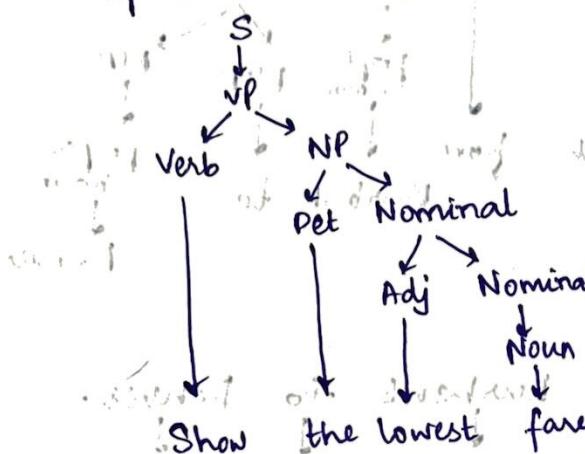


1. Top down, bottom up parsing for the sentences using the given grammar.

a. Show the lowest fare:

Verb Det Adj Noun

Top down Parsing



Show me the cheapest fare that has lunch.

Verb personal noun Det Adj Noun Det Verb Noun

for this sentence to belong to the given grammar, the verb should be followed by NP.  
[ $VP \rightarrow \text{Verb}/\text{Verb NP}$ ]

→ The sentence doesn't belong to the given grammar

c. Give me Sunday's flights arriving in Las Vegas from Memphis and New York City.

Verb personal noun possessive noun noun verb preposition proper noun preposition proper noun

• No conjunctions in the given grammar.

→ The sentence does not belong to the given grammar.

d. List all flights between five and seven p.m.

Verb Det Noun preposition num conj num

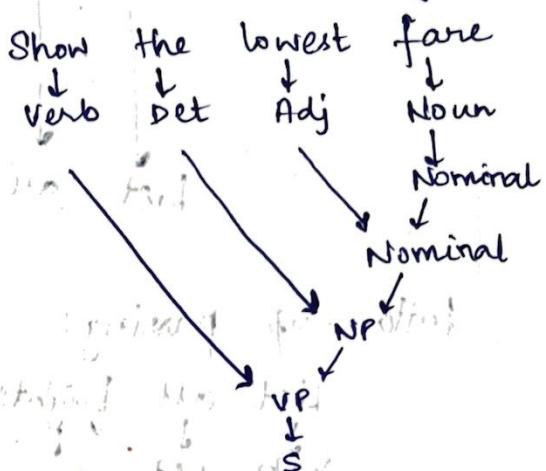
• No numeric values, conjunctions in the grammar.

→ The sentence does not belong to the given grammar.

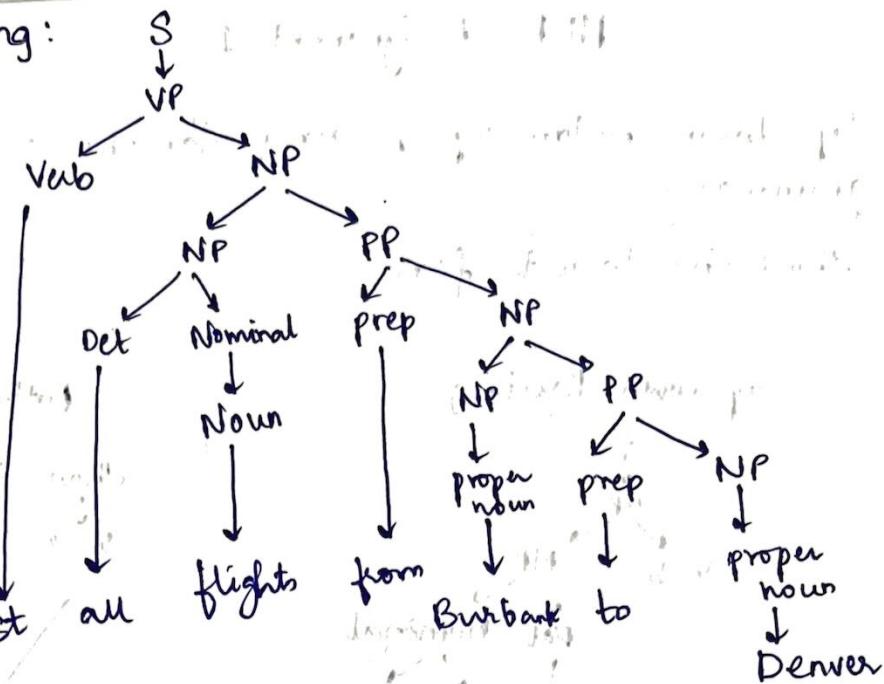
e. List all flights from Burbank to Denver.

Verb Det Noun preposition Proper noun prep proper noun

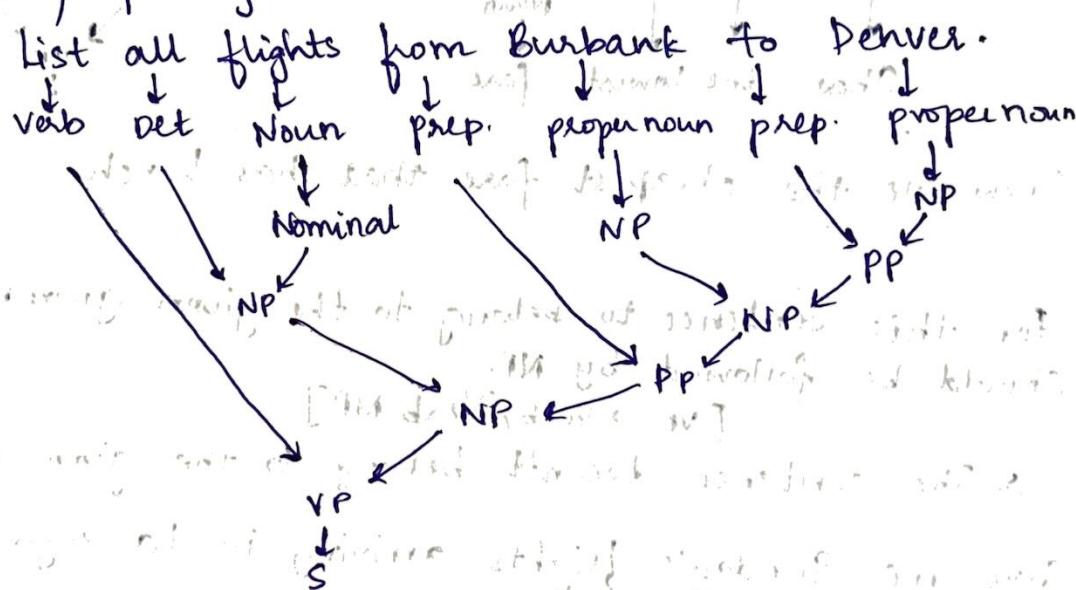
bottom-up parsing



Top-down parsing:



Bottom-up parsing:



f. Show me all flights that depart before ten am and have first class fares.

• no conjunctions and numerals in the grammar.  
→ The sentence does not belong to the grammar.

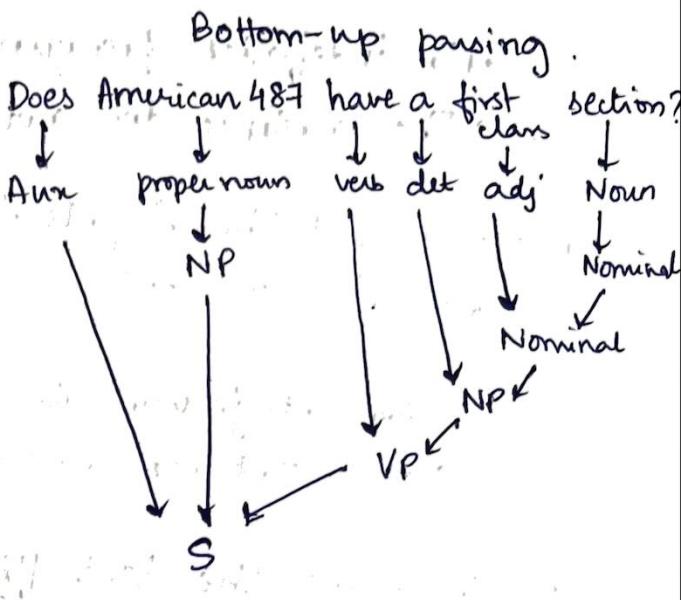
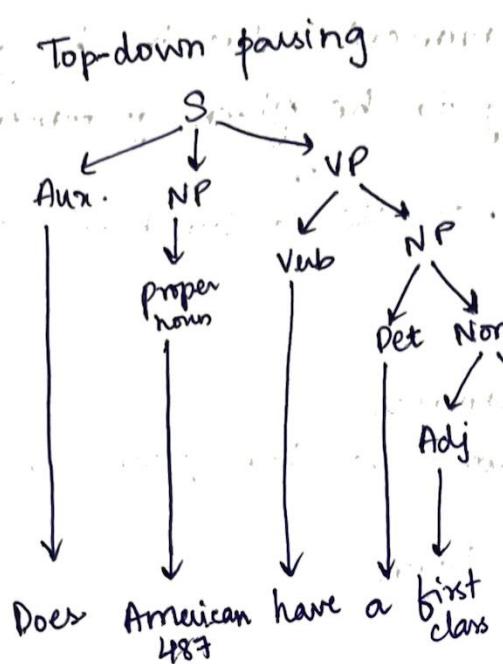
g. Show me all the flights leaving Baltimore.

• Determiner followed by determiner is not allowed in this grammar.

→ The sentence does not belong to the grammar.

- h. Show me flights arriving within thirty minutes of each other.
- verb personal noun verb prep. num noun prep det indefinite pronoun
- No indefinite pronouns or numeric values in the grammar.
  - The sentence does not belong to the given grammar.
- i. Please list the flights from Charlotte to LongBeach arriving after lunch time.
- introduction verb det noun prep. proper noun prep proper noun verb
- prep noun noun
- No interjections in the grammar
  - The sentence does not belong to the given grammar.
- j. Show me the last flight to leave.
- verb personal pronoun det adj noun prep verb
- According to the given grammar, preposition is never followed by a verb.
  - The sentence does not belong to the given grammar.
- k. Does American airlines have a flight between five am and six am.
- Auxiliary proper noun verb det noun prep num noun conj num noun
- This grammar does not have numerals or conjunctions.
  - The sentence does not belong to the given grammar.
- l. I would like to fly on American Airlines.
- personal pronoun aux verb particle verb prep proper noun
- No particles in the grammar.
  - The sentence does not belong to the given grammar.
- m. Please repeat that.
- introduction verb det
- No interjections in the grammar.
  - The sentence does not belong to the given grammar.

n. Does American 487 have a first class section?  
Auxiliary Proper noun Verb Det Adj Noun



- o. I need to fly between Philadelphia and Atlanta.  
noun Verb particle verb prep proper noun conj proper noun  
• No particles or conjunctions in the grammar.  
→ The sentence does not belong to the given grammar.

p. What is the fare from Atlanta to Denver?  
wh pronoun aux det noun prep proper noun prep proper noun  
• No wh pronoun in the grammar are followed by aux immediately.  
→ The sentence does not belong to the given grammar.

q. Is there an American Airlines flight from Philadelphia to Dallas?  
Aux adverb det proper noun noun prep proper noun prep proper noun  
• No adverb in the grammar.  
→ The sentence does not belong to the given grammar.

r. What flights do you have from Burbank to Tacoma?  
wh pronoun noun aux personal verb prep proper noun prep proper noun  
• No wh pronouns in the grammar, is followed by noun and then aux.  
→ The sentence does not belong to the given grammar.

s. Can you give me the same information for United?  
 Aux personal verb personal pronoun det adjective noun prep proper noun

- According to grammar, personal pronoun ( $NP \rightarrow$  personal pronoun) is always followed VP or PP or Aux.

$[S \rightarrow NP\ VP \mid Wh\ NP\ VP \mid Wh\ NP\ Aux\ NP\ VP]$   
 $NP \rightarrow NP\ PP]$

and VP starts with verb, PP starts with preposition.  
 Here, personal pronoun is followed by determiner.

→ The sentence does not belong to the given grammar.

t. I like to fly from Detroit to Saint Petersburg on Tuesday.  
 personal verb personal verb prep proper noun prep proper noun prep noun

- No particles in the grammar.

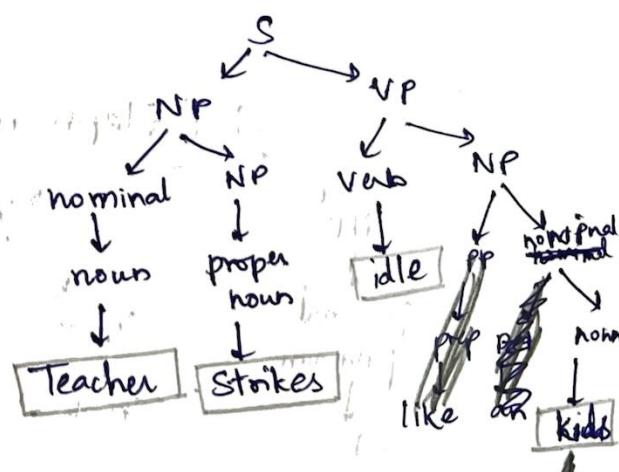
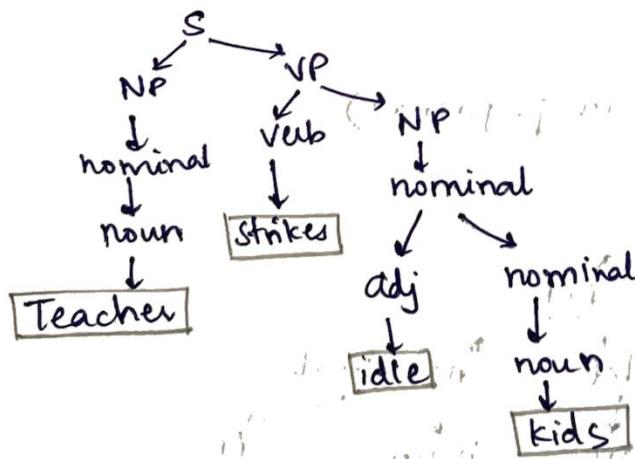
→ The sentence does not belong to the given grammar.

## Q. 2. Different parse trees for ambiguous sentences.

a. Teacher strikes idle kids.

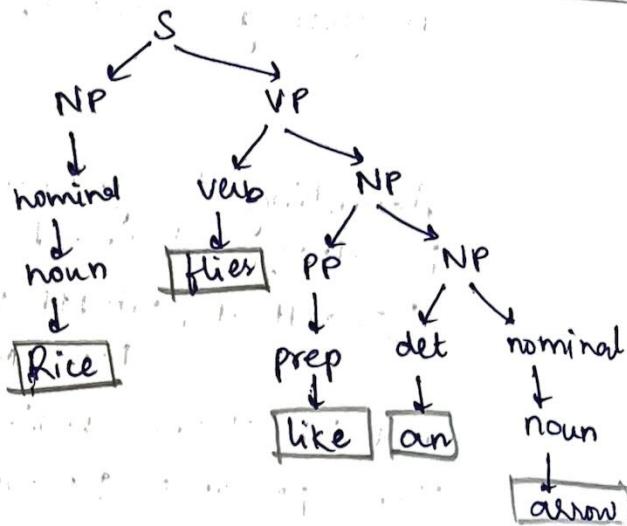
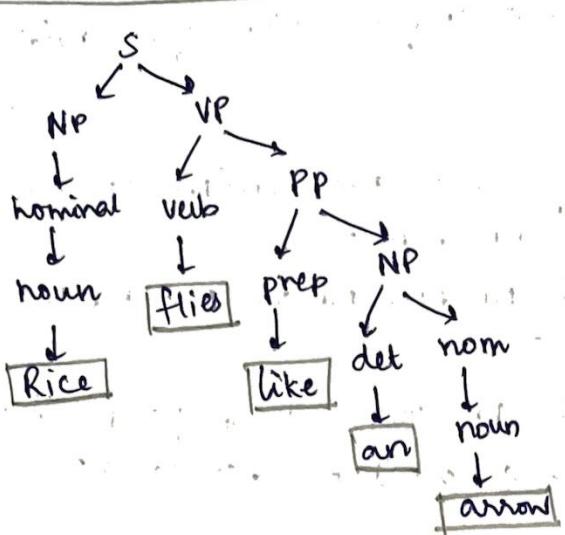
Teacher strikes idle kids.  
 noun verb adj noun

Teacher strikes idle kids.  
 proper noun verb noun

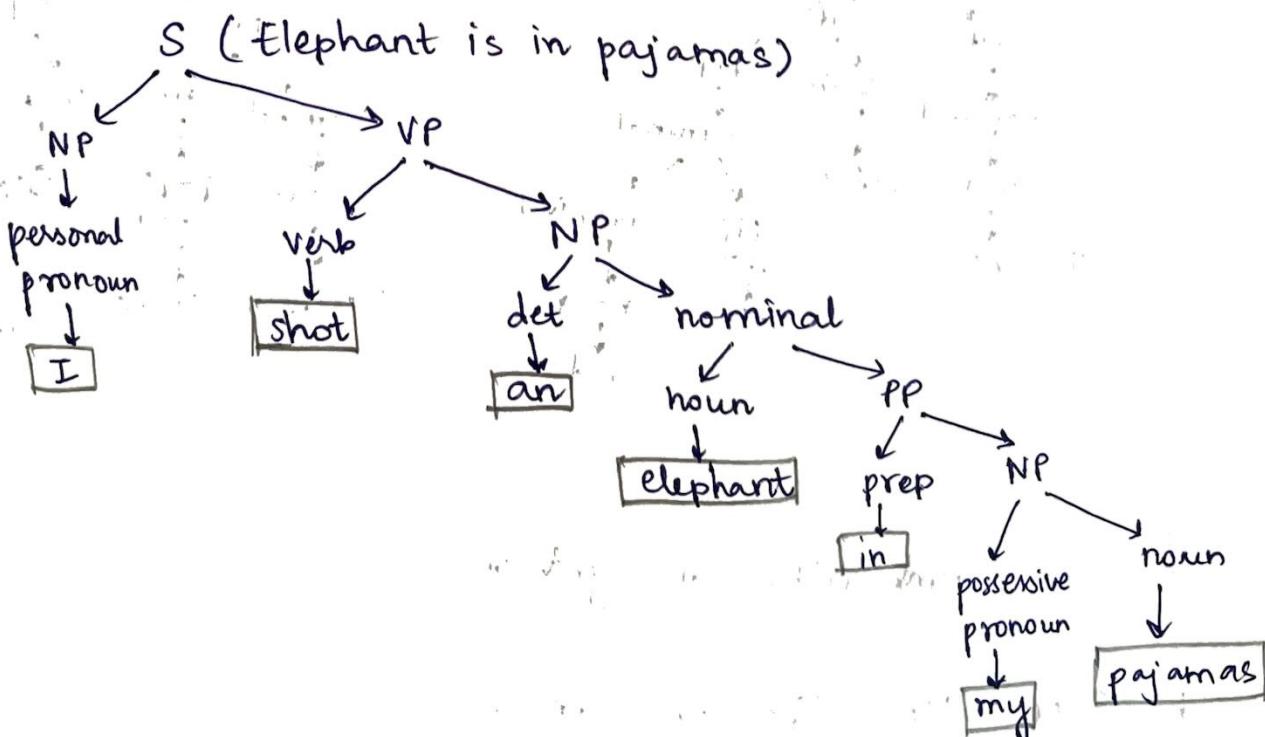
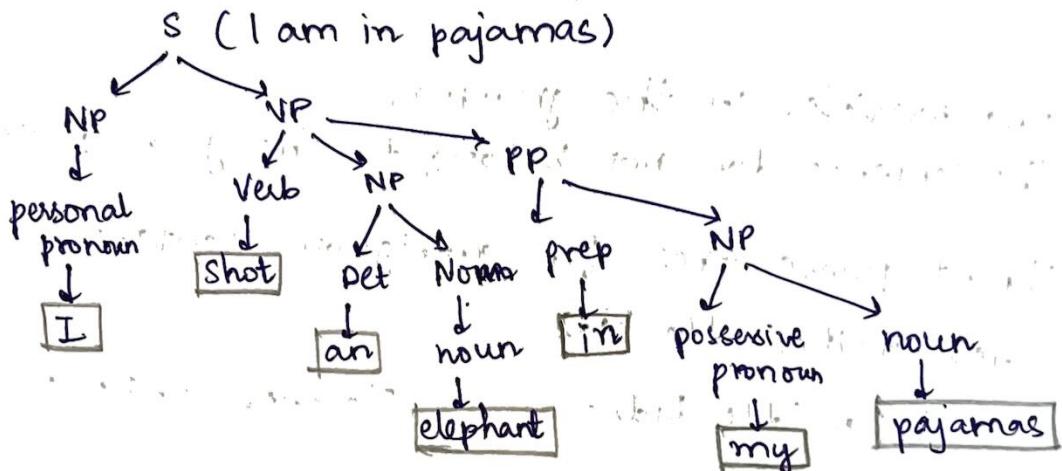


- Ambiguity in syntax.

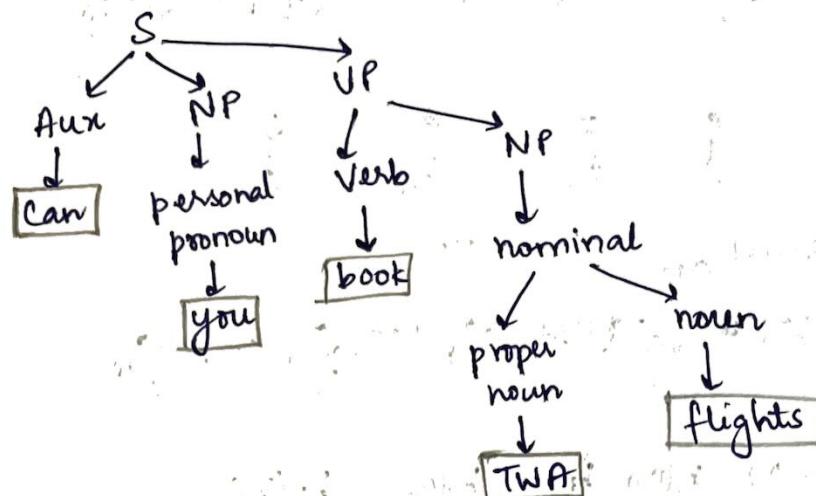
b. Rice flies like an arrow.  
 noun verb prep det noun



c. I shot an elephant in my pajamas.



d. Can you book TWA flights?



Only semantic ambiguity

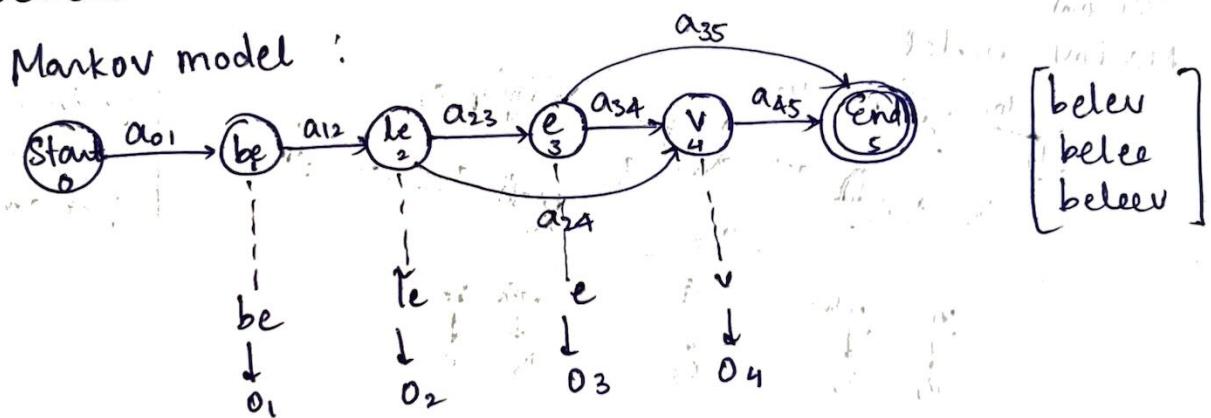
1) Yes/No question

2) Asking to do something

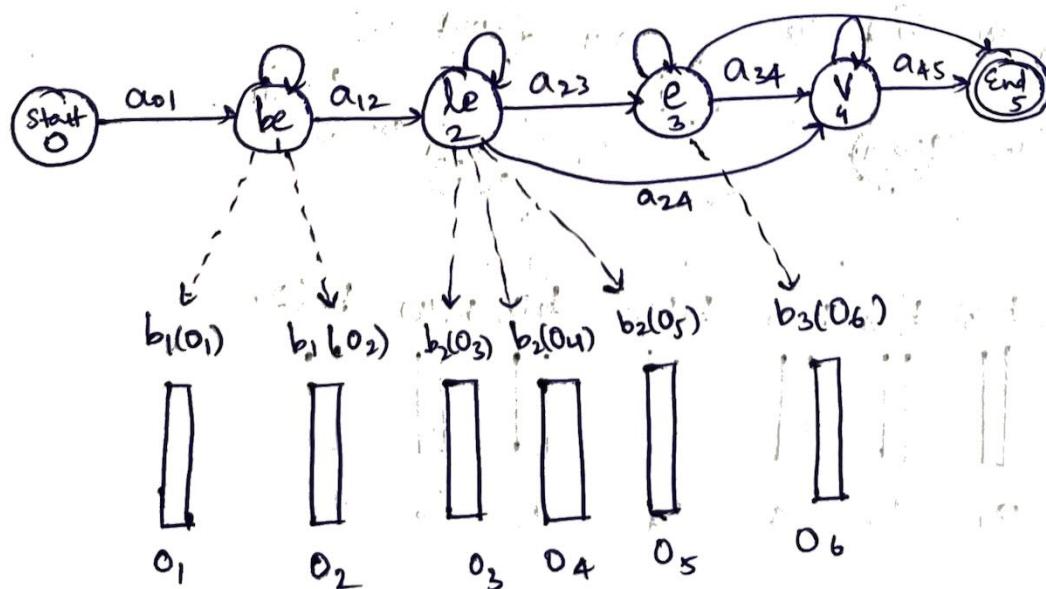
### Q.3. Pronunciation Networks

#### a. Believe

Markov model :

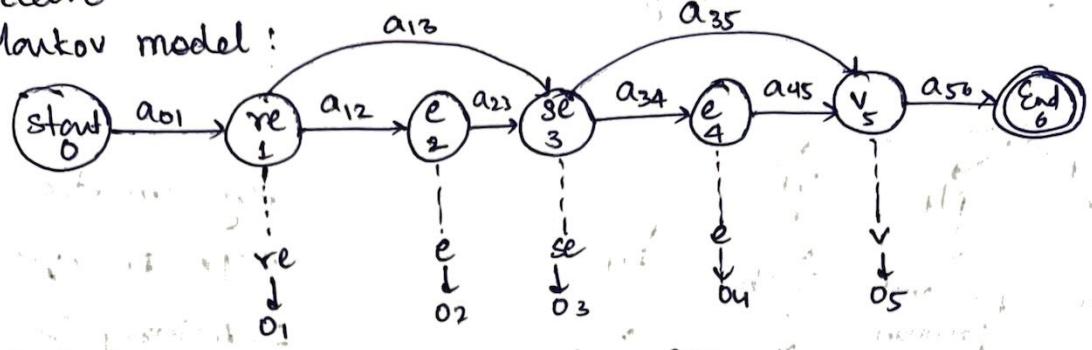


Hidden Markov Model :

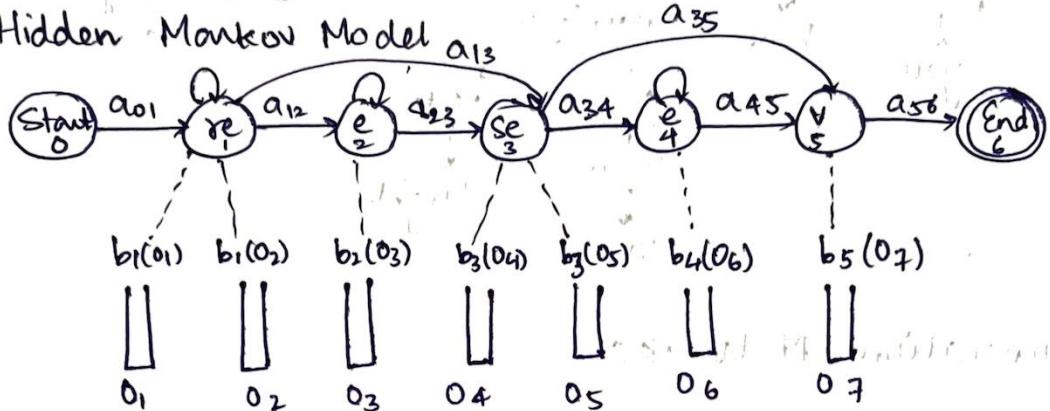


b. Receive

Markov model:

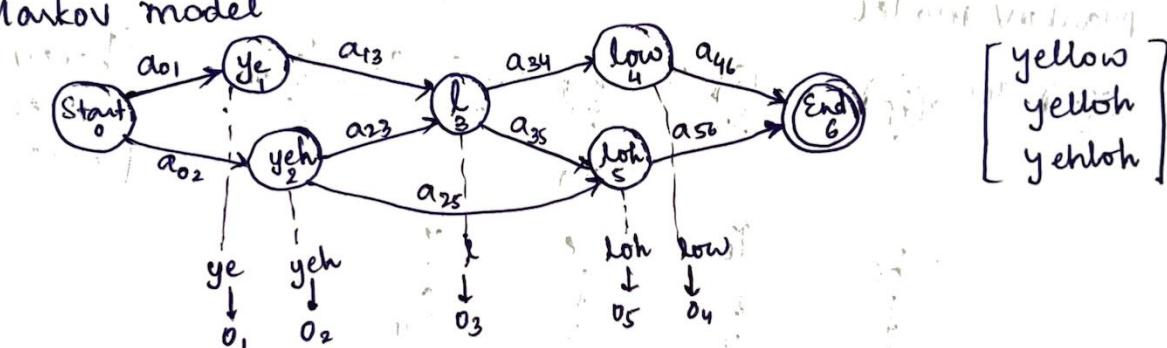


Hidden Markov Model  $a_{13}$

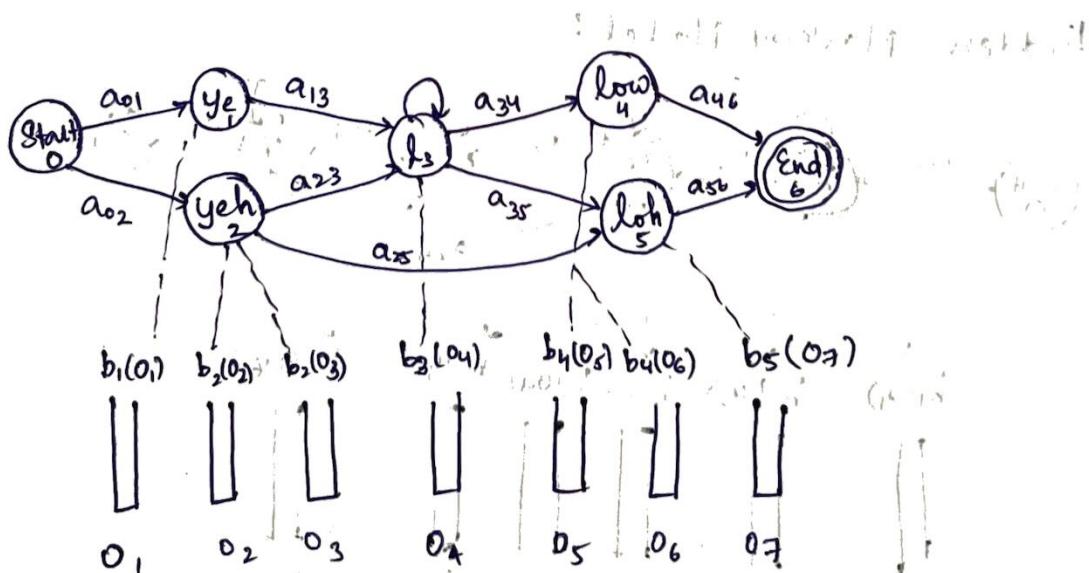


c. Yellow

Markov model

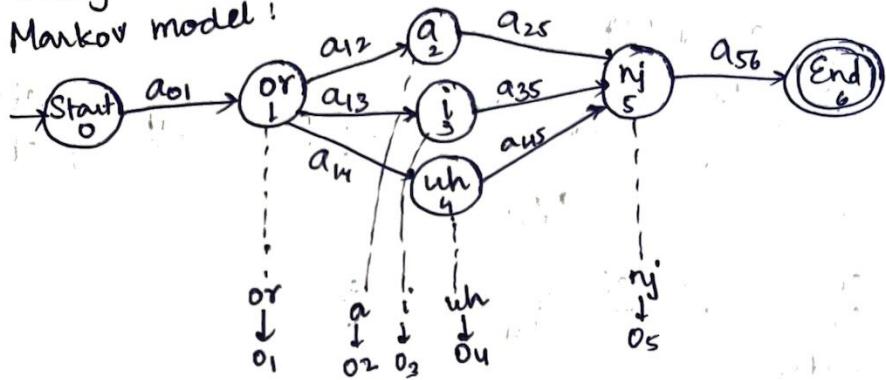


Hidden Markov Model



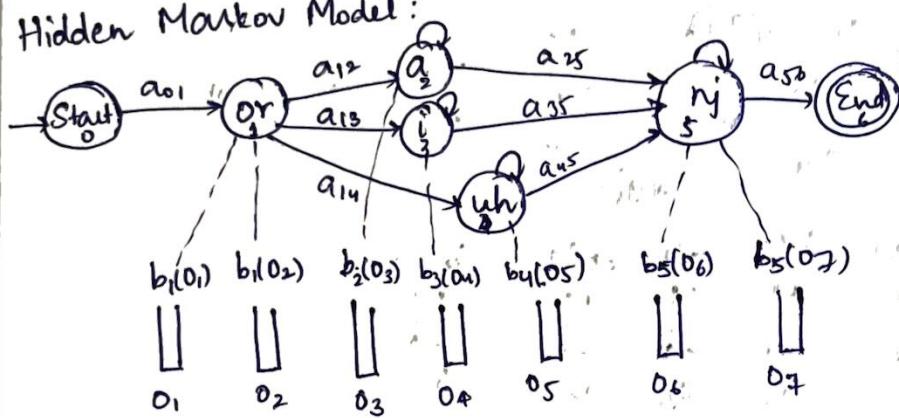
d. Orange

Markov model:



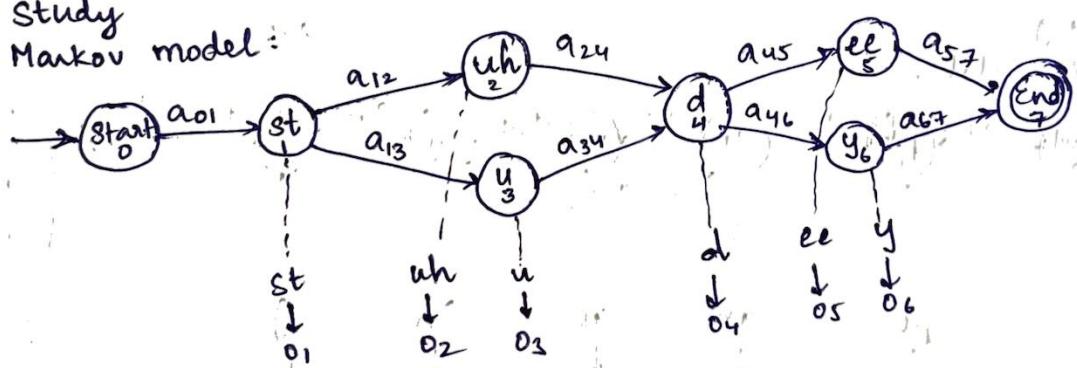
[ orang  
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oruhnj ]

Hidden Markov Model:



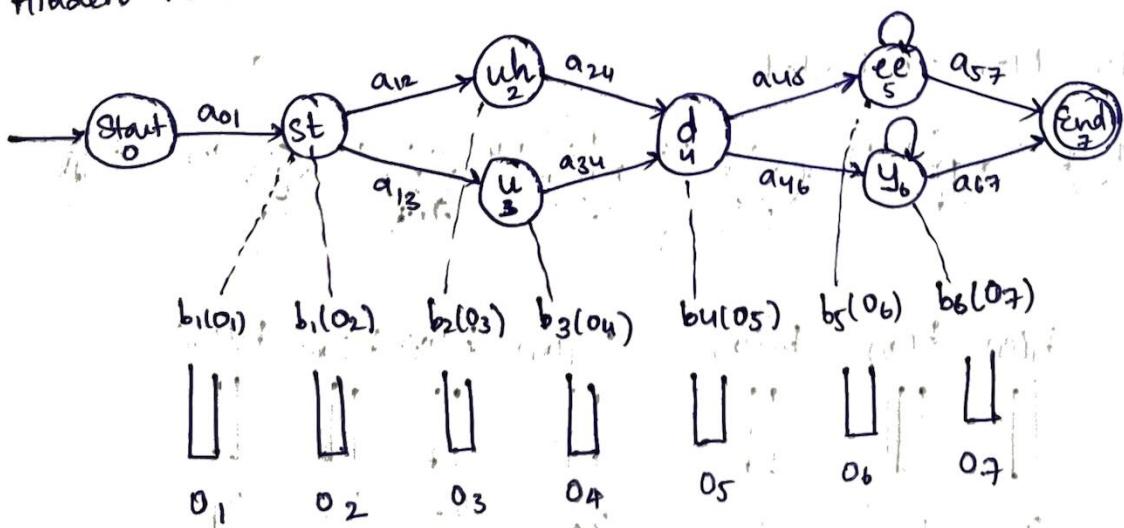
e. Study

Markov model:



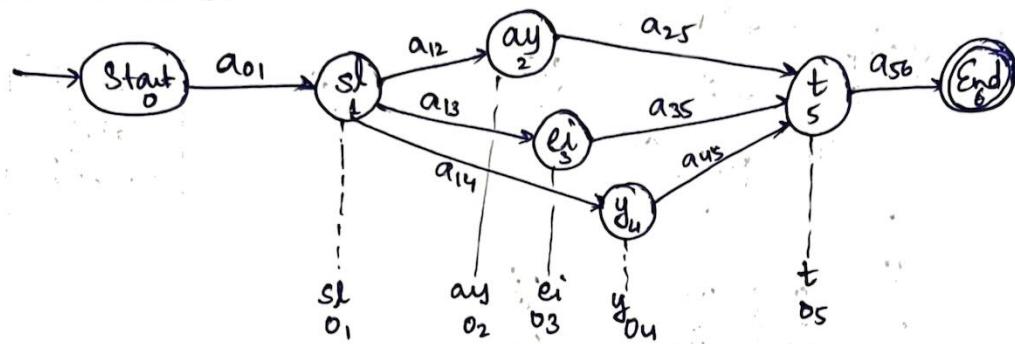
[ Stuhdee  
stuhdy  
studdee  
study ]

Hidden Markov model:



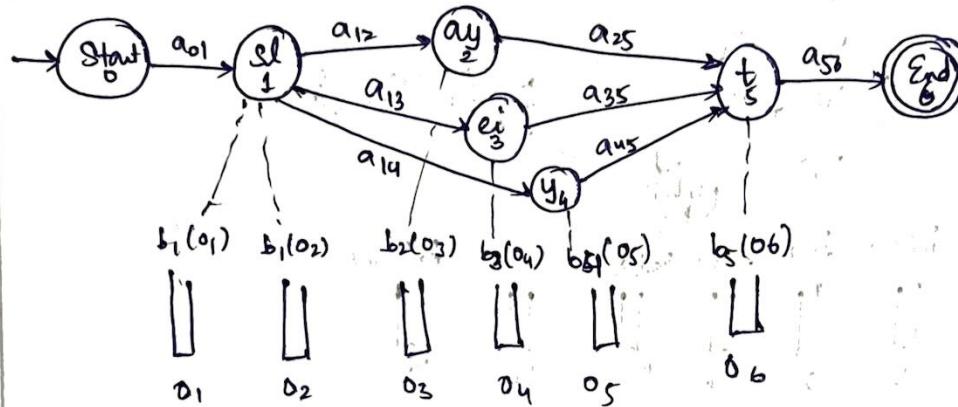
f. Slight

Markov model:



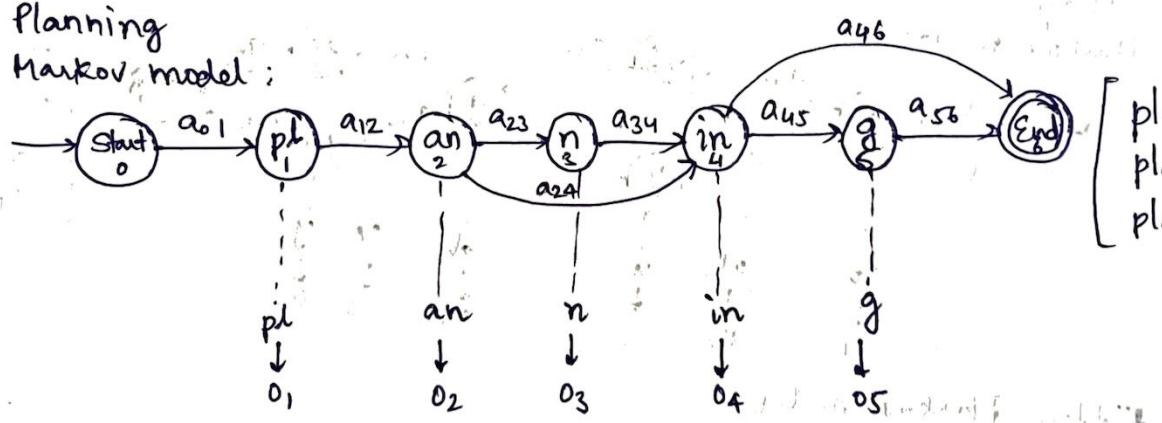
[slayt]  
sleit  
slyt

Hidden Markov model:



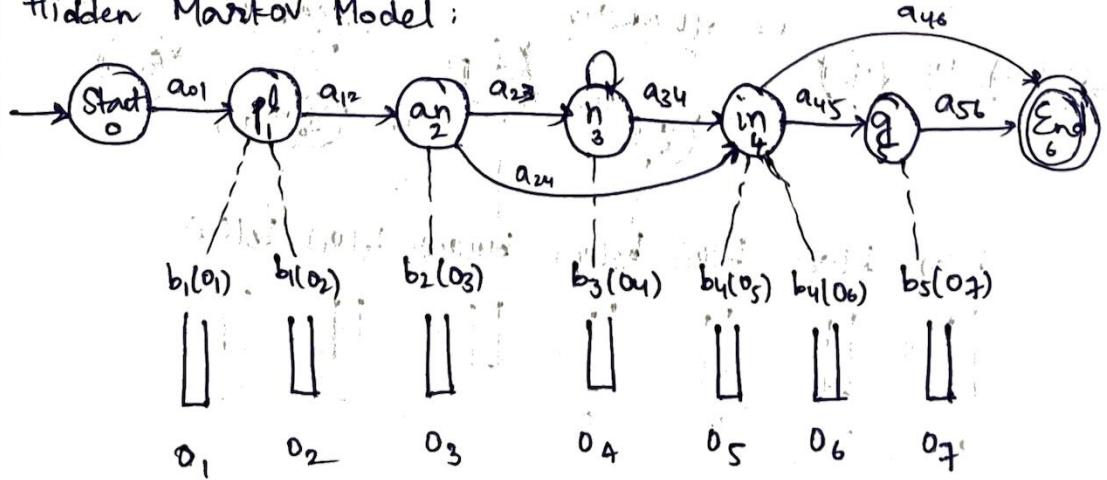
g. Planning

Markov model:

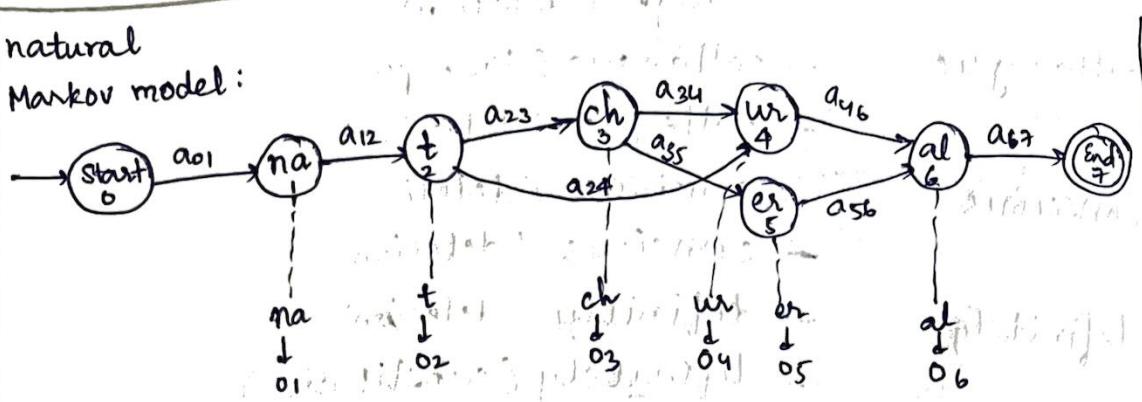


[planing]  
planin  
planning

Hidden Markov Model:

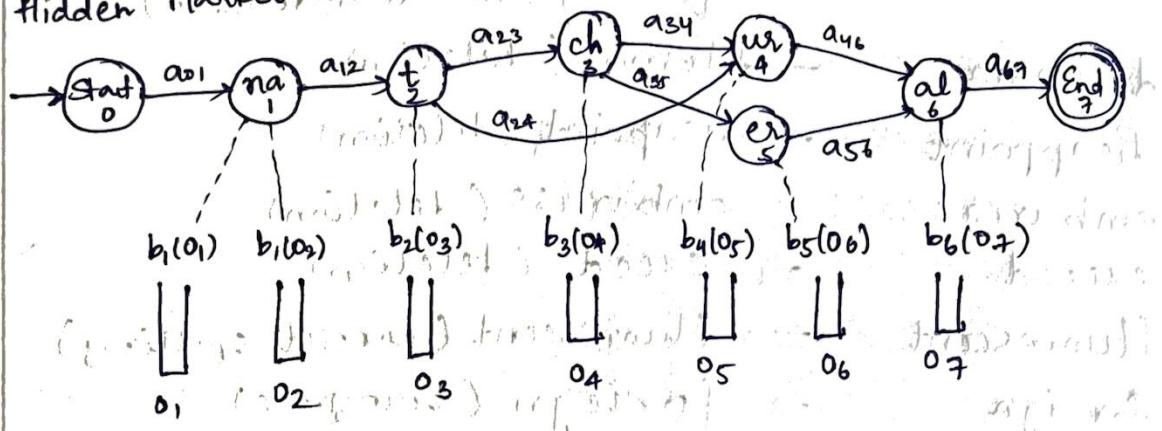


- h. natural  
Markov model:



natural  
natcherl  
natural  
natcherl

- hidden (Markov) model:



#### 4. Confusion matrices in Statistical Spell Checking

absence - absence (transpose)

- absence (substitution)

acceptable - acceptable (substitution)

accidentally - accidentally (deletion)

acommodate - accomodate (deletion)

- acommodate (deletion)

accidently - accidentally (insertion)

achieve - achieve (transpose)

acknowledge - acknowledge (deletion)

- aknowledge (deletion)

acquaintance - acquaintance (substitution)

- aquaintance (deletion)

beginning - beginning (deletion)

believe - believe (correct spelling)

calendar - calender (substitution)

category - catagory (substitution)

caught - caihgt (transpose)

- caught (deletion)
- collægue (transpose)
- colleague (deletion)
- concious (deletion)
- consious (deletion)
- definitely (deletion)
- definately (substitution)
- defiantly (insertion; deletion)
- dilema (deletion)
- disapoint (deletion)
- embarrass (deletion)
- exced (deletion)
- fluorescent (correct spelling)
- foriegn (transpose)
- freind (transpose)
- gratefull (insertion)
- greatful (insertion; deletion)
- garantee (deletion)
- garentee (deletion, substitution)
- garanty (deletion, substitution)
- guidence (substitution)
- harrass (insertion)
- height (insertion)
- heighth (transpose)
- heirarchy (transpose)
- ignorence (substitution)
- immitate (insertion)
- intelligence (deletion)
- intelligance (substitution)
- kernel (substitution)
- liesure (transpose)
- libary (deletion)
- liberry (insertion, deletion)

miniature  
millennium

- miniture (deletion)
- millenium (deletion)
- midennium (deletion)

necessary

- necessary (insertion)

- necessery (substitution)

- occasionally (deletion)

- Occassionally (insertion)

personnel

- personell (deletion, insertion)
- personnel (deletion)

- preceed (transpose)

- presance (substitution)

- principal (substitution)

- professer (substitution)

- prufe (substitution, deletion, insertion)

- que (deletion)

- questionnaire (deletion)

- questionnaire (deletion)

- realy (deletion)

- recomend (deletion)

- reccomend (insertion)

- sieze (transpose)

- seperate (substitution)

- speach (substitution)

- speeche (insertion)

- suprise (deletion)

- surprize (substitution)

- there (deletion, insertion)

- untill (insertion)

- vaccuum (insertion)

- vacuum (substitution)

- vacume (deletion, insertion)

really

recommend

seize

separate

speech

surprise

their

until

vacuum

- ✓ 100
- vehicle — vehicle (inception, deletion)  
weather — weather (deletion)  
welfare — welfare (inception)  
— welfare (inception, deletion)  
whether — whether (deletion)  
writing — writing (inception)  
— writing (inception)