ROUND -LOW +BACK| MERGEF 1.

"SYLLABICIZING"
 TRANS 4 SYLLAB.
  SD % 'C '0'BND 1'|-CONS +VOCAL -LOW +BACK -ROUND (ALPHA)STRESS|
       2'|+SON| %, WHERE ALPHA > 1.
  SC ERASE 1,
     |+VOCAL -LOW -BACK -ROUND (ALPHA)STRESS| MERGEF 2,
     IF <2 INC1 |+CONS +VOCAL +SON +CONT -ANT|>
       THEN <|+RETROF| MERGEF 2>.

"RUH-REDUCTION"
 TRANS 5 RUHRED.
  SD % 7* 8* ('|-CONS +VOCAL 1STRESS| '0'NV2 2'|+SON| (3'BND 4('BND)
     1'SCHWA, 2'|+SON| (3'BND 4('BND)) 1'SCHWA '0'NV2
     '|-CONS +VOCAL 1STRESS|) %, WHERE 7 NINC1 |+MORBND| |
                                       8 NINC1 |+MORBND|.
  SC |*VOCAL *LOW *BACK *ROUND *STRESS| MOVEF 1 2,
     FRASE 1, ERASE 3, ERASE 4,
     IF <2 INC1 |+CONS +VOCAL +SON +CONT -ANT|>
       THEN <|+RETROF| MERGEF 2>.

"RUH-LESSNESS"
"MUST FOLLOW RUH-RED"
 RULE 6 RUHLESS.
  RUH => |-CONS +BACK -RETROF|/
         'CON ('SB) ('MB) _, (ALPHA)STRESS| ('SB) ('MB) 'CON %,
     WHERE ALPHA > 1>.

"NASALIZED VOWELS"
 RULE 7 NASVOW.
  V => |+NASAL|/<% _ '0'BND '|+CONS -VOCAL +NASAL| %>.
```

```
"INTRODUCTION OF TRANSITIONAL STOPS"
 TRANS 19 TRANSTOP.
  SD % 1'|+CONS +NASAL (NU)ANT (MU)COR| ('SB) ('MB)
       '|-SON (BETA)VOICE (EPSI)ANT (LAMBDA)COR (ALPHA)CONT| %,
     WHERE (ALPHA><-) | (NU><EPSI) | (MU><LAMBDA).
  SC ('|+CONS -VOCAL -SON -CONT (NU)ANT (MU)COR (BETA)VOICE -STRID|)
     ADRIS 1.
"PALATALIZATION"
 TRANS 14 PALAT1.
  SD % 1'|-SON -CONT +ANT +COR| '0'BND
       3'|-CONS -VOCAL -BACK| '|-CONS +VOCAL (ALPHA)STRESS|%,
     WHERE ALPHA > 1.
  SC |-ANT +STRID| MERGEF 1,
     1 ALFSE 3.
 RULE 15 PALAT2.
   Y => */<% '|-SON -ANT +COR| _ %>.
 TRANS 16 PALAT3.
  SD % 1('|-SON +ANT +COR +STRID|, '|-SON -CONT +ANT +COR|)
       '1'BND '|-ANT +COR +STRID| %.
  SC |-ANT +STRID| MERGEF 1.

"ALVEOLAR FLAPPING"
 TRANS 12 ALFLAP.
  SD % '|-CONS +VOCAL (ALPHA)STRESS|
     (('|+SON +CONT -ANT|, '|+SON -CONT +COR|)) '0'BND
     1'|-SON -CONT +ANT +COR| '0'BND
     2(*) '|-CONS +VOCAL (BETA)STRESS| %,
   WHERE ¬(ALPHA > BETA) & (BETA > 1) & (NUL 2 | 1 EQ 2).
  SC |+SON +CONT| MERGEF
     IF <NNUL 2> THEN <|+SON +CONT| MERGEF 2>.

"GLOTTAL STOP FORMATION"
 RULE 13 GLOT.
  T => |-CONS -ANT -COR +GLOTTAL|/<% _ ('MB 'MB, 'BND 'C,
                        '|+VOCAL +ANT +COR +SON -STRID +VOICE|) %>.

"DENTAL DELETION"
 TRANS 9 DENDELD.
  SD % 'V '0'NV '|+SON +ANT +COR| ('SB) 1'D (3'BND 4('BND)) 2'NV %,
     WHERE ((NNUL 3) | ((2 NINC1 |+SON +CONT -ANT|) &
                        (2 NINC1 |-LOW +BACK|))).
  SC ERASE 1.
 TRANS DENDELT1.
  SD % 'V '0'NV '|-SON| ('SB) 1'T (3'BND 4('BND)) 2'NV %,
     WHERE ((NNUL 3) | ((2 NINC1 |+SON +CONT -ANT|) &
                        (2 NINC1 |-LOW +BACK|))).
  SC ERASE 1.
 "RULE 10 DENDELT2."
  "APPEARS TO BE A SUBSET OF ALFLAP AND ASSIMULATION"
  "T => */<% '|-CONS +VOCAL (ALPHA)STRESS| '|+COR +NASAL| ('SB)"
  "          _ ('BND ('BND)) '|-CONS +VOCAL (BETA)STRESS|%,"
  "     WHERE ALPHA < BETA>."
 RULE 11 DENDELT3.
  T => */<% '|+COR +NASAL| _ ('MB ('MB)) '|+COR +NASAL| %>.
```

```
"REGRESSIVE ASSIMILATICN"
 RULE 17 REGVOICE.
   |+CONS -VOCAL (BETA)VOICE| => |(ALPHA)VOICE|/
      <% _ '0'BND '|+CONS -VOCAL (ALPHA)VOICE| %,
    WHERE ALPHA >< BETA>.
 TRANS REGARTIC.
  SD % 1'|+CONS (MU)ANT (NU)COR +NASAL| '0'BND
        '|+CONS -VOCAL (ALPHA)ANT (BETA)COR| %,
      WHERE (ALPHA >< MU) | (BETA >< NU).
  SC |(ALPHA)ANT (BETA)COR| MERGEF 1.

"PROGRESSIVE ASSIMILATION"
 RULE 18 PROVOICE.
  |+CONS -VOCAL (BETA)VOICE| => |(ALPHA)VOICE|/
      <% '|+CONS -VOCAL (ALPHA)VOICE| '0'BND _ %,
    WHERE ALPHA >< BETA>.
 TRANS PROARTIC.
  SD % '|+CONS -VOCAL (ALPHA)ANT (BETA)COR| '0'BND
       1'|+CONS +NASAL (MU)ANT (NU)COR| %,
     WHERE (ALPHA >< MU) | (BETA >< NU).
  SC |(ALPHA)ANT (BETA)COR| MERGEF 1.

"GEMINATE REDUCTION"
 TRANS 20 GEMRED.
  SD % 1'C (5'BND 6('BND)) 2* %, WHERE 1 EQ 2.
  SC FRASE 1, |+LONG| MERGEF 2,
     IF <NNUL 5> THEN <('|+SYLBND|) SUBSE 5, ERASE 6>

"NASAL REDUCTION"
 RULE 8 NASRED.
  |+CONS -VOCAL +NASAL| => */
     <% '|-CONS +VOCAL +NASAL| _ '0'BND 'NV %>.

"DARK [L]"
 RULE 21 DARKL.
  L => |-ANT -COR|/<% _ ('C) 'MB %>.

"[R]-FLAPPING"
 RULE 22 RFLAP.
  R => |-VOCAL +ANT|/<% 'MB 'MB 'THU _ %>.

"[F]-DEVOICING"
 RULE 23 RDEVOICE.
  F => |-VOICE|/<% ('SB, 'BND 'BND) 'T _ %>.

CP I.
$ENDTRA $MAIN FTRIN TRAN.
```

```
    "THE PRIME EXAMPLES FROM NEU"
    "WANT TO GO:"    S<'MB V<'MB 'W 'A1 'N 'T 'MB> P<'MB 'T 'U2 'MB>
                         V<'MB 'G 'O1 'MB> 'MB>.
TREE READ BY FTRTN
 1 S          2 #
              3 V          4 #
                           5 W
                           6 A/1/
                           7 N
                           8 T
                           9 #
             10 P         11 #
                          12 T
                          13 U/2/
                          14 #
             15 V         16 #
                          17 G
                          18 O/1/
                          19 #
             20 #

          # # W A/1/ N T # # T U/2/ # # G O/1/ # #
*****      TRANSFORMATICNS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR     1"REDVOW   "(AACC)     ,SD=   2. RES=   6. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      13
ANTEST CALLED FOR     8"NASVOW   "(AACC)     ,SD=   9. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       6
ANTEST CALLED FOR    13"ALFLAP   "(AACC)     ,SD=  14. RES=  18. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       8
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      12
ANTEST CALLED FOR    18"REGVOICE"(AACC)     ,SD=  19. RES=  22. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       7
ANTEST CALLED FOR    22"GEMRED   "(AACC)     ,SD=  23. RES=  26. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE       0      8
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      12
CHANGE. CALL ELEMOP FOR  SUBSE      21      9
CHANGE. CALL ELEMOP FOR  ERASE       0      11
ANTEST CALLED FOR    23"NASRED   "(AACC)     ,SD=  24. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE       0      7
SCAN CALLED AT      2      .

TRANSFORMATIONS WHICH HAVE APPLIED ARE
                1          1   REDVOW
                2          8   NASVOW
                3         13   ALFLAP
                4         18   REGVOICE
                5         22   GEMRED
                6         23   NASRED
```

```
TREE READ BY FTRIN
 1 S          2 #
              3 V          4 #
                           5 W
                           6 A>/1/
                          21 +
             10 P         12 TAF
                          13 IH/2/
                          14 #
             15 V         16 #
                          17 G
                          18 O/1/
                          19 #
             20 #

        # # W A>/1/ + TAF IH/2/ # # G O/1/ # #


12 TAF    |+LONG|
13 IH/2/  |-TENSE|
```

```
   "PFOFUSICN:"      S<'MB N<'MB 'P 'R 'O2 'SB 'F 'Y 'U1 'SB
                              'ZH 'EH3 'N 'MB> 'MB>.
TREE READ BY FTRIN
 1 S           2 #
               3 N            4 #
                              5 P
                              6 R
                              7 O/2/
                              8 +
                              9 F
                             10 Y
                             11 U/1/
                             12 +
                             13 ZH
                             14 EH/3/
                             15 N
                             16 #
              17 #

          # # P R O/2/ + F Y U/1/ + ZH EH/3/ N # #

*****      TRANSFORMATICNS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR     1"REDVOW  "(AACC)      ,SD=   2. RES=   6. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN        7
ANTEST CALLED FOR     5"SYLLAB  "(AACC)      ,SD=   6. RES=  11. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE         0     14
CHANGE. HAVE CSEXCH FOR  MERGEF    IN        15
ANTEST CALLED FOR     6"RUHRFD  "(AACC)      ,SD=   7. RES=  13. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MOVEF     IN        6
CHANGE. CALL ELEMOP FOR  ERASE         0     7
CHANGE. HAVE CSEXCH FOR  MERGEF    IN        6
ANTEST CALLED FOR    21"PROARTIC"(AACC),      SD=  22. RES=  25. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN        15
SCAN CALLED AT      2

TRANSFORMATICNS WHICH HAVE APPLIED ARE
               1          1  REDVOW
               2          5  SYLLAB
               3          6  RUHRED
               4         21  PROARTIC
```

```
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 P
                           6 R/2/
                           8 +
                           9 F
                          10 Y
                          11 U/1/
                          12 +
                          13 ZH
                          15 NPAS/3/
                          16 #
             17 #

        # # P R/2/ + F Y U/1/ + ZH NPAS/3/ # #


 6 R/2/     |-LOW +BACK -ROUND +RETROF|
15 NPAS/3/  |-LOW -BACK -ROUND|
```

```
   "GOVERNOR:"        S<'MB N<'MB 'G 'UH1 'VV 'SB 'EH3 'R 'SB
                               'N 'MB 'EH2 'R 'MB> 'MB>.
 TREE READ BY FTRIN
  1 S         2 #
              3 N         4 #
                          5 G
                          6 UH/1/
                          7 VV
                          8 +
                          9 EH/3/
                         10 R
                         11 +
                         12 N
                         13 #
                         14 EH/2/
                         15 R
                         16 #
             17 #

         # # G UH/1/ VV + EH/3/ R + N # EH/2/ R # #

*****     TRANSFORMATIONS     *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR    1"REDVOW  "(AACC)    ,SD=  2. RES=  6. TOP=   1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR MERGEF   IN      9
ANTEST CALLED FOR    3"SCHWDB  "(AACC)    ,SD=  4. RES=  9. TOP=   1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE      0    9
CHANGE. CALL ELEMOP FOR  ERASE      0   10
CHANGE. CALL ELEMOP FOR  ERASE      0   11
ANTEST CALLED FOR    5"SYLLAB  "(AACC)    ,SD=  6. RES= 11. TOP=   1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE      0   14
CHANGE. HAVE CSEXCH FOR  MERGEF   IN     15
CHANGE. HAVE CSEXCH FOR  MERGEF   IN     15
ANTEST CALLED FOR   21"PROARTIC"(AACC)    ,SD= 22. RES= 25. TOP=   1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN     12
SCAN CALLED AT      2

TRANSFORMATIONS WHICH HAVE APPLIED ARE
            1          1  REDVOW
            2          3  SCHWDB
            3          5  SYLLAB
            4         21  PROARTIC
```

```
TREE PEAD BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 G
                           6 UH/1/
                           7 VV
                           8 +
                          12 M
                          13 #
                          15 R/2/
                          16 #
             17 #

        # # G UH/1/ VV + M # R/2/ # #


15 R/2/ |-LOW -BACK -ROUND +RETFOF|
```

```
   "CAPTAIN:"        S<'MB N<'MB 'K 'AE1 'P 'SB 'T 'EH2 'N 'MB> 'MB>.
TREE PEAD BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 K
                           6 AE/1/
                           7 P
                           8 +
                           9 I
                          10 EH/2/
                          11 N
                          12 #
             13 #

         # # K AE/1/ P + T EH/2/ N # #

*****     TRANSFORMATICNS     *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR    5"SYLLAB  "(AACC)     ,SD=  6. RES= 11. TOP,   1:S
ANTEST RFTURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE        0    10
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      11
ANTEST CALLED FOR   14"GLOT     "(AACC)     ,SD= 15. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       9
SCAN CALLED AT      2

TRANSFORMATICNS  WHICH  HAVF  APPLIED  ARE
              1           5   SYILAB
              2          14   GLOT

 TREE READ BY FTRIN
  1 S          2 #
               3 N          4 #
                            5 K
                            6 AE/1/
                            7 P
                            8 +
                            9 GS
                           11 NS/2/
                           12 #
              13 #

          # # K AE/1/ P + GS NS/2/ # #


 11 NS/2/ |-LOW -BACK -ROUND|
```

```
          S<'MB N<'MB 'F 'EE1 'D 'SB 'EH3 'R 'SB 'EH2 'L
                'MB> 'MB>.
 FTRIN
    2 #
    3 N          4 #
                 5 F
                 6 EE/1/
                 7 D
                 8 +
                 9 EH/3/
                10 R
                11 +
                12 EH/2/
                13 L
                14 #
    5 #.

  EE/1/ D + EH/3/ R + EH/2/ L # #
 SFORMATIONS      *****
        1      I
 FOR     1"REDVOW   "(AACC)      ,SD=   2. RES=   6. TOP=    1:S
 ** 1**
  EXCH FOR  MERGEF    IN       9
 FOR     3"SCHWDB   "(AACC)      ,SD=   4. RES=   9. TOP=    1:S
 ** 1**
  ELEMOP FOR  ERASE        0     9
  ELEMOP FOR  ERASE        0    11
 FOR     5"SYLLAB   "(AACC)       ,SD=   6. RES= 11. TOP=    1:S
 ** 1**
 LEMOP FOR  ERASE        0    12
 EXCH FOR  MERGEF    IN       13
 OR     24"DARKL   "(AACC)       ,SD= 25. RES=   0. TOP=    1:S
 ** 1**
 EXCH FOR  MERGEF    IN       13
      2
 S WHICH HAVE APPLIED ARE
    1          1   REDVOW
    2          3   SCHWDB
    3          5   SYLLAB
    4         24   DARKL
 FTRIN
    2 #
    3 N          4 #
                 5 F
                 6 EE/1/
                 7 D
                 8 +
                10 R
                13 DL/2/
                14 #
 5 #

 EE/1/ D + R DL/2/ # #

 -BACK -ROUND|
```

```
    "SOME MORE WORDS FROM NFU"
    "LEFT TO:"          S<'MB ADJ<'MB 'L 'EE1 'F 'T 'MB> PREP<'MB 'T 'U2
                                'MB> 'MB>.
 TREE READ BY FTRIN
  1 S           2 #
                3 ADJ          4 #
                               5 L
                               6 EE/1/
                               7 F
                               8 T
                               9 #
               10 PREP        11 #
                              12 T
                              13 U/2/
                              14 #
               15 #

          # # L EE/1/ F T # # T U/2/ # #

*****      TRANSFORMATIONS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR    14"GLOT     "(AACC)      ,SD= 15.  RES=   0.  TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN        8
SCAN CALLED AT      2

TRANSFORMATIONS WHICH HAVE APPLIED ARE
              1          14  GLCT

 TREE READ BY FTRIN
  1 S           2 #
                3 ADJ          4 #
                               5 L
                               6 EE/1/
                               7 F
                               8 GS
                               9 #
               10 PREP        11 #
                              12 T
                              13 U/2/
                              14 #
               15 #

          # # L EE/1/ F GS # # T U/2/ # #
```

```
   "REFERENCES:"     S<'MB N<'MB 'R 'EE1 'F 'SB 'EH3 'R 'SB 'EH2 'N
                          'SB 'S 'MB 'EH3 'Z 'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 R
                           6 EE/1/
                           7 F
                           8 +
                           9 EH/3/
                          10 R
                          11 +
                          12 EH/2/
                          13 N
                          14 +
                          15 S
                          16 #
                          17 EH/3/
                          18 Z
                          19 #
            20 #

        # # R EE/1/ F + EH/3/ R + EH/2/ N + S # EH/3/ Z # #

*****     TRANSFORMATIONS     *****
SCAN CALLED AT      1     I
ANTEST CALLED FOR     1"REDVOW  "(AACC)     ,SD=  2. RES=  6. TOP=    1:S
ANTEST RETURNS ** 2**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      9
ANTEST CALLED FOR     3"SCHWDB  "(AACC)     ,SD=  4. RES=  9. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE       0     9
CHANGE. CALL ELEMOP FOR  ERASE       0    11
ANTEST CALLED FOR     5"SYLLAB  "(AACC)     ,SD=  6. RES= 11. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE       0    12
CHANGE. HAVE CSEXCH FOR  MERGEF   IN     13
ANTEST CALLED FOR     9"TRANSTOP"(AACC)     ,SD= 10. RES= 16. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ADRIS      21    13
ANTEST CALLED FOR    14"GLOT    "(AACC)     ,SD= 15. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN     22
SCAN CALLED AT      2

TRANSFORMATIONS WHICH HAVE APPLIED ARE
              1         1  REDVOW
              2         3  SCHWDB
              3         5  SYLLAB
              4         9  TRANSTOP
              5        14  GLOT
```

```
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 R
                           6 EE/1/
                           7 F
                           8 +
                          10 R
                          13 NS/2/
                          22 GS
                          14 +
                          15 S
                          16 #
                          17 EH/3/
                          18 Z
                          19 #
             20 #

        # # R EE/1/ F + R NS/2/ GS + S # EH/3/ Z # #


13 NS/2/ |-LCW -BACK -ROUND|
```

```
   "CHOCOLATE:"      S<'MB N<'MB 'CH 'A1 'K 'SB 'O3 'SB 'L 'EH2 'T
                                'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 CH
                           6 A/1/
                           7 K
                           8 +
                           9 O/3/
                          10 +
                          11 L
                          12 EH/2/
                          13 T
                          14 #
             15 #

         # # CH A/1/ K + O/3/ + L EH/2/ T # #

*****      TRANSFORMATIONS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR     1"REDVOW   "(AACC)      ,SD=    2. RES=   6. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CS'EXCH FOR  MERGEF    IN       9
ANTEST CALLED FOR     3"SCHWDB   "(AACC)      ,SD=    4. RES=   9. TOP=    1:S
ANTEST RETURNS ** 2**
CHANGE. CALL ELEMOP FOR  ERASE        0     9
CHANGE. CALL ELEMOP FOR  ERASE        0    10
CHANGE. CALL ELEMOP FOR  ERASE        0     9
WARNING. ELEMOP.  TRYING TO ERASE NONEXISTENT NODE.  NODE =      9
CHANGE. CALL ELEMOP FOR  ERASE        0    10
WARNING. ELEMOP.  TRYING TO ERASE NONEXISTENT NODE.  NODE =     10
ANTEST CALLED FOR     6"RUHRED   "(AACC)      ,SD=    7. RES=  13. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MOVEF     IN      11
CHANGE. CALL ELEMOP FOR  ERASE        0    12
ANTEST CALLED FOR    14"GLOT     "(AACC)      ,SD=   15. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      13
SCAN CALLED AT      2      .

TRANSFORMATIONS WHICH HAVE APPLIED ARE
              1.          1  REDVOW
              2           3  SCHWDB
              3           6  RUHRED
              4          14  GLCT
```

```
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 CH
                           6 A/1/
                           7 K
                           8 +
                          11 L/2/
                          13 GS
                          14 #
             15 #

        # # CH A/1/ K + L/2/ GS # #


11 L/2/ |-LOW +BACK -ROUND|
```

```
   "DIARY:"          S<'MB N<'MB 'D '001 'Y 'SB 'EH3 'SB 'R 'I2 'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 D
                           6 CC/1/
                           7 Y
                           8 +
                           9 EH/3/
                          10 +
                          11 R
                          12 I/2/
                          13 #
             14 #

         # # D 00/1/ Y + EH/3/ + R I/2/ # #

*****     TRANSFORMATIONS     *****
SCAN CALLED AT     1     I
ANTEST CALLED FOR    1"REDVOW  "(AACC)     ,SD=   2. RES=   6. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN       9
ANTEST CALLED FOR    3"SCHWDB  "(AACC)     ,SD=   4. RES=   9. TOP=    1:S
ANTEST RETURNS ** 2**
CHANGE. CALL ELEMOP FOR  ERASE        0     9
CHANGE. CALL ELEMOP FOR  ERASE        0    10
WARNING. ELEMOP.  TRYING TO ERASE NONEXISTENT NODE.  NODE =      9
CHANGE. CALL ELEMOP FOR  ERASE        0    10
WARNING. ELEMOP.  TRYING TO ERASE NONEXISTENT NODE.  NODE =     10
SCAN CALLED AT     2

TRANSFORMATIONS WHICH HAVE APPLIED ARE
             1          1  REDVOW
             2          3  SCHWDB

 TREE READ BY FTRIN
  1 S          2 #
               3 N          4 #
                            5 D
                            6 CO/1/
                            7 Y
                            8 +
                           11 R
                           12 I/2/
                           13 #
              14 #

          # # D 00/1/ Y + R I/2/ # #
```

```
   "FRONT & BACK:"  S<'MB N<'MB 'F 'R 'UH1 'N 'T 'MB> C<'MB 'AE2 'N 'D 'MB>
                        N<'MB 'B 'AE1 'K 'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 F
                           6 R
                           7 UH/1/
                           8 N
                           9 T
                          10 #
             11 C         12 #
                          13 AE/2/
                          14 N
                          15 D
                          16 #
             17 N         18 #
                          19 B
                          20 AE/1/
                          21 K
                          22 #
             23 #

         # # F R UH/1/ N T # # AE/2/ N D # # B AE/1/ K # #
*****     TRANSFORMATIONS     *****
SCAN CALLED AT     1     I
ANTEST CALLED FOR    8"NASVOW  "(AACC)     ,SD=  9. RES=  0. TOP=    1:S
ANTEST RETURNS ** 2**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      7
CHANGE. HAVE CSEXCH FOR  MERGEF    IN     13
ANTEST CALLED FOR   13"ALFLAP  "(AACC)     ,SD= 14. RES= 18. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      9
ANTEST CALLED FOR   15"DENDELD "(AACC)     ,SD= 16. RES= 20. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE        0    15
ANTEST CALLED FOR   18"REGVOICE"(AACC)     ,SD= 19. RES= 22. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      8
ANTEST CALLED FOR   19"REGARTIC"(AACC)     ,SD= 20. RES= 23. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN     14
ANTEST CALLED FOR   23"NASRED  "(AACC)     ,SD= 24. RES=  0. TOP=    1:S
ANTEST RETURNS ** 2**
CHANGE. CALL ELEMOP FOR  ERASE        0     8
CHANGE. CALL ELEMOP FOR  ERASE        0    14
SCAN CALLED AT     2

TRANSFORMATIONS WHICH HAVE APPLIED ARE
              1          8  NASVOW
              2         13  ALFLAP
              3         15  DENDELD
              4         18  REGVOICE
              5         19  REGARTIC
              6         23  NASRED
```

```
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 F
                           6 R
                           7 UH>/1/
                           9 TAF
                          10 #
             11 C         12 #
                          13 AE>/2/
                          16 #
             17 N         18 #
                          19 B
                          20 AE/1/
                          21 K
                          22 #
             23 #

        # # F R UH>/1/ TAF # # AE>/2/ # # B AE/1/ K # #
```

```
   "SOFTEN:"        S<'MB V<'MB 'S '001 'F 'T 'SB 'MB 'EH2 'N 'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 V          4 #
                           5 S
                           6 00/1/
                           7 F
                           8 T
                           9 +
                          10 #
                          11 EH/2/
                          12 N
                          13 #
             14 #

         # # S 00/1/ F T + # EH/2/ N # #

*****     TRANSFORMATIONS     *****
SCAN CALLED AT     1     I
ANTEST CALLED FOR    5"SYLLAB  "(AACC)     ,SD=  6. RES= 11. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE       0    11
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      12
ANTEST CALLED FOR   16"DFNDEIT1"(AACC)     ,SD= 17. RES= 21. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE       0     9
ANTEST CALLED FOR   21"PROARTIC"(AACC)     ,SD= 22. RES= 25. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      12
SCAN CALLED AT     2

TRANSFORMATIONS WHICH HAVE APPLIED ARE
             1          5  SYLLAB
             2         16  DENDELT1
             3         21  PROARTIC

 TREE READ BY FTRIN
  1 S          2 #
               3 V          4 #
                            5 S
                            6 00/1/
                            7 F
                            9 +
                           10 #
                           12 MS/2/
                           13 #
              14 #

          # # S 00/1/ F + # MS/2/ # #


 12 MS/2/ |-LOW -BACK -ROUND|
```

```
   "UTTERANCE:"      S<'MB N<'MB 'UH1 'T 'SB 'EH3 'R 'SB 'MB 'EH2 'N 'S
                          'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 UH/1/
                           6 T
                           7 +
                           8 EH/3/
                           9 R
                          10 +
                          11 #
                          12 EH/2/
                          13 N
                          14 S
                          15 #
             16 #

         # # UH/1/ T + EH/3/ R + # EH/2/ N S # #

*****     TRANSPORMATICNS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR     1"REDVOW   "(AACC)       SD=   2. RES=   6. TOP=    1:S
ANTEST RETURNS ** 2**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN        8
ANTEST CALLED FOR     3"SCHWDB   "(AACC)      ,SD=   4. RES=   9. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE         0     8
CHANGE. CALL ELEMOP FOR  ERASE         0    10
CHANGE. CALL ELEMOP FOR  ERASE         0    11
ANTEST CALLED FOR     5"SYLLAB   "(AACC)      ,SD=   6. RES=  11. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE         0    12
CHANGE. HAVE CSEXCH FOR  MERGEF    IN        13
ANTEST CALLED FOR     9"TRANSTOP"(AACC)      ,SD=  10. RES=  16. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ADRIS        17     13
ANTEST CALLED FOR    14"GLOT     "(AACC)      ,SD=  15. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN         6
SCAN CALLED AT      2

TRANSFORMATICNS WHICH HAVE APPLIED ARE
              1          1  REDVOW
              2          3  SCHWDB
              3          5  SYLLAB
              4          9  TRANSTOP
              5         14  GLOT
```

```
TREE READ BY FTFIN
 1 S          2 #
              3 N          4 #
                           5 UH/1/
                           6 GS
                           7 +
                           9 R
                          13 NS/2/
                          18 I
                          14 S
                          15 #
             16 #

        # # UH/1/ GS + R NS/2/ T S # #


13 NS/2/ |-LOW -BACK -ROUND|
```

```
    "DREAMT:"          S<'MB V<'MB 'D 'R 'EE1 'M 'T 'MB> 'MB>.
TREE READ BY FTRIN
  1 S          2 #
               3 V          4 #
                            5 D
                            6 R
                            7 EE/1/
                            8 M
                            9 T
                           10 #
              11 #

          # # D R EE/1/ M*T # #

*****      TRANSFORMATIONS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR     8"NASVOW   "(AACC)      ,SD=   9. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       7
ANTEST CALLED FOR     9"TRANSTOP"(AACC)      ,SD=  10. RES=  16. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ADRIS       12     8
ANTEST CALLED FOR    14"GLOT     "(AACC)     ,SD=  15. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVF CSEXCH FOR  MERGEF    IN       9
ANTEST CALLED FOR    18"REGVOICE"(AACC)     ,SD=  19. RES=  22. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       8
ANTEST CALLED FOR    23"NASRED   "(AACC)     ,SD=  24. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE       0      8
SCAN CALLED AT      2

TRANSFORMATIONS WHICH HAVE APPLIED ARE
              1          8  NASVOW
              2          9  TRANSTOP
              3         14  GLOT
              4         18  REGVOICE
              5         23  NASRED

 TREE READ BY FTRIN
  1 S          2 #
               3 V          4 #
                            5 D
                            6 R
                            7 EF>/1/
                           13 P
                            9 GS
                           10 #
              11 #

          # # D R EE>/1/ P GS # #
```

```
   "RINGED:"          S<'MB V<'MB 'R 'II1 'NG 'MB 'D 'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 V          4 #
                           5 R
                           6 II/1/
                           7 NG
                           8 #
                           9 D
                          10 #
             11 #.

         # # R II/1/ NG # D # #

*****     TRANSFORMATIONS     *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR     8"NASVOW  "(AACC)     ,SD=  9. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN       6
ANTEST CALLED FOR     9"TRANSTOP"(AACC)     ,SD= 10. RES= 10. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ADRIS       12     7
ANTEST CALLED FOR    23"NASRED  "(AACC)     ,SD= 24. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE        0     7
SCAN CALLED AT      2,

TRANSFORMATIONS WHICH HAVE APPLIED ARE
              1          8  NASVOW
              2          9  TRANSTOP
              3         23  NASRED

 TREE READ BY FTRIN
  1 S          2 #
               3 V          4 #
                            5 R
                            6 II>/1/
                           13 G
                            8 #
                            9 D
                           10 #
              11 #

          # # R II>/1/ G # D # #
```

```
          S<'MB V<'MB 'D 'II1 'D 'MB> PRON<'MB 'Y 'U2 'MB> 'MB>.
 ETRIN
   #
   V          4 #
              5 D
              6 II/1/
              7 D
              8 #
   PRON      10 #
             11 Y
             12 U/2/
             13 #
  #

 II/1/ D # # Y U/2/ # #

 FORMATICNS      *****
       1      I
 OR    10"PALAT1  "(AACC)     ,SD= 11. RES= 17. TOP=    1:S
 ** 1**
 EXCH FOR  MERGEF    IN        7
 EMOP FOR  ALESE         7    11
 OR    11"PALAT2  "(AACC)     ,SD= 12. RES=  0. TOP=    1:S
 ** 1**
 EMOP FOR  ERASE         0    11
       2

 WHICH HAVE APPLIED ARE
          10  PALAT1
          11  PALAT2

 TRIN
   #
   V          4 #
              5 D
              6 II/1/
              8 #
   PRON.     10 #
              7 JH
             12 U/2/
             13 #
  #

 II/1/ # # JH U/2/ # #
```

```
   "FAT YOUR:"      S<'MB V<'MB 'I1 'T 'MB> POSS<'MB 'Y 'EH2 'R 'MB> 'MB>
TREE READ BY FTRIN
 1 S          2 #
              3 V          4 #
                           5 I/1/
                           6 T
                           7 #
              8 POSS       9 #
                          10 Y
                          11 EH/2/
                          12 R
                          13 #
             14 #

         # # I/1/ T # # Y EH/2/ R # #

*****     TRANSFORMATIONS     *****
SCAN CALLED AT     1     I
ANTEST CALLED FOR   10"PALAT1  "(AACC)     ,SD= 11. RES= 17. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN       6
CHANGE. CALL ELEMOP FOR  ALESE        6    10
ANTEST CALLED FOR   11"PALAT2  "(AACC)     ,SD= 12. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE        0    10
SCAN CALLED AT     2
TRANSFORMATICNS.WHICH HAVE APPLIED ARE
              1         10  PALAT1
              2         11  PALAT2

 TREE READ BY FTRIN
  1 S          2 #
               3 V          4 #
                            5 I/1/
                            7 #
               8 POSS       9 #
                            6 CH
                           11 EH/2/
                           12 R
                           13 #
              14 #

          # # I/1/ # # CH EH/2/ R # #
```

```
   "SAMPLES:"        S<'MB N<'MB 'S 'AE1 'M 'SB 'P 'EH2 'L 'MB 'Z
                          'MB> 'MB>.
TREE READ BY FTRIN
  1 S          2 #
               3 N          4 #
                            5 S
                            6 AE/1/
                            7 M
                            8 +
                            9 P
                           10 EH/2/
                           11 L
                           12 #
                           13 Z
                           14 #
             15 #

          # # S AE/1/ M + P EH/2/ L # Z # #

*****      TRANSFORMATIONS      *****
SCAN, CALLED AT      1      I
ANTEST CALLED FOR     5"SYLLAB  "(AACC)      ,SD=   6. RES= 11. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE         0     10
CHANGE. HAVE CSEXCH FOR  MERGEF    IN        11
ANTEST CALLED FOR     8"NASVOW  "(AACC)      ,SD=   9. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN         6
ANTEST CALLED FOR    18"REGVOICE"(AACC)      ,SD=  19. RES= 22. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN         7
ANTEST CALLED FOR    23"NASRED  "(AACC)      ,SD=  24. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE         0      7
ANTEST CALLED FOR    24"DARKL   "(AACC)      ,SD=  25. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN        11
SCAN CALLED AT       2

TRANSFORMATIONS WHICH HAVE APPLIED ARE
                1          5  SYLLAB
                2          8  NASVOW
                3         18  REGVOICE
                4         23  NASRED
                5         24  DARKL
```

```
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 S
                           6 AE>/1/
                           8 +
                           9 P
                          11 DL/2/
                          12 #
                          13 Z
                          14 #
             15 #

        # # S AE>/1/ + P DL/2/ # Z # #


11 DL/2/ |-LOW -BACK -POUND|
```

```
   "SUDDENLY:"       S<'MB N<'MB 'S 'UH1 'D 'SB 'EH3 'N 'SB 'MB 'L 'I2
                          'MB> 'MB>.
TRFE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 S
                           6 UH/1/
                           7 D
                           8 +
                           9 EH/3/
                          10 N
                          11 +
                          12 #
                          13 L
                          14 I/2/
                          15 #
             16 #

         # # S UH/1/ D + EH/3/ N + # L I/2/ # #

*****      TRANSFORMATIONS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR     5"SYLLAB   "(AACC)      ,SD=   6. RES= 11. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE         0     9
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       10
SCAN CALLED AT      2

TRANSFORMATICNS WHICH HAVE APPLIED ARE
              1          5  SYLLAB

 TREE READ BY FTRIN
  1 S          2 #
               3 N          4 #
                            5 S
                            6 UH/1/
                            7 E
                            8
                           10 NS/3/
                           11 +
                           12 #
                           13 L
                           14 I/2/
                           15 #
              16 #

          # # S UH/1/ D + NS/3/ + # L I/2/ # #


 10 NS/3/ |-LOW -BACK -ROUND|
```

```
   "CAMPING:"        S<'MB V<'MB 'K 'AE1 'M 'SB 'P 'MB 'II2 'NG 'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 V          4 #
                           5 K
                           6 AE/1/
                           7 M
                           8 +
                           9 P
                          10 #
                          11 II/2/
                          12 NG
                          13 #
             14 #

         # # K AE/1/ M + P # II/2/ NG # #

*****     TRANSFORMATIONS     *****
SCAN CALLED AT     1     I
ANTEST CALLED FOR    4"ING     "(AACC)     ,SD=   5. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      12
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      11
ANTEST CALLED FOR    5"SYLLAB  "(AACC)     ,SD=   6. RES= 11. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE        0    11
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      12
ANTEST CALLED FOR    8"NASVOW  "(AACC)     ,SD=   9. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      6
ANTEST CALLED FOR   18"REGVOICE"(AACC)     ,SD= 19. RES= 22. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      7
ANTEST CALLED FOR   21"PROARTIC"(AACC)     ,SD= 22. RES= 25. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN     12
ANTEST CALLED FOR   23"NASRED  "(AACC)     ,SD= 24. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE           7
SCAN CALLED AT     2     .

TRANSFORMATIONS WHICH HAVE APPLIED ARE
              1         4  ING
              2         5  SYLLAB
              3         8  NASVOW
              4        18  REGVOICE
              5        21  PROARTIC
              6        23  NASRED
```

```
TREE READ BY FTRIN
 1 S          2 #
              3 V          4  #
                           5  K
                           6  AE>/1/
                           8  +
                           9  P
                          10  #
                          12  MS/2/
                          13  #
             14  #

        # # K AE>/1/ + P # MS/2/ # #


12 MS/2/ |-LOW -BACK -ROUND|
```

```
   "KANGAROO:"      S<'MB N<'MB 'K 'AE1 'NG 'SB 'G 'EH3 'SB 'R 'U2
    "STRESS VARIANT"          'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 K
                           6 AE/1/
                           7 NG
                           8 +
                           9 G
                          10 EH/3/
                          11 +
                          12 R
                          13 U/2/
                          14 #
             15 #

         # # K AE/1/ NG + G EH/3/ + R U/2/ # #
*****     TRANSFORMATIONS     *****
SCAN CALLED AT     1     I
ANTEST CALLED FOR    1"REDVOW  "(AACC)     ,SD=  2. RES=  6. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      10
ANTEST CALLED FOR    3"SCHWDB  "(AACC)     ,SD=  4. RES=  9. TOP=    1:S
ANTEST RETURNS ** 2**
CHANGE. CALL ELEMOP FOR  ERASE       0    10
CHANGE. CALL ELEMOP FOR  ERASE       0    11
CHANGE. CALL ELEMOP FOR  ERASE       0    10
WARNING. ELEMOP.  TRYING TO ERASE NONEXISTENT NODE.  NODE =    10
CHANGE. CALL ELEMOP FOR  ERASE       0    11
WARNING. ELEMOP.  TRYING TO ERASE NONEXISTENT NODE.  NODE =    11
ANTEST CALLED FOR    8"NASVOW  "(AACC)     ,SD=  9. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      6
ANTEST CALLED FOR   23"NASRED  "(AACC)     ,SD= 24. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE,      0    7
SCAN CALLED AT     2
TRANSFORMATICNS WHICH HAVE APPLIED ARE
             1         1  REDVOW
             2         3  SCHWDB
             3         8  NASVOW
             4        23  NASRED
 TREE READ BY FTRIN
  1 S          2 #
               3 N          4 #
                            5 K
                            6 AE>/1/
                            8 +
                            9 G
                           12 R
                           13 U/2/
                           14 #
              15 #
          # # K AE>/1/ + G R U/2/ # #
```

```
   "COTTON:"          S<'MB N<'MB 'K 'A1 'T 'SB 'EH2 'N 'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 K
                           6 A/1/
                           7 T
                           8 +
                           9 EH/2/
                          10 N
                          11 #
             12 #

         # # K A/1/ T + EH/2/ N # #

*****     TRANSFORMATIONS     *****
SCAN CALLED AT     1     I
ANTEST CALLED FOR    5"SYLLAB  "(AACC)     ,SD=  6. RES= 11. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE        0     9
CHANGE. HAVE CSEXCH FOR  MERGEF    IN     10
ANTEST CALLED FOR   14"GLOT     "(AACC)     ,SD= 15. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      7
SCAN CALLED AT     2
TRANSFORMATIONS WHICH HAVE APPLIED ARE
             1          5  SYLLAB
             2         14  GLOT

 TREE READ BY FTRIN
  1 S          2 #
               3 N          4 #
                            5 K
                            6 A/1/
                            7 GS
                            8 +
                           10 NS/2/
                           11 #
              12 #

          # # K A/1/ GS + NS/2/ # #


 10 NS/2/ |-LOW -BACK -ROUND|
```

```
   "INTRODUCTION:"  S<'MB N<'MB 'II2 'N 'SB 'T 'R 'O3 'SB 'D 'UH1 'K
                          'SB 'SH 'EH2 'N 'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 II/2/
                           6 N
                           7 +
                           8 T
                           9 R
                          10 O/3/
                          11 +
                          12 D
                          13 UH/1/
                          14 K
                          15 +
                          16 SH
                          17 EH/2/
                          18 N
                          19 #
             20 #

          # # II/2/ N + T R O/3/ + D UH/1/ K + SH EH/2/ N # #

*****      TRANSFORMATIONS      *****
SCAN CALLED AT     1     I
ANTEST CALLED FOR    1"REDVOW  "(AACC)     ,SD=   2. RES=   6. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      10
ANTEST CALLED FOR    5"SYLLAB  "(AACC)     ,SD=   6. RES=  11. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE       0    17
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      18
ANTEST CALLED FOR    6"RUHRED  "(AACC)      SD=   7. RES=  13. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MOVEF    IN       9
CHANGE. CALL ELEMOP FOR  ERASE       0    10
CHANGE. HAVE CSEXCH FOR  MERGEF   IN       9
ANTEST CALLED FOR    8"NASVOW  "(AACC)     ,SD=   9. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN       5
ANTEST CALLED FOR   18"REGVOICE"(AACC)     ,SD=  19. RES=  22. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN       6
ANTEST CALLED FOR   21"PROARTIC"(AACC)     ,SD=  22. RES=  25. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      18
ANTEST CALLED FOR   23"NASRED  "(AACC)      SD=  24. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE       0     6
ANTEST CALLED FOR   26"RDEVOICE"(AACC)     ,SD=  27. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN       9
SCAN CALLED AT     2     .
```

```
TRANSFORMATIONS  WHICH  HAVE  APPLIED  ARE
                1          1   REDVOW
                2          5   SYLLAB
                3          6   RUHRED
                4          8   NASVOW
                5         18   REGVOICE
                6         21   PROARTIC
                7         23   NASRED
                8         26   RDEVOICE

 TREE READ BY FTRIN
  1 S          2 #
               3 N          4 #
                            5 II>/2/
                            7 +
                            8 T
                            9 RDV/3/
                           11 +
                           12 D
                           13 UH/1/
                           14 K
                           15 +
                           16 SH
                           18 NPAS/2/
                           19 #
              20 #

        # # II>/2/ + T RDV/3/ + D UH/1/ K + SH NPAS/2/ # #


  9 RDV/3/   |-LOW +BACK -ROUND +RETROF|
 18 NPAS/2/  |-LOW -BACK -ROUND|
```

```
   "SAYING:"          S<'MB V<'MB 'S 'E1 'SB 'MB 'II2 'NG 'MB> 'MB>.
TRFE READ BY FTRIN.
 1 S          2 #
              3 V          4 #
                           5 S
                           6 E/1/
                           7 +
                           8 #
                           9 II/2/
                          10 NG
                          11 #
             12 #

         # # S E/1/ + # II/2/ NG # #

*****      TRANSFORMATIONS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR     4"ING      "(AACC)      ,SD=   5. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      10
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       9
ANTEST CALLED FOR     8"NASVOW   "(AACC)      ,SD=   9. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       9
SCAN CALLED AT      2      .

TRANSFORMATIONS  WHICH HAVE APPLIED ARE
               1          4  ING
               2          8  NASVOW

 TREE READ BY FTRIN
 1 S          2 #
              3 V          4 #
                           5 S
                           6 E/1/
                           7 +
                           8 #
                           9 IH>/2/
                          10 N
                          11 #
             12 #

         # # S E/1/ + # IH>/2/ N # #


  9 IH/2/ |-TENSE|
```

```
   "NOTHING:"        S<'MB N<'MB 'N 'UH1 'THU 'SB 'II2 'NG 'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 N
                           6 UH/1/
                           7 THU
                           8 +
                           9 II/2/
                          10 NG
                          11 #
             12 #

         # # N UH/1/ THU + II/2/ NG # #

*****      TRANSFORMATIONS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR    4"ING      "(AACC)     ,SD=   5. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      10
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       9
ANTEST CALLED FOR    5"SYLLAB   "(AACC)     ,SD=   6. RES= 11. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE        0     9
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      10
SCAN CALLED AT      2      .

TRANSFORMATICNS WHICH HAVE APPLIED ARE
              1          4  ING
              2          5  SYLLAB

 TREE READ BY FTRIN
  1 S.         2 #
               3 N          4 #
                            5 N
                            6 UH/1/
                            7 THU
                            8 +
                           10 NS/2/
                           11 #
              12 #

          # # N UH/1/ THU + NS/2/ # #

 10 NS/2/ |-LOW -BACK -ROUND|
```

```
   "TO RETAIN:"      S<'MB P<'MB 'T 'U1 'MB> V<'MB 'R 'I2 'SB 'T 'E1 'N
                          'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 P          4 #
                           5 T
                           6 U/1/
                           7 #
              8 V          9 #
                          10 R
                          11 I/2/
                          12 +
                          13 T
                          14 E/1/
                          15 N
                          16 #
             17 #

         # # T U/1/ # # R I/2/ + T E/1/ N # #.

*****      TRANSFORMATICNS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR     1"REDVOW  "(AACC)      ,SD=   2. RES=   6. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      11
ANTEST CALLED FOR     6"RUHRED  "(AACC)      ,SD=   7. RES=  13. TOP=    1:S
ANTEST RETURNS ** 2**
CHANGE. HAVE CSEXCH FOR  MOVEF     IN      10
CHANGE. CALL ELEMOP FOR  ERASE        0    11
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      10
CHANGE. HAVE CSEXCH FOR  MOVEF     IN      10
CHANGE. CALL ELEMOP FOR  ERASE        0    11
WARNING. ELEMOP.  TRYING TO ERASE NONEXISTENT NODE.  NODE =     11
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      10
ANTEST CALLED EOR     8"NASVOW  "(AACC)      ,SD=   9. RES=   0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      14
SCAN CALLFD AT      2

TRANSFORMATICNS WHICH HAVE APPLIED ARE
              1          1  REDVOW
              2          6  RUHRED
              3          8  NASVOW
```

```
FTRIN
2 #
3 P          4 #
             5 T
             6 U/1/
             7 #
8 V          9 #
            10 R/2/
            12 +
            13 T
            14 E>/1/
            15 N
            16 #
17 #

T U/1/ # # R/2/ + T E>/1/ N # #

W +BACK -ROUND +RETROF|
```

```
   "SURPRISE:"      S<'MB N<'MB 'S 'EH2 'R 'SB 'P 'R 'OO1 'Y 'Z 'MB> 'MB>
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 S
                           6 EH/2/
                           7 R
                           8 +
                           9 P
                          10 R
                          11 OO/1/
                          12 Y
                          13 Z
                          14 #
             15 #

        # # S EH/2/ R + P R OO/1/ Y Z # #

*****     TRANSFORMATIONS     *****
SCAN CALLED AT     1     I
ANTEST CALLED FOR    5"SYLLAB  "(AACC)     ,SD=  6. RES= 11. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE        0     6
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       7
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       7
ANTEST CALLED FOR    7"RUHLESS "(AACC)     ,SD=  8. RES= 15. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN       7
SCAN CALLED AT     2     .

TRANSFORMATIONS WHICH HAVE APPLIED ARE
             1          5  SYLLAB
             2          7  RUHLESS

 TREE READ BY FTRIN
  1 S         2 #
              3 N          4 #
                           5 S
                           7 SCHWA/2/
                           8 +
                           9 P
                          10 R
                          11 OO/1/
                          12 Y
                          13 Z
                          14 #
             15 #

        # # S SCHWA/2/ + P R OO/1/ Y Z # #

  7 SCHWA |+SON +CONT -ANT +COR +VOICE -STRID -RETROF|
```

```
   "OLD MAN:"        S<'MB A<'MB 'O1 'L 'D 'MB> N<'MB 'M 'AE1 'N 'MB> 'MB>.
TREE READ BY, FTRIN
 1 S          2 #
              3 A          4 #
                           5 C/1/
                           6 L
                           7 D
                           8 #
              9 N         10 #
                          11 M
                          12 AE/1/
                          13 N
                          14 #
             15 #

         # # O/1/ L D # # M AE/1/ N # #

*****      TRANSFORMATICNS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR    8"NASVOW  "(AACC)     ,SD=  9. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      12
ANTEST CALLED FOR   15"DENDELD "(AACC)     ,SD= 16. RES= 20. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE         0     7
ANTEST CALLED FOR   24"DARKL   "(AACC)     ,SD= 25. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN       6
SCAN CALLED AT     2      .

TRANSFORMATICNS WHICH HAVE APPLIED ARE
              1          8  NASVOW
              2         15  DENDELD
              3         24  DARKL

 TREE READ BY FTRIN
  1 S         2 #
              3 A          4 #
                           5 O/1/
                           6 DL
                           8 #
              9 N         10 #
                          11 M
                          12 AE>/1/
                          13 N
                          14 #
             15 #

         # # O/1/ DL # # M AE>/1/ N # #
```

```
   "SANITY CLAUSE:" S<'MB N<'MB 'S 'AE1 'N 'SB 'EH3 'SB 'T 'I2 'MB>
    "NOT FROM NEU"          N<'MB 'K 'L 'OO1 'Z 'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 S
                           6 AE/1/
                           7 N
                           8 +
                           9 EH/3/
                          10 +
                          11 T
                          12 I/2/
                          13 #
             14 N         15 #
                          16 K
                          17 L
                          18 OO/1/
                          19 Z
                          20 #
             21 #

        # # S AE/1/ N + EH/3/ + T I/2/ # # K L OO/1/ Z # #

*****     TRANSFORMATIONS     *****
SCAN CALLED AT     1     I
ANTEST CALLED FOR    1"REDVOW  "(AACC)     ,SD=  2. RES=  6. TOP=    1:S
ANTEST RETURNS ** 2**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      9
CHANGE. HAVE CSEXCH FOR  MERGEF   IN     12
ANTEST CALLED FOR    6"RUHRED  "(AACC)     ,SD=  7. RES= 13. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MOVEF    IN      7
CHANGE. CALL ELEMOP FOR  ERASE       0    9
CHANGE. CALL ELEMOP FOR  ERASE       0    8
ANTEST CALLED FOR   13"ALFLAP  "(AACC)     ,SD= 14. RES= 18. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN     11
SCAN CALLED AT     2     .

TRANSFORMATICNS WHICH HAVE APPLIED ARE
             1         1  REDVOW
             2         6  RUHRED
             3        13  ALFLAP
```

```
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 S
                           6 AE/1/
                           7 NS/3/
                          10 +
                          11 TAF
                          12 IH/2/
                          13 #
             14 N         15 #
                          16 K
                          17 L
                          18 OO/1/
                          19 Z
                          20 #
             21 #

        # # S AE/1/ NS/3/ + TAF IH/2/ # # K L OO/1/ Z # #

 7 NS/3/ |-LOW +BACK -ROUND|
12 IH/2/ |-TENSE|
```

```
   "SITTING:"        S<'MB V<'MB 'S 'II1 'T. 'SB 'MB 'I2 'NG 'MB> !MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 V          4 #
                           5 S
                           6 II/1/
                           7 T
                           8 +
                           9 #
                          10 I/2/
                          11 NG
                          12 #
             13 #

         # # S II/1/ T + # I/2/ NG # #

*****     TRANSFORMATIONS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR    4"ING      "(AACC)     ,SD=  5. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      11
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      10
ANTEST CALLED FOR    5"SYLLAB   "(AACC)     ,SD=  6. RES= 11. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. CALL ELEMOP FOR  ERASE        0    10
CHANGE. HAVE CSEXCH FOR  MERGEF    IN      11
SCAN CALLED AT      2      .

TRANSFORMATIONS WHICH HAVE APPLIED ARE
              1          4   ING
              2          5   SYLLAB

 TREE READ BY FTRIN
  1 S          2 #
               3 V          4 #
                            5 S
                            6 II/1/
                            7 T
                            8 +
                            9 #
                           11 NS/2/
                           12 #
              13 #

          # # S II/1/ T + # NS/2/ # #

 11 NS/2/ |-LOW -BACK -ROUND|
```

```
   "MISCHIEF:"      S<'MB N<'MB 'M 'II2 'S 'SB 'CH 'II1 'F 'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 M
                           6 II/2/
                           7 S
                           8 +
                           9 CH
                          10 II/1/
                          11 F
                          12 #
             13 #

         # # M II/2/ S + CH II/1/ F # #

*****     TRANSFORMATIONS     *****
SCAN CALLED AT     1     I
ANTEST CALLED FOR   12"PALAT3  "(AACC)     ,SD= 13. RES=  0. TOP=   1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      7
SCAN CALLED AT     2     .

TRANSFORMATICNS WHICH HAVE APPLIED ARE
             1         12  PALAT3
TREE READ BY FTRIN
 1 S          2 #
              3 N          4 #
                           5 M
                           6 II/2/
                           7 SH
                           8 +
                           9 CH
                          10 II/1/
                          11 F
                          12 #
             13 #

         # # M II/2/ SH + CH II/1/ F # #
```

```
   "THREE TREES:"   S<'MB A<'MB 'THU 'R 'I1 'MB> N<'MB 'T 'R 'I1 'Z
                                'MB> 'MB>.
TREE READ BY FTRIN
 1 S          2 #
              3 A          4 #
                           5 THU
                           6 R
                           7 I/1/
                           8 #
              9 N         10 #
                          11 T
                          12 R
                          13 I/1/
                          14 Z
                          15 #
             16 #

         # # THU R I/1/ # # T R I/1/ Z # #

*****     TRANSFORMATIONS      *****
SCAN CALLED AT      1      I
ANTEST CALLED FOR   25"RFLAP    "(AACC)     ,SD= 26. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN       6
ANTEST CALLED FOR   26"RDEVOICE"(AACC)     ,SD= 27. RES=  0. TOP=    1:S
ANTEST RETURNS ** 1**
CHANGE. HAVE CSEXCH FOR  MERGEF   IN      12
SCAN CALLED AT      2

TRANSFORMATIONS WHICH HAVE APPLIED ARE
              1         25  RFIAP
              2         26  RDEVOICE

 TREE READ BY FTRIN
  1 S         2 #
              3 A          4 #
                           5 THU
                           6 DAF
                           7 I/1/
                           8 #
              9 N         10 #
                          11 T
                          12 RDV
                          13 I/1/
                          14 Z
                          15 #
             16 #

         # # THU DAF I/1/ # # T RDV I/1/ Z # #
              $END
```