

Context Free Grammar Development Program

COMP 6751 Project 2 Demo File

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0. Expectations of originality

I certify that this submission is my original work and meets the Faculty's Expectations of Originality.
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1. Test Scenarios

1.1. Test Scenario 1

Given: User enters the text content: '**John ate an apple**'.

When: The validation data correctly input.

Result: Program can run successfully, and the text preprocess pipeline and proofreading results given.

Conclusion: The program can preprocess and proofread the text content. Sentences split, pos tag, name entity, Earley parse and Earley parse process results are displayed as **Figures 1, 2, 3, and 4** shown below.

```
Run: PreProcess ×
/usr/local/bin/python3.9 /Users/zouhaochen/PycharmProjects/COMP_6751/Project2/PreProcess.py
Please enter the text you want to parse:
John ate an apple.

Options to the results: save/print
Do you want to save the parse tree? N
Do you want to print the parse tree? Y

[Sentences Splitting]
['John ate an apple.']

[POS Tagging]
[[('John', 'NNP'), ('ate', 'VBP'), ('an', 'DT'), ('apple', 'NN')]]

[Name Entities]
{'John'}

[Earley Parsing]
S[]
(NP[NUM='sg']
 (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John)))
 (VP[NUM=?n, TENSE='past']
  (TV[TENSE='past'] ate)
  (NP[NUM='sg']
   (DT[NUM='sg'] (Det[NUM='sg'] an))
   (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))))
)

[Earley Parse Process]
|.Joh.ate. an.apple.
|[--] . . .| [0:1] 'John'
|. [--] . .| [1:2] 'ate'
|. . [--] .| [2:3] 'an'
|. . . [--]| [3:4] 'apple'
|[--] . . .| [0:1] PropN[NUM='sg'] -> 'John' *
|[--] . . .| [0:1] NNP[NUM='sg'] -> PropN[NUM='sg'] *
|[--> . . .| [0:1] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|[--] . . .| [0:1] Nom[NUM='sg'] -> NNP[NUM='sg'] *
|[--> . . .| [0:1] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
```

Figure 1. Test scenario 1 result: 'John ate an apple.'

Run: PreProcess

```

[Earley Parse Process]
|.Joh.ate. an.app.
|[--] . . . [0:1] 'John'
|. . . . . [1:2] 'ate'
|. . . . . [2:3] 'an'
|. . . . . [3:4] 'apple'
|--- . . . . [0:1] Prop[NUM='sg'] -> 'John' *
|--- . . . . [0:1] NNP[NUM='sg'] -> PropN[NUM='sg'] *
|--- . . . . [0:1] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|--- . . . . [0:1] Nom[NUM='sg'] -> NNP[NUM='sg'] *
|--- . . . . [0:1] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
|--- . . . . [0:1] NP[NUM='sg'] -> Nom[NUM='sg'] *
|--- . . . . [0:1] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|--- . . . . [0:1] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|--- . . . . [0:1] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|--- . . . . [0:1] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|--- . . . . [0:1] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|. . . . [1:2] TV[TENSE='past'] -> 'ate' *
|. . . . [1:2] IV[TENSE='past'] -> 'ate' *
|. . . . [1:2] VP[NUM=?n, TENSE=?t] -> IV[TENSE=?t] * TO[] VP[TENSE='inf'] {?t: 'past'}
|. . . . [1:2] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] *
|. . . . [1:2] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|. . . . [1:2] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|--- . . . [0:2] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|--- . . . [0:2] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|--- . . . [0:2] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. . . . [0:2] S[] -> VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
|--- . . . [0:2] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] {?n: 'sg'}
|--- . . . [0:2] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|. . . . [2:3] Det[NUM='sg'] -> 'an' *
|. . . . [2:3] DT[NUM='sg'] -> Det[NUM='sg'] *
|. . . . [2:3] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n: 'sg'}
|. . . . [2:3] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n: 'sg'}
|. . . . [2:3] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n: 'sg'}
|. . . . [3:4] NN[] -> 'apple' *
|. . . . [3:4] N[NUM='sg'] -> NN[] *
|. . . . [3:4] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|. . . . [3:4] NP[NUM=?n] -> N[] * Nom[NUM=?n] {}
|. . . . [3:4] Nom[NUM=?n] -> N[] *
|. . . . [3:4] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
|. . . . [3:4] NP[NUM=?n] -> Nom[NUM=?n] *
|. . . . [2:4] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] *
|. . . . [2:4] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n: 'sg', ?n2: 'sg'}
|. . . . [2:4] NP[NUM=?n] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|. . . . [2:4] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|. . . . [2:4] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|. . . . [2:4] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n: 'sg'}
|. . . . [2:4] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|. . . . [1:4] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|. . . . [1:4] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|. . . . [1:4] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|=====[0:4] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|=====[0:4] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|=====[0:4] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. . . . [3:4] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|. . . . [3:4] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|. . . . [3:4] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|. . . . [3:4] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|. . . . [3:4] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
<generator object FeatureChart.parses at 0x7fb3f897c6d0>

```

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Figure 2. Test scenario 1 result: 'John ate an apple.'

Run: PreProcess

```

[Earley Parse Process]
|[--] . . . [0:2] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. . . . [1:2] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
|--- . . . [0:2] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] {?n: 'sg'}
|--- . . . [0:2] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|. . . . [2:3] Det[NUM='sg'] -> 'an' *
|. . . . [2:3] DT[NUM='sg'] -> Det[NUM='sg'] *
|. . . . [2:3] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n: 'sg'}
|. . . . [2:3] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n: 'sg'}
|. . . . [2:3] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n: 'sg'}
|. . . . [3:4] NN[] -> 'apple' *
|. . . . [3:4] N[NUM='sg'] -> NN[] *
|. . . . [3:4] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|. . . . [3:4] NP[NUM=?n] -> N[] * Nom[NUM=?n] {}
|. . . . [3:4] Nom[NUM=?n] -> N[] *
|. . . . [3:4] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
|. . . . [3:4] NP[NUM=?n] -> Nom[NUM=?n] *
|. . . . [2:4] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] *
|. . . . [2:4] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n: 'sg', ?n2: 'sg'}
|. . . . [2:4] NP[NUM=?n] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|. . . . [2:4] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|. . . . [2:4] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|. . . . [2:4] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n: 'sg'}
|. . . . [2:4] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|. . . . [1:4] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|. . . . [1:4] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|. . . . [1:4] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|=====[0:4] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|=====[0:4] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|=====[0:4] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. . . . [3:4] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|. . . . [3:4] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|. . . . [3:4] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|. . . . [3:4] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|. . . . [3:4] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
<generator object FeatureChart.parses at 0x7fb3f897c6d0>

```

Process finished with exit code 0

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Figure 3. Test scenario 1 result: 'John ate an apple.'

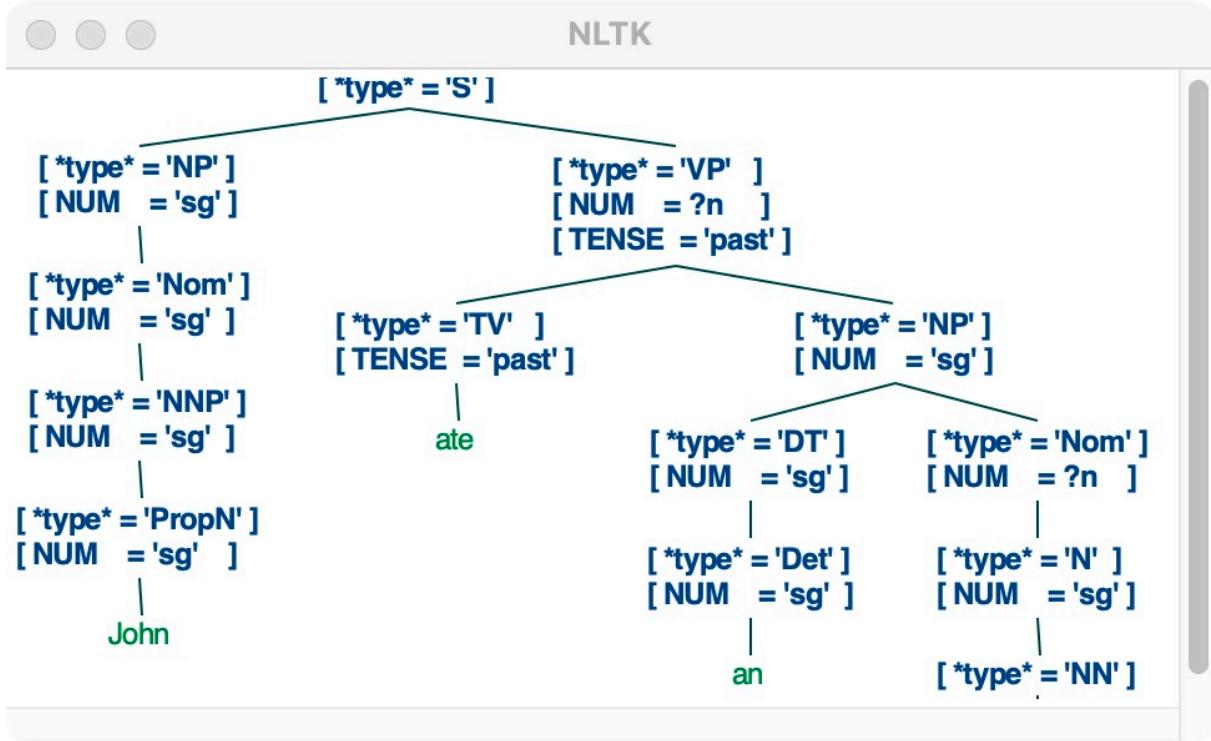


Figure 4. Test scenario 1 result: 'John ate an apple.'

1.2. Test Scenario 2

Given: User enters the text content: 'John ate the apple at the table.'

When: The validation data correctly input.

Result: Program can run successfully, and the text preprocess pipeline and proofreading results given.

Conclusion: The program can preprocess and proofread the text content. Sentences split, pos tag, name entity, Earley parse and Earley parse process results are displayed as Figures 5 ~ 11 shown below.

```
Run: PreProcess
/usr/Local/bin/python3.9 /Users/zouhaochen/PycharmProjects/COMP_6751/Project2/PreProcess.py
Please enter the text you want to parse:
John ate the apple at the table.

Options to the results: save/print
Do you want to save the parse tree? N
Do you want to print the parse tree? Y

[Sentences Splitting]
['John ate the apple at the table.']

[POS Tagging]
[['John', 'NNP'], ('ate', 'VBP'), ('the', 'DT'), ('apple', 'NN'), ('at', 'IN'), ('the', 'DT'), ('table', 'NN')]

[Name Entities]
{'John'}

[Earley Parsing]
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John))))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past'] ate)
    (NP[NUM=?n]
      (DT[NUM=?n] (Det[NUM=?n] the))
      (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))))
  (PP[])
    (IN[] (P[] at))
    (NP[NUM=?n]
      (DT[NUM=?n] (Det[NUM=?n] the))
      (Nom[NUM=?n] (N[NUM='sg'] (NN[] table))))))
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John))))
  (VP[NUM=?n, TENSE='past']
    (TV[TENSE='past'] ate)
    (NP[NUM=?n])))
```

Figure 5. Test scenario 2 result: 'John ate the apple at the table.'

The screenshot shows a software interface for a parser named 'PreProcess'. The main window displays a parse tree for the sentence 'John ate the apple at the table'. The tree starts with an S node, which branches into NP (NUM='sg') and VP. The NP node further branches into (Nom[NUM='sg']) and (NNP[NUM='sg'] (PropN[NUM='sg'] John))). The VP node branches into (VP[NUM=?n, TENSE='past']) and (NP[NUM=?n]). The (VP) node branches into (TV[TENSE='past'] ate) and (NP[NUM=?n]). The (NP) node branches into (DT[NUM=?n] (Det[NUM=?n] the)) and (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))). The (PP) node branches into (IN[] (P[] at)) and (NP[NUM=?n]). The (NP) node branches into (DT[NUM=?n] (Det[NUM=?n] the)) and (Nom[NUM=?n] (N[NUM='sg'] (NN[] table))))). The bottom section of the interface is labeled '[Earley Parse Process]' and lists the steps taken by the Earley parser to derive this tree, including transitions like PropN[NUM='sg'] -> 'John' *, NP[NUM=?n] -> NP[NUM=?n] * CC[], and various state transitions involving S, NP, VP, and TV nodes.

```

Run: PreProcess ×
S[]
  (NP[NUM='sg']
    (Nom[NUM='sg']) (NNP[NUM='sg'] (PropN[NUM='sg'] John)))
  (VP[NUM=?n, TENSE='past']
    (TV[TENSE='past'] ate)
  (NP[NUM=?n]
    (DT[NUM=?n] (Det[NUM=?n] the))
    (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))
  (PP[])
    (IN[] (P[] at))
  (NP[NUM=?n]
    (DT[NUM=?n] (Det[NUM=?n] the))
    (Nom[NUM=?n] (N[NUM='sg'] (NN[] table)))))))
  [Earley Parse Process]
  I.J.a.t.a.a.t.t.
  |[-] . . . . .| [0:1] 'John'
  |. [-] . . . . .| [1:2] 'ate'
  |. . [-] . . . . .| [2:3] 'the'
  |. . . [-] . . . . .| [3:4] 'apple'
  |. . . . [-] . . . . .| [4:5] 'at'
  |. . . . . [-] . . . . .| [5:6] 'the'
  |. . . . . . [-] . . . . .| [6:7] 'table'
  |[-] . . . . . .| [0:1] PropN[NUM='sg'] -> 'John' *
  |[-] . . . . . .| [0:1] NNP[NUM='sg'] -> PropN[NUM='sg'] *
  |[> . . . . . .| [0:1] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
  |[-] . . . . . .| [0:1] Nom[NUM='sg'] -> NNP[NUM='sg'] *
  |[> . . . . . .| [0:1] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
  |[-] . . . . . .| [0:1] NP[NUM='sg'] -> Nom[NUM='sg'] *
  |[> . . . . . .| [0:1] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
  |[-] . . . . . .| [0:1] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
  |[> . . . . . .| [0:1] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
  |[> . . . . . .| [0:1] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
  |[> . . . . . .| [0:1] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
  |. [-] . . . . . .| [1:2] TV[TENSE='past'] -> 'ate' *
  |. [-] . . . . . .| [1:2] IV[TENSE='past'] -> 'ate' *
  |. [-] . . . . . .| [1:2] VP[NUM=?n, TENSE=?t] -> IV[TENSE=?t] * TO[] VP[TENSE='inf'] {?t: 'past'}
  |. [-] . . . . . .| [1:2] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] *
  
```

Figure 6. Test scenario 2 result: 'John ate the apple at the table.'

This screenshot is identical to Figure 6, showing the same parse tree and Earley process for the sentence 'John ate the apple at the table'. The interface includes a toolbar with icons for Commit, Git, TODO, Duplicates, Run, Python Console, and Terminal.

```

Run: PreProcess ×
  [Earley Parse Process]
  I.J.a.t.a.a.t.t.
  |[-] . . . . .| [0:1] 'John'
  |. [-] . . . . .| [1:2] 'ate'
  |. . [-] . . . . .| [2:3] 'the'
  |. . . [-] . . . . .| [3:4] 'apple'
  |. . . . [-] . . . . .| [4:5] 'at'
  |. . . . . [-] . . . . .| [5:6] 'the'
  |. . . . . . [-] . . . . .| [6:7] 'table'
  |[-] . . . . . .| [0:1] PropN[NUM='sg'] -> 'John' *
  |[-] . . . . . .| [0:1] NNP[NUM='sg'] -> PropN[NUM='sg'] *
  |[> . . . . . .| [0:1] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
  |[-] . . . . . .| [0:1] Nom[NUM='sg'] -> NNP[NUM='sg'] *
  |[> . . . . . .| [0:1] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
  |[-] . . . . . .| [0:1] NP[NUM='sg'] -> Nom[NUM='sg'] *
  |[> . . . . . .| [0:1] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
  |[-] . . . . . .| [0:1] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
  |[> . . . . . .| [0:1] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
  |[> . . . . . .| [0:1] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
  |[> . . . . . .| [0:1] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
  |. [-] . . . . . .| [1:2] TV[TENSE='past'] -> 'ate' *
  |. [-] . . . . . .| [1:2] IV[TENSE='past'] -> 'ate' *
  |. [-] . . . . . .| [1:2] VP[NUM=?n, TENSE=?t] -> IV[TENSE=?t] * TO[] VP[TENSE='inf'] {?t: 'past'}
  |. [-] . . . . . .| [1:2] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] *
  |. [-] . . . . . .| [1:2] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PPL[] {?n2: Variable('?n'), ?t: 'past'}
  |. [-] . . . . . .| [1:2] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PPL[] {?n3: Variable('?n'), ?t: 'past'}
  |[<--] . . . . . .| [0:2] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
  |[<--] . . . . . .| [0:2] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
  |[<--] . . . . . .| [0:2] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
  |. [-] . . . . . .| [1:2] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
  |[<--] . . . . . .| [0:2] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] {?n: 'sg'}
  |[<--] . . . . . .| [0:2] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
  |. [-] . . . . . .| [2:3] Det[NUM=?n] -> 'the' *
  |. . [-] . . . . .| [2:3] DT[NUM=?n] -> Det[NUM=?n] *
  |. . [-] . . . . .| [2:3] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')}
  |. . [-] . . . . .| [2:3] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')}
  |. . [-] . . . . .| [2:3] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')}
  |. . [-] . . . . .| [3:4] NN[] -> 'apple' *
  
```

Figure 7. Test scenario 2 result: 'John ate the apple at the table.'

Run: PreProcess

```

[|---] . . . | [0:2] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[|---> . . . | [0:2] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[|---> . . . | [0:2] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[. [-> . . . | [1:2] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * INTRO[] {?t: 'past'}
[|---> . . . | [0:2] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] {?n: 'sg'}
[|---> . . . | [0:2] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[. . [-] . . . | [2:3] Det[NUM=?n] -> 'the' *
[. . [-] . . . | [2:3] DT[NUM=?n] -> Det[NUM=?n] *
[. . [-] . . . | [2:3] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')}
[. . [-] . . . | [2:3] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')}
[. . [-] . . . | [2:3] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')}
[. . [-] . . . | [3:4] NN[] -> 'apple' *
[. . [-] . . . | [3:4] N[NUM='sg'] -> NN[] *
[. . [-] . . . | [3:4] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
[. . [-] . . . | [3:4] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
[. . [-] . . . | [3:4] Nom[NUM=?n] -> N[] *
[. . [-] . . . | [3:4] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
[. . [-] . . . | [3:4] NP[NUM=?n] -> Nom[NUM=?n] *
[. . [-] . . . | [2:4] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
[. . [-] . . . | [2:4] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[. . [-] . . . | [2:4] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[. . [-] . . . | [2:4] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[. . [-] . . . | [2:4] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[. . [-] . . . | [2:4] S[] -> NP[NUM=?n] * VP[NUM=?n] TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[. . [-] . . . | [2:4] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[. . [-] . . . | [1:4] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[]
[. . [-] . . . | [1:4] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[. . [-] . . . | [1:4] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[. . [-] . . . | [0:4] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[. . [-] . . . | [0:4] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[. . [-] . . . | [0:4] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[. . [-] . . . | [3:4] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[. . [-] . . . | [3:4] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[. . [-] . . . | [3:4] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[. . [-] . . . | [3:4] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[. . [-] . . . | [3:4] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[. . . [-] . . | [4:5] P[] -> 'at' *
[. . . [-] . . | [4:5] IN[] -> P[] *

```

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Figure 8. Test scenario 2 result: 'John ate the apple at the table.'

Run: PreProcess

```

[. . . [-] . . | [4:5] P[] -> 'at' *
[. . . [-] . . | [4:5] IN[] -> P[] *
[. . . [-] . . | [4:5] PP[] -> IN[] * NP[] {}
[. . . [-] . . | [4:5] PP[] -> IN[] * DATE[] {}
[. . . [-] . . | [5:6] Det[NUM=?n] -> 'the' *
[. . . [-] . . | [5:6] DT[NUM=?n] -> Det[NUM=?n] *
[. . . [-] . . | [5:6] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')}
[. . . [-] . . | [5:6] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')}
[. . . [-] . . | [5:6] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')}
[. . . [-] . . | [6:7] NN[] -> 'table' *
[. . . [-] . . | [6:7] N[NUM='sg'] -> NN[] *
[. . . [-] . . | [6:7] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
[. . . [-] . . | [6:7] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
[. . . [-] . . | [6:7] Nom[NUM=?n] -> N[] *
[. . . [-] . . | [6:7] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
[. . . [-] . . | [6:7] NP[NUM=?n] -> Nom[NUM=?n] *
[. . . [-] . . | [5:7] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
[. . . [-] . . | [5:7] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[. . . [-] . . | [5:7] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[. . . [-] . . | [5:7] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[. . . [-] . . | [5:7] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[. . . [-] . . | [5:7] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[. . . [-] . . | [5:7] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[. . . [-] . . | [4:7] PP[] -> IN[] NP[] *
[. . . [-] . . | [4:7] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[. . . [-] . . | [4:7] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[. . . [-] . . | [4:7] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[. . . [-] . . | [4:7] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[. . . [-] . . | [3:7] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
[. . . [-] . . | [2:7] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
[. . . [-] . . | [1:7] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[. . . [-] . . | [1:7] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[. . . [-] . . | [1:7] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[. . . [-] . . | [0:7] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[. . . [-] . . | [0:7] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[. . . [-] . . | [0:7] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[. . . [-] . . | [2:7] S[] -> NP[NUM=?n] VP[NUM=?n] {?n2: Variable('?n')}
[. . . [-] . . | [2:7] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n3: Variable('?n')}

```

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Figure 9. Test scenario 2 result: 'John ate the apple at the table.'

Run: PreProcess X

```

| . . . [-----] [4:7] PP[] -> IN[] NP[] *
| . . . [----->] [4:7] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| . . . [----->] [4:7] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
| . . . [----->] [4:7] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
| . . . [----->] [3:7] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
| . . [----->] [2:7] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
| . [----->] [1:7] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
| . [----->] [1:7] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
| . [----->] [1:7] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
| [=====] [0:7] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [=====] [0:7] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [=====] [0:7] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| . [----->] [2:7] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| . [----->] [2:7] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| . [----->] [2:7] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| . [----->] [2:7] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
| . [----->] [1:7] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
| . [----->] [1:7] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
| . [=====] [0:7] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [=====] [0:7] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [=====] [0:7] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| . [----->] [3:7] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| . [----->] [3:7] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| . [----->] [3:7] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| . [----->] [3:7] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
| . [----->] [6:7] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| . [----->] [6:7] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| . [----->] [6:7] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| . [----->] [6:7] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
| . [----->] [6:7] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
| . . . . . [>] [6:7] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| . . . . . [>] [6:7] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| . . . . . [>] [6:7] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| . . . . . [>] [6:7] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
| . . . . . [>] [6:7] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
<generator object FeatureChart.parses at 0x7fe3d05bc6d0>
```

Process finished with exit code 0

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Figure 10. Test scenario 2 result: 'John ate the apple at the table.'

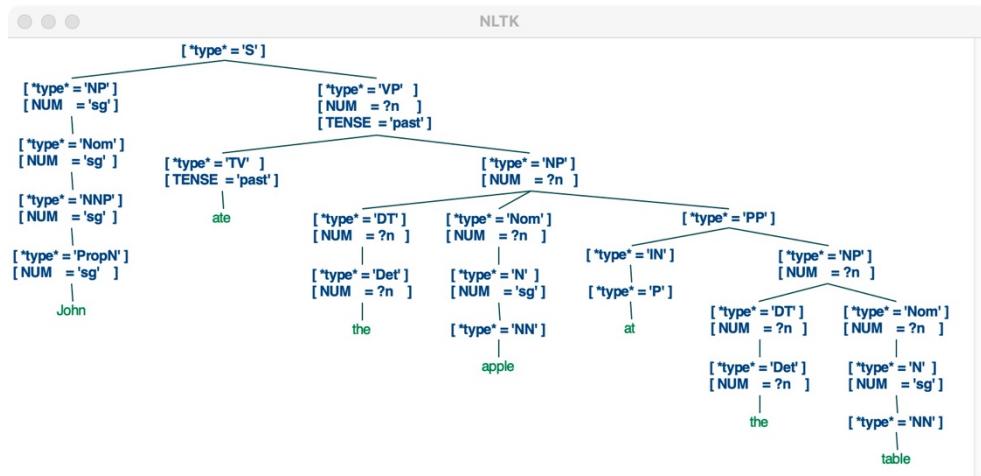
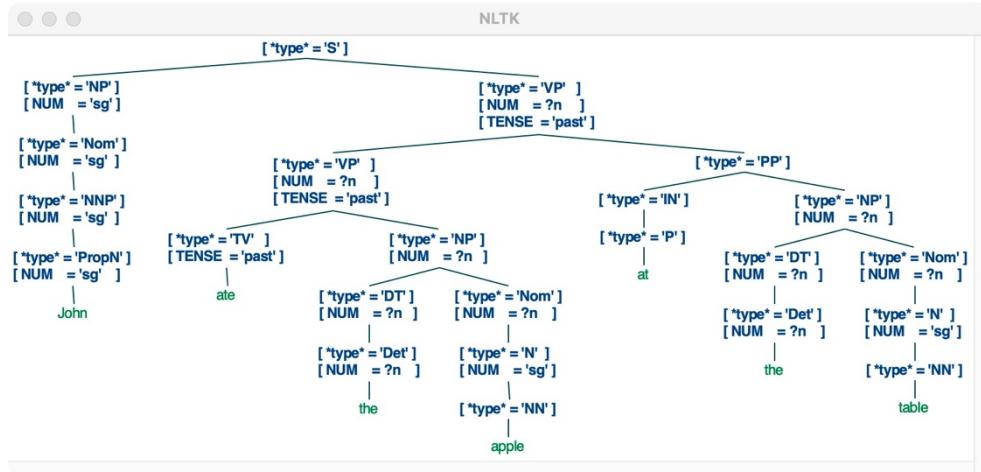


Figure 11. Test scenario 2 result: 'John ate the apple at the table.'

1.3. Test Scenario 3

Given: User enters the text content: 'John, who ate the apple from the fridge, was sick Wednesday.'

When: The validation data correctly input.

Result: Program can run successfully, and the text preprocess pipeline and proofreading results given.

Conclusion: The program can preprocess and proofread the text content. Sentences split, pos tag, name entity, Earley parse and Earley parse process results are displayed as Figures 12 ~ 17 shown below.

```
Run: PreProcess
/usr/local/bin/python3.9 /Users/zouhaochen/PycharmProjects/COMP_6751/Project2/PreProcess.py
Please enter the text you want to parse:
John, who ate the apple from the fridge, was sick Wednesday.

Options to the results: save/print
Do you want to save the parse tree? N
Do you want to print the parse tree? Y

[Sentences Splitting]
['John', 'who', 'ate', 'the', 'apple', 'from', 'the', 'fridge', 'was', 'sick', 'Wednesday.']

[POS Tagging]
[['John', 'NNP'], ('.', ','), ('who', 'WP'), ('ate', 'VBP'), ('the', 'DT'), ('apple', 'NN'), ('from', 'IN'), ('the', 'DT'), ('fridge', 'NN'), ('.', ','), ('.', 'VBD'), ('sick', 'JJ'), ('Wednesday', 'NNP')]

[Name Entities]
{'John'}
```

Figure 12. Test scenario 3 result: 'John, who ate the apple from the fridge, was sick Wednesday.'

```
Run: PreProcess
|[].....| [0:1] 'John'
|..[]....| [1:2] 'who'
|...[]....| [2:3] 'ate'
|....[]....| [3:4] 'the'
|.....[]....| [4:5] 'apple'
|.....[]....| [5:6] 'from'
|.....[]....| [6:7] 'the'
|.....[]....| [7:8] 'fridge'
|.....[]....| [8:9] 'was'
|.....[]....| [9:10] 'sick'
|.....[]....| [10:11] 'Wednesday'
|[].....| [0:1] Prop[ NUM='sg' ] -> 'John' *
|[].....| [0:1] NP[ NUM='sg' ] -> PropN[ NUM='sg' ] *
|[]>.....| [0:1] NP[ NUM=?n ] -> NP[ NUM=?n ] * CC[ ] NP[ NUM=?n ] {?n: 'sg'}
|[].....| [0:1] Nom[ NUM='sg' ] -> NP[ NUM='sg' ] *
|[]>.....| [0:1] NP[ NUM=?n ] -> Nom[ NUM=?n ] * PP[ ] {?n: 'sg'}
|[].....| [0:1] NP[ NUM='sg' ] -> Nom[ NUM='sg' ] *
|[]>.....| [0:1] S[ ] -> NP[ NUM=?n ] * VP[ NUM=?n ] {?n: 'sg'}
|[]>.....| [0:1] S[ ] -> NP[ NUM=?n ] * VP[ NUM=?n ] DATE[ ] {?n: 'sg'}
|[]>.....| [0:1] S[ ] -> NP[ NUM=?n ] * VP[ NUM=?n ] CC[ ] TV[ NUM=?n ] INTRO[ ] S[ ] {?n: 'sg'}
|[]>.....| [0:1] S[ ] -> NP[ NUM=?n ] * TV[ NUM=?n ] INTRO[ ] S[ ] {?n: 'sg'}
|[]>.....| [0:1] S[ ] -> NP[ NUM=?n ] * TV[ NUM=?n ] INTRO[ ] S[ ] CC[ ] IN[ ] S[ ] {?n: 'sg'}
|[].....| [1:2] NP[ +WH ] -> 'who' *
|[]>.....| [1:2] S[ ] -> NP[ NUM=?n ] * VP[ NUM=?n ] {}
|[]>.....| [1:2] S[ ] -> NP[ NUM=?n ] * VP[ NUM=?n ] DATE[ ] {}
|[]>.....| [1:2] S[ ] -> NP[ NUM=?n ] * VP[ NUM=?n ] CC[ ] TV[ NUM=?n ] INTRO[ ] S[ ] {}
|[]>.....| [1:2] S[ ] -> NP[ NUM=?n ] * TV[ NUM=?n ] INTRO[ ] S[ ] {}
|[]>.....| [1:2] S[ ] -> NP[ NUM=?n ] * TV[ NUM=?n ] INTRO[ ] S[ ] CC[ ] IN[ ] S[ ] {}
|[].....| [2:3] TV[ TENSE='past' ] -> 'ate' *
|[].....| [2:3] IV[ TENSE='past' ] -> 'ate' *
|[]>.....| [2:3] VP[ NUM=?n, TENSE=?t ] -> IV[ TENSE=?t ] * TO[ ] VP[ TENSE='inf' ] {?t: 'past'}
|[].....| [2:3] VP[ NUM=?n, TENSE='past' ] -> IV[ TENSE='past' ] *
|[]>.....| [2:3] VP[ NUM=?n, TENSE=?t ] -> VP[ NUM=?n, TENSE=?t ] * PP[ ] {?n2: Variable('?n'), ?t: 'past'}
|[]>.....| [2:3] VP[ NUM=?n, TENSE=?t ] -> VP[ NUM=?n, TENSE=?t ] * PP[ ] {?n3: Variable('?n'), ?t: 'past'}
|[].....| [1:3] S[ ] -> NP[ NUM=?n ] VP[ NUM=?n ] *
|[]>.....| [1:3] S[ ] -> NP[ NUM=?n ] VP[ NUM=?n ] * DATE[ ] {?n2: Variable('?n')}
|[]>.....| [1:3] S[ ] -> NP[ NUM=?n ] VP[ NUM=?n ] * CC[ ] TV[ NUM=?n ] INTRO[ ] S[ ] {?n2: Variable('?n')}
|[]>.....| [2:3] VP[ NUM=?n, TENSE=?t ] -> TV[ NUM=?n, TENSE=?t ] * NP[ ] {?t: 'past'}
```

Figure 13. Test scenario 3 result: 'John, who ate the apple from the fridge, was sick Wednesday.'

Run: PreProcess

```

[...]
1..[>.....| [2:3] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
1..[>.....| [1:3] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] {}
1..[>.....| [1:3] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] CC[] IN[] S[] {}
1..[>.....| [3:4] Det[NUM=?n] -> 'the' *
1..[>.....| [3:4] DT[NUM=?n] -> Det[NUM=?n] *
1..[>.....| [3:4] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')}
1..[>.....| [3:4] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')}
1..[>.....| [3:4] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')}
1..[>.....| [4:5] NN[] -> 'apple' *
1..[>.....| [4:5] N[NUM='sg'] -> NN[] *
1..[>.....| [4:5] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
1..[>.....| [4:5] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
1..[>.....| [4:5] Nom[NUM=?n] -> N[] *
1..[>.....| [4:5] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
1..[>.....| [4:5] NP[NUM=?n] -> Nom[NUM=?n] *
1..[>.....| [3:5] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
1..[>.....| [3:5] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
1..[>.....| [3:5] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
1..[>.....| [3:5] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
1..[>.....| [3:5] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
1..[>.....| [3:5] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
1..[>.....| [3:5] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
1..[>.....| [2:5] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
1..[>.....| [2:5] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
1..[>.....| [2:5] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
1..[>.....| [1:5] S[] -> NP[NUM=?n] VP[NUM=?n] *
1..[>.....| [1:5] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n')}
1..[>.....| [1:5] S[] -> NP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
1..[>.....| [1:5] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
1..[>.....| [1:5] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
1..[>.....| [1:5] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
1..[>.....| [1:5] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
1..[>.....| [1:5] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
1..[>.....| [5:6] P[] -> 'from' *
1..[>.....| [5:6] IN[] -> P[] *
1..[>.....| [5:6] PP[] -> IN[] * NP[] {}
1..[>.....| [5:6] PP[] -> IN[] * DATE[] {}
1..[>.....| [6:7] Det[NUM=?n] -> 'the' *

```

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Figure 14. Test scenario 3 result: ‘John, who ate the apple from the fridge, was sick Wednesday.’

Run: PreProcess

```

[...]
1..[>.....| [6:7] Det[NUM=?n] -> 'the' *
1..[>.....| [6:7] DT[NUM=?n] -> Det[NUM=?n] *
1..[>.....| [6:7] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')}
1..[>.....| [6:7] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')}
1..[>.....| [6:7] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')}
1..[>.....| [7:8] NN[] -> 'fridge' *
1..[>.....| [7:8] N[NUM='sg'] -> NN[] *
1..[>.....| [7:8] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
1..[>.....| [7:8] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
1..[>.....| [7:8] Nom[NUM=?n] -> N[] *
1..[>.....| [7:8] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
1..[>.....| [7:8] NP[NUM=?n] -> Nom[NUM=?n] *
1..[>.....| [6:8] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
1..[>.....| [6:8] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
1..[>.....| [6:8] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
1..[>.....| [6:8] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
1..[>.....| [6:8] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
1..[>.....| [6:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
1..[>.....| [6:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
1..[>.....| [6:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
1..[>.....| [5:8] PP[] -> IN[] NP[] *
1..[>.....| [5:8] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
1..[>.....| [5:8] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
1..[>.....| [5:8] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
1..[>.....| [5:8] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
1..[>.....| [4:8] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
1..[>.....| [3:8] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
1..[>.....| [2:8] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
1..[>.....| [2:8] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
1..[>.....| [2:8] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
1..[>.....| [1:8] S[] -> NP[NUM=?n] VP[NUM=?n] *
1..[>.....| [1:8] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n')}
1..[>.....| [1:8] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
1..[>.....| [3:8] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
1..[>.....| [3:8] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
1..[>.....| [3:8] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
1..[>.....| [3:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
1..[>.....| [3:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
1..[>.....| [2:8] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *

```

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Figure 15. Test scenario 3 result: ‘John, who ate the apple from the fridge, was sick Wednesday.’

Run: PreProcess

```

|..[---->...| [2:8] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|..[---->...| [2:8] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|..[---->...| [2:8] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|..[---->...| [1:8] S[] -> NP[NUM=?n] VP[NUM=?n] *
|..[---->...| [1:8] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n')}
|..[---->...| [1:8] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|..[---->...| [4:8] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|..[---->...| [4:8] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|..[---->...| [4:8] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|..[---->...| [4:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|..[---->...| [4:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[>...| [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[>...| [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[>...| [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[>...| [7:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[>...| [7:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[>...| [8:9] AUX[TENSE='past'] -> 'was' *
|.....[>...| [8:9] VP[NUM=?n, TENSE=?t] -> AUX[TENSE=?t] * JJ[] {?t: 'past'}
|.....[>...| [9:10] JJ[] -> 'sick' *
|.....[>...| [9:10] DATE[] -> JJ[] * WEEK[] {}
|.....[-.| [8:10] VP[NUM=?n, TENSE='past'] -> AUX[TENSE='past'] JJ[] *
|.....[-.| [8:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[-.| [8:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[-.| [6:10] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[>>.| [6:10] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [6:10] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [3:10] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[>>.| [3:10] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [3:10] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [4:10] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[>>.| [4:10] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [4:10] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [7:10] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[>>.| [7:10] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [7:10] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [10:11] WEEK[] -> 'Wednesday' *
|.....[>.| [10:11] DATE[] -> WEEK[] *
|.....[-.| [9:11] DATE[] -> JJ[] WEEK[] *

```

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Figure 16. Test scenario 3 result: ‘John, who ate the apple from the fridge, was sick Wednesday.’

Run: PreProcess

```

|.....[>...| [7:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[>...| [7:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[-.| [8:9] AUX[TENSE='past'] -> 'was' *
|.....[>...| [8:9] VP[NUM=?n, TENSE=?t] -> AUX[TENSE=?t] * JJ[] {?t: 'past'}
|.....[>...| [9:10] JJ[] -> 'sick' *
|.....[>...| [9:10] DATE[] -> JJ[] * WEEK[] {}
|.....[-.| [8:10] VP[NUM=?n, TENSE='past'] -> AUX[TENSE='past'] JJ[] *
|.....[-.| [8:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[-.| [8:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[-.| [6:10] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[>>.| [6:10] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [6:10] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [3:10] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[>>.| [3:10] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [3:10] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [4:10] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[>>.| [4:10] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [4:10] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [7:10] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[>>.| [7:10] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [7:10] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[>>.| [10:11] WEEK[] -> 'Wednesday' *
|.....[>.| [10:11] DATE[] -> WEEK[] *
|.....[-.| [9:11] DATE[] -> JJ[] WEEK[] *
|.....[>.| [9:11] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.....[>.| [9:11] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.....[>.| [9:11] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|.....[>.| [10:11] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.....[>.| [10:11] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.....[>.| [10:11] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|.....[>.| [6:11] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] *
|.....[>.| [3:11] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] *
|.....[>.| [4:11] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] *
|.....[>.| [7:11] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] *
<generator object FeatureChart.parsers at 0x7fac8497a190>

Process finished with exit code 0

```

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Figure 17. Test scenario 3 result: ‘John, who ate the apple from the fridge, was sick Wednesday.’

1.4. Test Scenario 4

Given: User enters the text content: '**On Monday, John ate the apple in his office.**'.

When: The validation data correctly input.

Result: Program can run successfully, and the text preprocess pipeline and proofreading results given.

Conclusion: The program can preprocess and proofread the text content. Sentences split, pos tag, name entity, Earley parse and Earley parse process results are displayed as **Figures 18 ~ 25** shown below.

```

Run: PreProcess
/usr/local/bin/python3.9 /Users/zouhaochen/PycharmProjects/COMP_6751/Project2/PreProcess.py
Please enter the text you want to parse:
On Monday, John ate the apple in his office.

Options to the results: save/print
Do you want to save the parse tree? N
Do you want to print the parse tree? Y

[Sentences Splitting]
['On Monday, John ate the apple in his office.']

[POS Tagging]
[ [('On', 'IN'), ('Monday', 'NNP'), ('.', ','), ('John', 'NNP'), ('ate', 'VBP'), ('the', 'DT'), ('apple', 'NN'), ('in', 'IN'), ('his', 'PRP$'), ('office', 'NN') ] ]

[Name Entities]
{'John'}

[Earley Parsing]
(S[])
  (PP[] (IN[] (P[] On)) (DATE[] (WEEK[] Monday)))
  (COMMA[],)
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John))))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past']
      (TV[TENSE='past'] ate)
      (NP[NUM=?n]
        (DT[NUM=?n] (Det[NUM=?n] the))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))
    )
    (PP[])
      (IN[] (P[] in))
      (NP[NUM=?n]
        (PRP[] his)
        (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] office)))))))
  )

```

Figure 18. Test scenario 4 result: 'On Monday, John ate the apple in his office.'

```

Run: PreProcess
S[]
  (PP[] (IN[] (P[] On)) (DATE[] (WEEK[] Monday)))
  (COMMA[],)
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John))))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past']
      (TV[TENSE='past'] ate)
      (NP[NUM=?n]
        (DT[NUM=?n] (Det[NUM=?n] the))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))
    )
    (PP[])
      (IN[] (P[] in))
      (NP[NUM=?n]
        (PRP[] his)
        (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] office)))))))
  )
  [Earley Parse Process]
  | 0.0.M.J.a.t.a.i.h.o.
  | [-] . . . . . | [0:1] 'On'
  | . [-] . . . . . | [1:2] 'Monday'
  | .. [-] . . . . . | [2:3] 'John'
  | ... [-] . . . . . | [3:4] 'ate'
  | .... [-] . . . . | [4:5] 'the'
  | .... [-] . . . . | [5:6] 'apple'
  | .... . [-] . . | [6:7] 'in'
  | ..... . [-] . | [7:8] 'his'
  | ..... . . [-] | [8:9] 'office'
  | [-] . . . . . | [0:1] P[] -> 'On' *
  | [-] . . . . . | [0:1] IN[] -> P[] *
  | [-> . . . . . | [0:1] PP[] -> IN[] * NP[] {}
  | [-> . . . . . | [0:1] PP[] -> IN[] * DATE[] {}
  | . [-] . . . . . | [1:2] WEEK[] -> 'Monday' *
  | . [-] . . . . . | [1:2] DATE[] -> WEEK[] *
  | . [-> . . . . . | [1:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
  | . [-> . . . . . | [1:2] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
  | . [-> . . . . . | [1:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
  | [--> . . . . . | [0:2] PP[] -> IN[] DATE[] *
  | [--> . . . . . | [0:2] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}

  ⌂ Commit ⌂ Git ⌂ TODO Duplicates ⌂ Run ⌂ Debug Python Console Terminal

```

Figure 19. Test scenario 4 result: 'On Monday, John ate the apple in his office.'

Run: PreProcess

```

|[--] . . . . . | [0:2] PP[] -> IN[] DATE[] *
|(--> . . . . . | [0:2] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|(--> . . . . . | [0:2] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|(--> . . . . . | [0:2] S[] -> PP[] * COMMA[] DATE[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
|. . [-] . . . . . | [2:3] Prop[NAME='sg'] -> 'John' *
|. . [-] . . . . . | [2:3] NNP[NUM='sg'] -> PropN[NUM='sg'] *
|. . [> . . . . . | [2:3] NP[NUM=?n] -> NNP[NUM=?n] * CCl NP[NUM=?n] {?n: 'sg'}
|. . [-] . . . . . | [2:3] Nom[NUM='sg'] -> NNP[NUM=?n] * PP[] {?n: 'sg'}
|. . [-] . . . . . | [2:3] NP[NUM='sg'] -> Nom[NUM=?n] *
|. . [> . . . . . | [2:3] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|. . [> . . . . . | [2:3] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|. . [> . . . . . | [2:3] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|. . [> . . . . . | [2:3] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|. . [> . . . . . | [2:3] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|. . [-] . . . . . | [3:4] TV[TENSE='past'] -> 'ate' *
|. . [-] . . . . . | [3:4] IV[TENSE='past'] -> 'ate' *
|. . [> . . . . . | [3:4] VP[NUM=?n, TENSE=?t] -> IV[TENSE='inf'] * TO[] VP[TENSE='inf'] {?t: 'past'}
|. . [> . . . . . | [3:4] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] *
|. . [> . . . . . | [3:4] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|. . [> . . . . . | [3:4] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|. . [-] . . . . . | [2:4] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|. . [> . . . . . | [2:4] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|. . [> . . . . . | [2:4] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. . [> . . . . . | [3:4] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
|. . [> . . . . . | [2:4] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] {?n: 'sg'}
|. . [> . . . . . | [2:4] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|. . [-] . . . . . | [4:5] Det[NUM=?n] -> 'the' *
|. . . . [-] . . . . | [4:5] DT[NUM=?n] -> Det[NUM=?n] *
|. . . . [-] . . . . | [4:5] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')}
|. . . . [-] . . . . | [4:5] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')}
|. . . . [-] . . . . | [4:5] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')}
|. . . . [-] . . . . | [5:6] NN[] -> 'apple' *
|. . . . [-] . . . . | [5:6] N[NUM='sg'] -> NN[] *
|. . . . [> . . . . | [5:6] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|. . . . [-] . . . . | [5:6] Nom[NUM=?n] -> N[] *
|. . . . [-] . . . . | [5:6] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
|. . . . [-] . . . . | [5:6] NP[NUM=?n] -> Nom[NUM=?n] *
|. . . . [-] . . . . | [4:6] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
|. . . . [-] . . . . | [4:6] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|. . . . [-] . . . . | [4:6] S[] -> NP[NUM=?n] * VP[NUM=?n] * PP[] {?n2: Variable('?n')}
|. . . . [-] . . . . | [4:6] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|. . . . [-] . . . . | [4:6] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|. . . . [-] . . . . | [4:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|. . . . [-] . . . . | [4:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] IN[] CC[] IN[] S[] {?n2: Variable('?n')}
|. . . . [-] . . . . | [3:6] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[]
|. . . . [-] . . . . | [3:6] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|. . . . [-] . . . . | [3:6] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|. . . . [-] . . . . | [2:6] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|. . . . [-] . . . . | [2:6] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|. . . . [-] . . . . | [2:6] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. . . . [-] . . . . | [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] * NP[] {*}
|. . . . [-] . . . . | [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|. . . . [-] . . . . | [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|. . . . [-] . . . . | [5:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|. . . . [-] . . . . | [5:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|. . . . [-] . . . . | [6:7] P[] -> 'in' *
|. . . . [-] . . . | [6:7] IN[] -> P[] *
|. . . . [-] . . . | [6:7] PP[] -> IN[] * NP[] {}
|. . . . [-] . . . | [6:7] PP[] -> IN[] * DATE[] {}
|. . . . [-] . . | [7:8] PRP[] -> 'his' *
|. . . . [-] . | [7:8] NP[NUM=?n] -> PRP[] *
|. . . . [-] . | [7:8] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
|. . . . [-] . | [7:8] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
|. . . . [-] . | [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|. . . . [-] . | [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|. . . . [-] . | [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|. . . . [-] . | [7:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|. . . . [-] . | [7:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}

```

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Figure 20. Test scenario 4 result: 'On Monday, John ate the apple in his office.'

Run: PreProcess

```

|. . . . [-] . . . . | [5:6] NN[] -> 'apple' *
|. . . . [-] . . . . | [5:6] N[NUM='sg'] -> NN[] *
|. . . . [-] . . . . | [5:6] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|. . . . [-] . . . . | [5:6] Nom[NUM=?n] -> N[] *
|. . . . [-] . . . . | [5:6] NP[NUM=?n] -> Nom[NUM=?n] *
|. . . . [-] . . . . | [5:6] NP[NUM=?n] -> Nom[NUM=?n] *
|. . . . [-] . . . . | [4:6] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
|. . . . [-] . . . . | [4:6] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|. . . . [-] . . . . | [4:6] S[] -> NP[NUM=?n] * VP[NUM=?n] * PP[] {?n2: Variable('?n')}
|. . . . [-] . . . . | [4:6] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|. . . . [-] . . . . | [4:6] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|. . . . [-] . . . . | [4:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|. . . . [-] . . . . | [4:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] IN[] CC[] IN[] S[] {?n2: Variable('?n')}
|. . . . [-] . . . . | [3:6] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[]
|. . . . [-] . . . . | [3:6] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|. . . . [-] . . . . | [3:6] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|. . . . [-] . . . . | [2:6] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|. . . . [-] . . . . | [2:6] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|. . . . [-] . . . . | [2:6] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. . . . [-] . . . . | [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] * NP[] {*}
|. . . . [-] . . . . | [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|. . . . [-] . . . . | [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|. . . . [-] . . . . | [5:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|. . . . [-] . . . . | [5:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|. . . . [-] . . . . | [6:7] P[] -> 'in' *
|. . . . [-] . . . | [6:7] IN[] -> P[] *
|. . . . [-] . . . | [6:7] PP[] -> IN[] * NP[] {}
|. . . . [-] . . . | [6:7] PP[] -> IN[] * DATE[] {}
|. . . . [-] . . | [7:8] PRP[] -> 'his' *
|. . . . [-] . | [7:8] NP[NUM=?n] -> PRP[] *
|. . . . [-] . | [7:8] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
|. . . . [-] . | [7:8] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
|. . . . [-] . | [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|. . . . [-] . | [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|. . . . [-] . | [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|. . . . [-] . | [7:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|. . . . [-] . | [7:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}

```

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Figure 21. Test scenario 4 result: 'On Monday, John ate the apple in his office.'

Run: PreProcess

```

I. . . . . [-] . [7:8] PRP[] -> 'his' *
I. . . . . [-] . [7:8] NP[NUM=?n] -> PRP[] *
I. . . . . [-> .] [7:8] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
I. . . . . [-> .] [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I. . . . . [-> .] [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I. . . . . [-> .] [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I. . . . . [-> .] [7:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I. . . . . [-> .] [7:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I. . . . . [-> .] [6:8] PP[] -> IN[] NP[] *
I. . . . . [->> .] [6:8] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I. . . . . [->> .] [6:8] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
I. . . . . [->> .] [6:8] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
I. . . . . [->> .] [6:8] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
I. . . . . [-----] . [5:8] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
I. . . . . [-----] . [4:8] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
I. . . . . [-----] . [3:8] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
I. . . . . [-----> .] [3:8] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
I. . . . . [-----> .] [3:8] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
I. . . . . [-----] . [2:8] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I. . . . . [-----] . [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I. . . . . [-----] . [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I. . . . . [-----] . [4:8] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I. . . . . [-----] . [4:8] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I. . . . . [-----] . [4:8] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I. . . . . [-----] . [4:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I. . . . . [-----] . [4:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I. . . . . [-----] . [3:8] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] NP[] *
I. . . . . [-----] . [3:8] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
I. . . . . [-----] . [3:8] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
I. . . . . [-----] . [2:8] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I. . . . . [-----] . [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I. . . . . [-----] . [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I. . . . . [-----] . [5:8] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I. . . . . [-----] . [5:8] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I. . . . . [-----] . [5:8] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I. . . . . [-----] . [5:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I. . . . . [-----] . [5:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I. . . . . [-----] . [5:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}

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Figure 22. Test scenario 4 result: 'On Monday, John ate the apple in his office.'

Run: PreProcess

```

I. . . . . [-----> .] [5:8] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I. . . . . [-----> .] [5:8] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I. . . . . [-----> .] [5:8] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I. . . . . [-----> .] [5:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I. . . . . [-----> .] [5:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I. . . . . [-] [8:9] NN[] -> 'office' *
I. . . . . [-] [8:9] NN[] [NUM='sg'] -> NN[] *
I. . . . . [-> .] [8:9] NP[NUM=?n] -> NN[] * CC[] NP[NUM=?n] {?n: 'sg'}
I. . . . . [-> .] [8:9] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
I. . . . . [-] [8:9] Nom[NUM=?n] -> N[] *
I. . . . . [-> .] [8:9] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
I. . . . . [-] [8:9] NP[NUM=?n] ->
I. . . . . [-> .] [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I. . . . . [-> .] [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I. . . . . [-> .] [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I. . . . . [-> .] [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I. . . . . [-> .] [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I. . . . . [-> .] [7:9] NP[NUM=?n] -> PRP[] NP[NUM=?n] *
I. . . . . [-> .] [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I. . . . . [-> .] [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I. . . . . [-> .] [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I. . . . . [-> .] [7:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I. . . . . [-> .] [7:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I. . . . . [-----] [6:9] PP[] -> IN[] NP[] *
I. . . . . [-----> .] [6:9] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I. . . . . [-----] [6:9] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
I. . . . . [-----> .] [6:9] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
I. . . . . [-----> .] [6:9] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
I. . . . . [-----] [5:9] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
I. . . . . [-----] [4:9] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
I. . . . . [-----] [3:9] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
I. . . . . [-----] [3:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
I. . . . . [-----] [3:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
I. . . . . [-----] [2:9] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I. . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I. . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I. . . . . [-----] [4:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I. . . . . [-----] [4:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}

```

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Figure 23. Test scenario 4 result: 'On Monday, John ate the apple in his office.'

Run: PreProcess

```

I. . . . . [--->] [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I. . . . . [--->] [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I. . . . . [--->] [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I. . . . . [--->] [7:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I. . . . . [--->] [6:9] S[] -> IN[] NP[] *
I. . . . . [--->] [6:9] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I. . . . . [--->] [6:9] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
I. . . . . [--->] [6:9] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
I. . . . . [-----] [5:9] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
I. . . . . [-----] [4:9] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
I. . . . . [-----] [3:9] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
I. . . . . [-----] [3:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
I. . . . . [-----] [2:9] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I. . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I. . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I. . . . . [-----] [4:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I. . . . . [-----] [4:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I. . . . . [-----] [4:9] S[] -> NP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I. . . . . [-----] [4:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I. . . . . [-----] [3:9] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
I. . . . . [-----] [3:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
I. . . . . [-----] [2:9] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I. . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I. . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I. . . . . [-----] [5:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I. . . . . [-----] [5:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I. . . . . [-----] [5:9] S[] -> NP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I. . . . . [-----] [5:9] S[] -> NP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I. . . . . [-----] [5:9] S[] -> NP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
<generator object FeatureChart.parses at 0x7fcac5ce8f6d0>

```

Process finished with exit code 0

Figure 24. Test scenario 4 result: 'On Monday, John ate the apple in his office.'

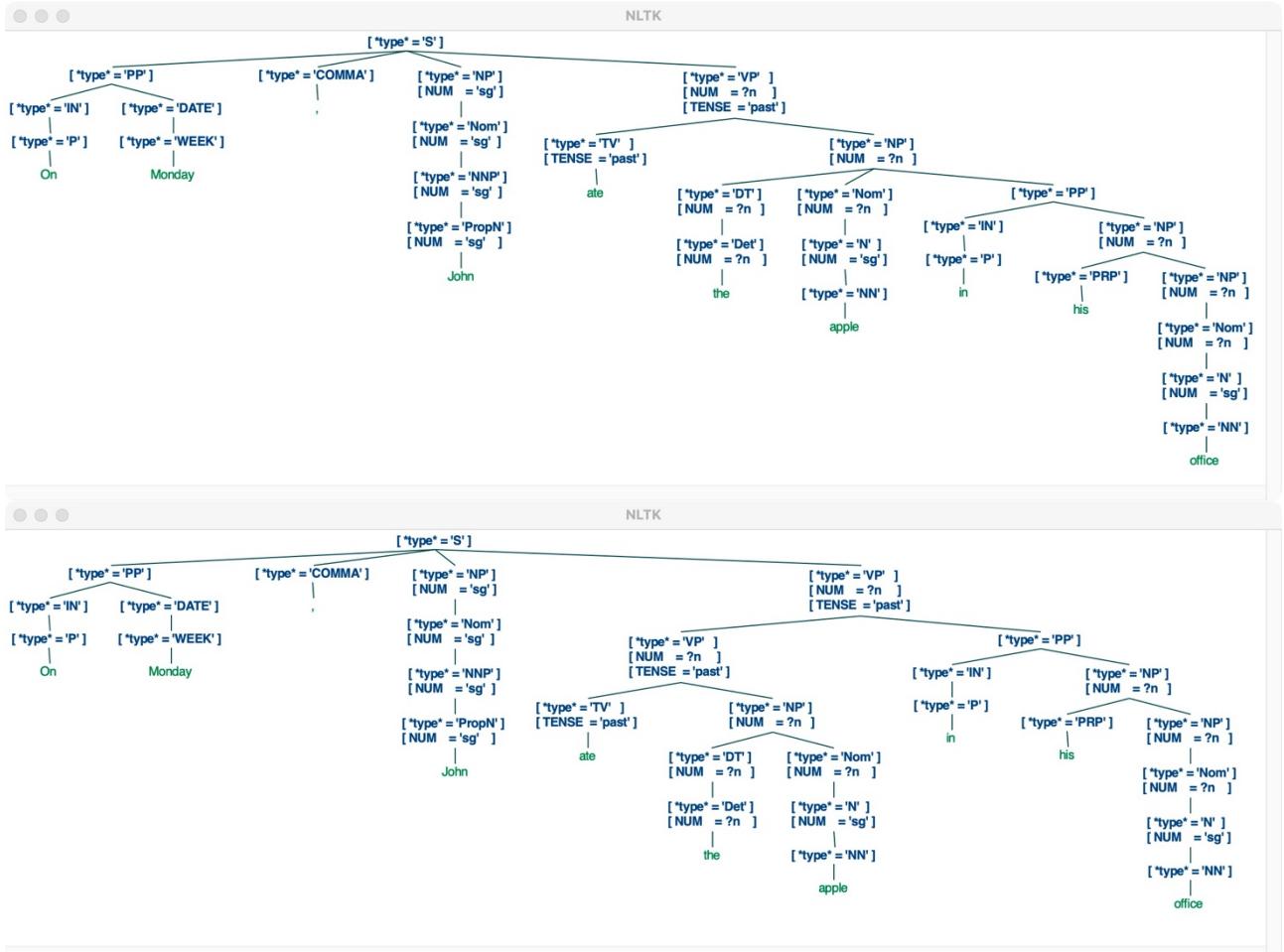


Figure 25. Test scenario 4 result: 'On Monday, John ate the apple in his office.'

1.5. Test Scenario 5

Given: User enters the text content: '**On Monday, John ate the apple in his office.**'.

When: The validation data correctly input.

Result: Program can run successfully, and the text preprocess pipeline and proofreading results given.

Conclusion: The program can preprocess and proofread the text content. Sentences split, pos tag, name entity, Earley parse and Earley parse process results are displayed as **Figures 26 ~ 33** shown below.

```

Run: PreProcess
/usr/local/bin/python3.9 /Users/zouhaochen/PycharmProjects/COMP_6751/Project2/PreProcess.py
Please enter the text you want to parse:
On Monday, John ate refrigerator apple in his office.

Options to the results: save/print
Do you want to save the parse tree? N
Do you want to print the parse tree? Y

[Sentences Splitting]
['On Monday, John ate refrigerator apple in his office.']

[POS Tagging]
[ [('On', 'IN'), ('Monday', 'NNP'), ('.', ','), ('John', 'NNP'), ('ate', 'NN'), ('refrigerator', 'NN'), ('apple', 'NN'), ('in', 'IN'), ('his', 'PRP$'), ('office', 'NN') ] ]

[Name Entities]
{'John'}

[Earley Parsing]
S()
  (PP[] (IN[] (P[] On)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John))))
    (VP[NUM=?n, TENSE='past']
      (VP[NUM=?n, TENSE='past'] ate)
      (NP[NUM=?n]
        (Nom[NUM=?n]
          (N[NUM='sg'] (NN[] refrigerator))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))))
    )
  (PP[])
    (IN[] (P[] in))
    (NP[NUM=?n]
      (PRP[] his)
      (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] office)))))))

```

Figure 26. Test scenario 5 result: '**On Monday, John ate the apple in his office.**'

```

Run: PreProcess
S()
  (PP[] (IN[] (P[] On)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John))))
    (VP[NUM=?n, TENSE='past']
      (TV[TENSE='past'] ate)
      (NP[NUM=?n]
        (Nom[NUM=?n]
          (N[NUM='sg'] (NN[] refrigerator))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))))
    )
  (PP[])
    (IN[] (P[] in))
    (NP[NUM=?n]
      (PRP[] his)
      (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] office)))))))

```

[Earley Parse Process]

```

I.O.M.J.a.r.a.i.h.o.
|[-] . . . . . | [0:1] 'On'
|.. [-] . . . . | [1:2] 'Monday'
|.. . [-] . . . . | [2:3] 'John'
|.. .. [-] . . . . | [3:4] 'ate'
|.. .. . [-] . . . . | [4:5] 'refrigerator'
|.. .. . . [-] . . | [5:6] 'apple'
|.. .. . . . [-] . | [6:7] 'in'
|.. .. . . . . [-] . | [7:8] 'his'
|.. .. . . . . . [-] | [8:9] 'office'
|[-] . . . . . . | [0:1] P[] -> 'On' *
|[-] . . . . . . | [0:1] IN[] -> P[] *
|[-> . . . . . . | [0:1] PP[] -> IN[] * NP[] {}
|[-> . . . . . . | [0:1] PP[] -> IN[] * DATE[] {}
|.. [-] . . . . . . | [1:2] WEEK[] -> 'Monday' *
|.. [-] . . . . . . | [1:2] DATE[] -> WEEK[] *
|.. [-> . . . . . . | [1:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.. [-> . . . . . . | [1:2] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.. [-> . . . . . . | [1:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|[- --] . . . . . . | [0:2] PP[] -> IN[] DATE[]

```

Figure 27. Test scenario 5 result: '**On Monday, John ate the apple in his office.**'

```
PreProcess > Run > Python Console
```

[---] | [0:2] PP[] -> IN[] DATE[] *

[--> | [0:2] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}

[--> | [0:2] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}

[--> | [0:2] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}

[--> | [0:2] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}

. . [-] | [2:3] PropN[NUM='sg'] -> 'John' *

. . [-] | [2:3] NNP[NUM='sg'] -> PropN[NUM='sg'] *

. . [-> | [2:3] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}

. . [-] | [2:3] Nom[NUM='sg'] -> NNP[NUM='sg'] *

. . [-> | [2:3] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}

. . [-] | [2:3] NP[NUM='sg'] -> Nom[NUM='sg'] *

. . [-> | [2:3] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}

. . [-> | [2:3] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {} {?n: 'sg'}

. . [-> | [2:3] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}

. . [-> | [2:3] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}

. . [-> | [2:3] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}

. . [-> | [3:4] TV[TENSE='past'] -> 'ate' *

. . [-] | [3:4] IV[TENSE='past'] -> 'ate' *

. . [-> | [3:4] VP[NUM=?n, TENSE=?t] -> IV[TENSE=?t] * TO[] VP[TENSE='inf'] {?t: 'past'}

. . [-] | [3:4] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] *

. . [-> | [3:4] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}

. . [-> | [3:4] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}

. . [-> | [2:4] S[] -> NP[NUM='sg'] VP[NUM='sg'] *

. . [-> | [2:4] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}

. . [-> | [2:4] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}

. . [-> | [3:4] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}

. . [-> | [2:4] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] {?n: 'sg'}

. . [-> | [2:4] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}

. . [-] | [4:5] NN[] -> 'refrigerator' *

. . [-] | [4:5] N[NUM='sg'] -> NN[] *

. . [-> | [4:5] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}

. . [-> | [4:5] Nom[NUM=?n] -> NI[] * Nom[NUM=?n] {}

. . [-] | [4:5] Nom[NUM=?n] -> NI[] *

. . [-> | [4:5] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}

. . [-] | [4:5] NP[NUM=?n] -> Nom[NUM=?n] *

. . [-> | [4:5] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}

. . [-> | [4:5] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}

. . [-> | [4:5] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}

Figure 28. Test scenario 5 result: ‘On Monday, John ate the apple in his office.’

```
Run: PreProcess >
+ [- . . . . [-] . . . . | [4:5] NN[] -> 'refrigerator' *
| . . . . [-] . . . . | [4:5] N[NUM='sg'] -> NN[] *
| . . . . [-> . . . . | [4:5] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
| . . . . [-> . . . . | [4:5] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
| . . . . [-] . . . . | [4:5] Non[NUM=?n] -> N[] *
| . . . . [-> . . . . | [4:5] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
| . . . . [-] . . . . | [4:5] NP[NUM=?n] -> Nom[NUM=?n] *
| . . . . [-> . . . . | [4:5] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| . . . . [-> . . . . | [4:5] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| . . . . [-> . . . . | [4:5] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| . . . . [-> . . . . | [4:5] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
| . . . . [-> . . . . | [4:5] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
| . . . . [-> . . . . | [3:5] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
| . . . . [-> . . . . | [3:5] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
| . . . . [-> . . . . | [3:5] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
| . . . . [----] . . . . | [2:5] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| . . . . [----> . . . . | [2:5] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| . . . . [----> . . . . | [2:5] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| . . . . [-] . . . . | [5:6] NN[] -> 'apple' *
| . . . . [-] . . . . | [5:6] N[NUM='sg'] -> NN[] *
| . . . . [-> . . . . | [5:6] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
| . . . . [-> . . . . | [5:6] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
| . . . . [-] . . . . | [5:6] Nom[NUM=?n] -> N[] *
| . . . . [-> . . . . | [5:6] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
| . . . . [-] . . . . | [5:6] NP[NUM=?n] -> Nom[NUM=?n] *
| . . . . [-] . . . . | [4:6] Non[NUM=?n] -> NI[] Non[NUM=?n] *
| . . . . [-> . . . . | [4:6] NP[NUM=?n] -> Non[NUM=?n] * PP[] {?n2: Variable('?n')}
| . . . . [-] . . . . | [4:6] NP[NUM=?n] -> Non[NUM=?n] *
| . . . . [-> . . . . | [4:6] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| . . . . [-> . . . . | [4:6] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| . . . . [-> . . . . | [4:6] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| . . . . [-> . . . . | [4:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
| . . . . [-> . . . . | [3:6] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
| . . . . [-> . . . . | [3:6] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
| . . . . [-> . . . . | [3:6] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
| . . . . [----] . . . . | [2:6] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| . . . . [----> . . . . | [2:6] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
```

Figure 29. Test scenario 5 result: ‘On Monday, John ate the apple in his office.’

Run: PreProcess

```

. . . [-----] . | [2:6] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
. . . [-----> . . | [2:6] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
. . . [-----> . . | [2:6] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
. . . . [-> . . | [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n2: Variable('?n')}
. . . . [-> . . | [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
. . . . [-> . . | [5:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
. . . . [-> . . | [5:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
. . . . [-] . | [6:7] P[] -> 'in' *
. . . . [-] . | [6:7] IN[] -> P[] *
. . . . [> . . | [6:7] PP[] -> IN[] * NP[] {}
. . . . [> . . | [6:7] PP[] -> IN[] * DATE[] {}
. . . . [-] . | [7:8] PRP[] -> 'his' *
. . . . [-] . | [7:8] NP[NUM=?n] -> PRP[] *
. . . . [> . | [7:8] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
. . . . [> . | [7:8] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
. . . . [> . | [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
. . . . [> . | [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
. . . . [> . | [7:8] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
. . . . [> . | [7:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
. . . . [> . | [7:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
. . . . [---] . | [6:8] PP[] -> IN[] NP[] *
. . . . [---] . | [6:8] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
. . . . [---] . | [6:8] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
. . . . [---] . | [6:8] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
. . . . [---> . | [6:8] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
. . . . [---] . | [5:8] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
. . . . [---] . | [4:8] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
. . . . [-----] . | [3:8] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
. . . . [-----> . | [3:8] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
. . . . [-----> . | [3:8] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
. . . . [-----] . | [2:8] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
. . . . [-----> . | [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
. . . . [-----> . | [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
. . . . [-----> . | [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
. . . . [-----> . | [3:8] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] * PP[] {?n2: Variable('?n'), ?t: 'past'}
. . . . [-----> . | [3:8] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
. . . . [-----] . | [2:8] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
. . . . [-----> . | [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
. . . . [-----> . | [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
. . . . [-----> . | [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
. . . . [-----> . | [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] IN[] S[] {?n2: Variable('?n')}
. . . . [-----] . | [8:9] NN[] -> 'office' *
. . . . [---] | [8:9] NN[?n] -> NN[] *
. . . . [---] | [8:9] NP[NUM=?n] -> NN[] *
. . . . [---] | [8:9] NP[NUM=?n] -> CC[] NP[NUM=?n] {?n: 'sg'}
. . . . [---] | [8:9] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
. . . . [---] | [8:9] Nom[NUM=?n] -> N[] *
. . . . [---] | [8:9] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
. . . . [---] | [8:9] NP[NUM=?n] -> Nom[NUM=?n] *
. . . . [---] | [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
. . . . [---] | [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
. . . . [---] | [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
. . . . [---] | [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
. . . . [---] | [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
. . . . [---] | [7:9] NP[NUM=?n] -> PRP[] NP[NUM=?n] *
. . . . [---] | [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
. . . . [---] | [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
. . . . [---] | [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
. . . . [---] | [7:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
. . . . [---] | [7:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
. . . . [---] | [6:9] PP[] -> IN[] NP[] *
. . . . [---] | [6:9] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
. . . . [---] | [6:9] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
. . . . [---] | [6:9] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}

```

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Figure 30. Test scenario 5 result: 'On Monday, John ate the apple in his office.'

Run: PreProcess

```

. . . . [-----> . | [4:8] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
. . . . [-----> . | [4:8] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
. . . . [-----> . | [4:8] S[] -> NP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
. . . . [-----> . | [4:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
. . . . [-----> . | [4:8] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
. . . . [-----> . | [3:8] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] * PP[] {?n2: Variable('?n'), ?t: 'past'}
. . . . [-----> . | [3:8] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
. . . . [-----] . | [2:8] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
. . . . [-----> . | [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
. . . . [-----> . | [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
. . . . [-----> . | [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
. . . . [-----> . | [2:8] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] IN[] S[] {?n2: Variable('?n')}
. . . . [-----] . | [8:9] NN[] -> 'office' *
. . . . [---] | [8:9] NN[?n] -> NN[] *
. . . . [---] | [8:9] NP[NUM=?n] -> NN[] *
. . . . [---] | [8:9] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
. . . . [---] | [8:9] Nom[NUM=?n] -> N[] *
. . . . [---] | [8:9] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
. . . . [---] | [8:9] NP[NUM=?n] -> Nom[NUM=?n] *
. . . . [---] | [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
. . . . [---] | [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
. . . . [---] | [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
. . . . [---] | [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
. . . . [---] | [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
. . . . [---] | [7:9] NP[NUM=?n] -> PRP[] NP[NUM=?n] *
. . . . [---] | [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
. . . . [---] | [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
. . . . [---] | [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
. . . . [---] | [7:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
. . . . [---] | [7:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
. . . . [---] | [6:9] PP[] -> IN[] NP[] *
. . . . [---] | [6:9] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
. . . . [---] | [6:9] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
. . . . [---] | [6:9] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}

```

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Figure 31. Test scenario 5 result: 'On Monday, John ate the apple in his office.'

Run: PreProcess

```

| . . . . . [--->] [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| . . . . . [--->] [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| . . . . . [--->] [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| . . . . . [--->] [7:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
| . . . . . [--->] [6:9] IN[] -> IN[] NP[] *
| . . . . . [--->] [6:9] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| . . . . . [--->] [6:9] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
| . . . . . [--->] [6:9] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
| . . . . . [-----] [5:9] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
| . . . . . [-----] [4:9] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
| . . . . . [-----] [3:9] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
| . . . . . [-----] [3:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
| . . . . . [-----] [2:9] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| . . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| . . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| . . . . . [-----] [4:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| . . . . . [-----] [4:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| . . . . . [-----] [4:9] S[] -> NP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| . . . . . [-----] [4:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
| . . . . . [-----] [3:9] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
| . . . . . [-----] [3:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
| . . . . . [-----] [2:9] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| . . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| . . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| . . . . . [-----] [5:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| . . . . . [-----] [5:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| . . . . . [-----] [5:9] S[] -> NP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| . . . . . [-----] [5:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
| . . . . . [-----] [5:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
<generator object FeatureChart.parses at 0x7fa4479393c0>

```

Process finished with exit code 0

Figure 32. Test scenario 5 result: ‘On Monday, John ate the apple in his office.’

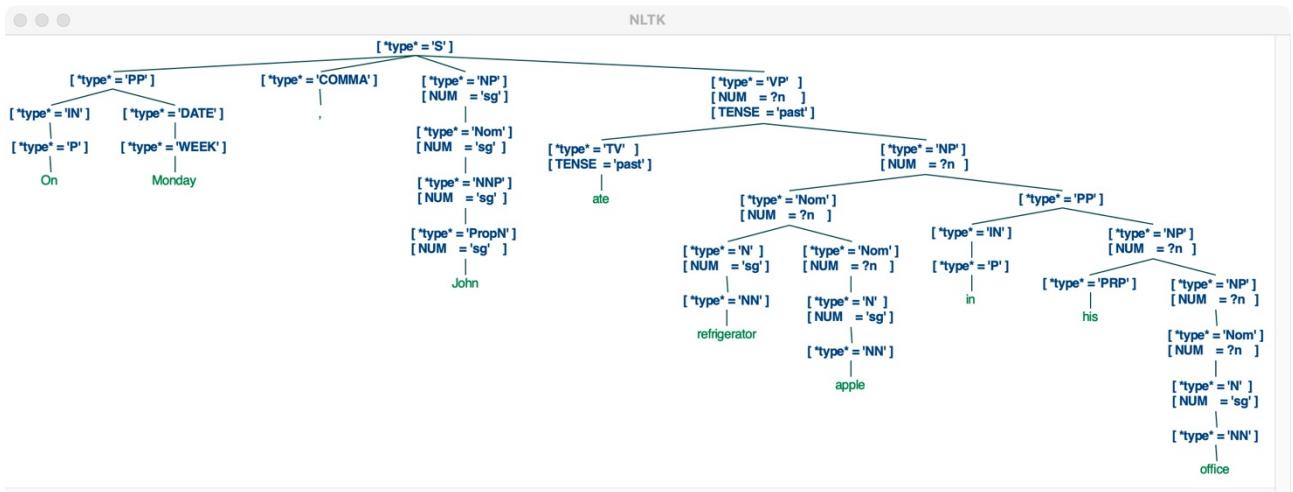
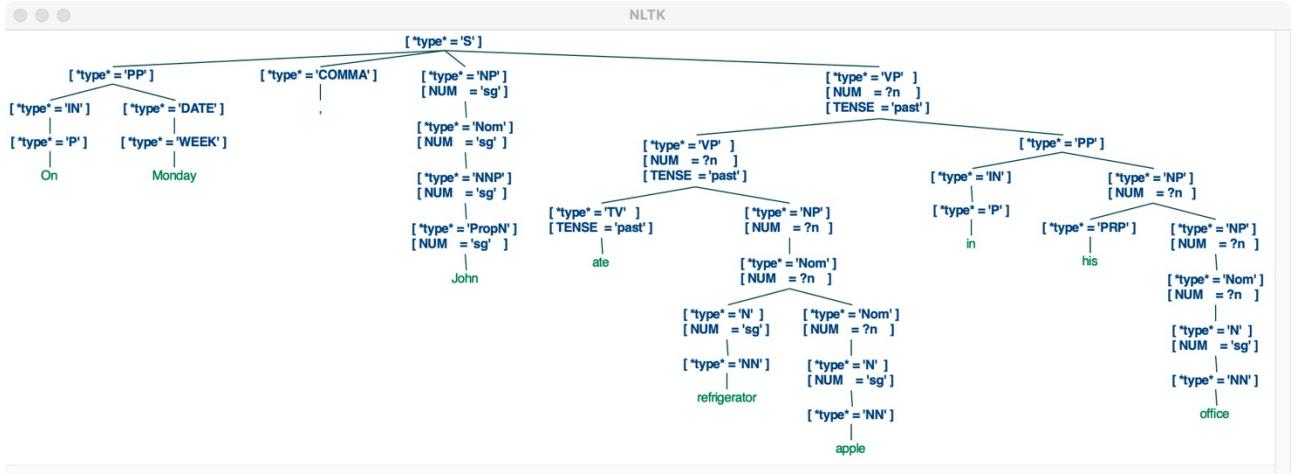


Figure 33. Test scenario 5 result: ‘On Monday, John ate the apple in his office.’

1.6. Test Scenario 6

Given: User enters the text content: 'Last week, on Monday, John finally took the apple from the fridge to his office.'

When: The validation data correctly input.

Result: Program can run successfully, and the text preprocess pipeline and proofreading results given.

Conclusion: The program can preprocess and proofread the text content. Sentences split, pos tag, name entity, Earley parse and Earley parse process results are displayed as Figures 34 ~ 49 shown below.

```
Run: PreProcess < /usr/local/bin/python3.9 /Users/zouhaochen/PycharmProjects/COMP_6751/Project2/PreProcess.py
Please enter the text you want to parse:
Last week, on Monday, John finally took the apple from the fridge to his office.

Options to the results: save/print
Do you want to save the parse tree? N
Do you want to print the parse tree? Y

[Sentences Splitting]
['Last week, on Monday, John finally took the apple from the fridge to his office.']

[POS Tagging]
[('Last', 'JJ'), ('week', 'NN'), ('.', '.'), ('on', 'IN'), ('Monday', 'NNP'), ('.', '.'), ('John', 'NNP'), ('finally', 'RB'), ('took', 'VBD'), ('the', 'DT'), ('apple', 'NN'), ('from', 'IN'), ('the', 'DT'), ('fridge', 'NN'), ('to', 'TO'), ('his', 'PRP$'), ('office', 'NN')]

[Name Entities]
{'John': 1}

[Earley Parsing]
(S[]
 (DATE[] (JJ[] Last) (WEEK[] week))
 (COMMA[],)
 (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
 (COMMA[],)
 (NP[NUM='sg']
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John))))
  (VP[NUM=?n, TENSE='past']
   (VP[NUM=?n, TENSE='past']
    (RB[] finally)
    (TV[TENSE='past'] took)
    (NP[NUM=?n]
     (DT[NUM=?n] (Det[NUM=?n] the))
     (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))))
   )
  )
 )
 (PP[]
  (IN[] (P[] from))
  (NP[NUM=?n]
   (DT[NUM=?n] (Det[NUM=?n] the))
   (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))
 )
 )
 (PP[])
  (IN[] (P[] to))
  (NP[NUM=?n]
   (PRP[] his)
   (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] office)))))))
)
(S[]
 (DATE[] (JJ[] Last) (WEEK[] week))
 (COMMA[],)
 (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
 (COMMA[],)
 (NP[NUM='sg']
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John))))
  (VP[NUM=?n, TENSE='past']
   (VP[NUM=?n, TENSE='past']
    (RB[] finally)
    (TV[TENSE='past'] took)
    (NP[NUM=?n]
     (DT[NUM=?n] (Det[NUM=?n] the))
     (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))))))
 )
 )
)
```

Figure 34. Test scenario 6 result: Last week, on Monday, John finally took the apple from the fridge to his office.'

```
Run: PreProcess < /usr/local/bin/python3.9 /Users/zouhaochen/PycharmProjects/COMP_6751/Project2/PreProcess.py
[Earley Parsing]
(S[]
 (DATE[] (JJ[] Last) (WEEK[] week))
 (COMMA[],)
 (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
 (COMMA[],)
 (NP[NUM='sg']
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John))))
  (VP[NUM=?n, TENSE='past']
   (VP[NUM=?n, TENSE='past']
    (RB[] finally)
    (TV[TENSE='past'] took)
    (NP[NUM=?n]
     (DT[NUM=?n] (Det[NUM=?n] the))
     (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))))))
 )
 (PP[]
  (IN[] (P[] from))
  (NP[NUM=?n]
   (DT[NUM=?n] (Det[NUM=?n] the))
   (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))))
 )
 (PP[])
  (IN[] (P[] to))
  (NP[NUM=?n]
   (PRP[] his)
   (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] office)))))))
)
(S[]
 (DATE[] (JJ[] Last) (WEEK[] week))
 (COMMA[],)
 (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
 (COMMA[],)
 (NP[NUM='sg']
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John))))
  (VP[NUM=?n, TENSE='past']
   (VP[NUM=?n, TENSE='past']
    (RB[] finally)
    (TV[TENSE='past'] took)
    (NP[NUM=?n]
     (DT[NUM=?n] (Det[NUM=?n] the))
     (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))))))
 )
 )
)
```

Figure 35. Test scenario 6 result: Last week, on Monday, John finally took the apple from the fridge to his office.'

```

Run: PreProcess ×
S[]
  (DATE[] (JJ[] Last) (WEEK[] week))
  (COMMA[] ,)
  (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
  (COMMA[] ,)
  (NP[NUM='sg'])
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] John)))
  (VP[NUM=?n, TENSE='past'])
    (RB[] finally)
    (TV[TENSE='past']) took
    (NP[NUM=?n])
      (DT[NUM=?n] (Det[NUM=?n] the))
      (Nom[NUM=?n]) (N[NUM='sg']) (NN[] apple))
    (PP[])
      (IN[] (P[] from))
      (NP[NUM=?n])
        (DT[NUM=?n] (Det[NUM=?n] the))
        (Nom[NUM=?n]) (N[NUM='sg']) (NN[] fridge)))
  (PP[])
    (IN[] (P[] to))
    (NP[NUM=?n])
      (PRP[] his)
      (NP[NUM=?n]) (Nom[NUM=?n]) (N[NUM='sg']) (NN[] office))))))

(S[])
  (DATE[] (JJ[] Last) (WEEK[] week))
  (COMMA[] ,)
  (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
  (COMMA[] ,)
  (NP[NUM='sg'])
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] John)))
  (VP[NUM=?n, TENSE='past'])
    (VP[NUM=?n, TENSE='past'])
      (RB[] finally)
      (TV[TENSE='past']) took
      (NP[NUM=?n])
        (DT[NUM=?n] (Det[NUM=?n] the))
        (Nom[NUM=?n]) (N[NUM='sg']) (NN[] apple)))
    (PP[])
      (IN[] (P[] from))
      (NP[NUM=?n])
        (DT[NUM=?n] (Det[NUM=?n] the))
        (Nom[NUM=?n]) (N[NUM='sg']) (NN[] fridge)))
    (PP[])
      (IN[] (P[] to))
      (NP[NUM=?n])
        (PRP[] his)
        (NP[NUM=?n]) (Nom[NUM=?n]) (N[NUM='sg']) (NN[] office))))))

(S[])
  (DATE[] (JJ[] Last) (WEEK[] week))
  (COMMA[] ,)
  (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
  (COMMA[] ,)
  (NP[NUM='sg'])
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] John)))
  (VP[NUM=?n, TENSE='past'])
    (RB[] finally)
    (TV[TENSE='past']) took
    (NP[NUM=?n])
      (DT[NUM=?n] (Det[NUM=?n] the))
      (Nom[NUM=?n]) (N[NUM='sg']) (NN[] apple))
    (PP[])

```

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Figure 36. Test scenario 6 result: *Last week, on Monday, John finally took the apple from the fridge to his office.*

```

Run: PreProcess ×
S[]
  (DATE[] (JJ[] Last) (WEEK[] week))
  (COMMA[] ,)
  (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
  (COMMA[] ,)
  (NP[NUM='sg'])
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] John)))
  (VP[NUM=?n, TENSE='past'])
    (VP[NUM=?n, TENSE='past'])
      (RB[] finally)
      (TV[TENSE='past']) took
      (NP[NUM=?n])
        (DT[NUM=?n] (Det[NUM=?n] the))
        (Nom[NUM=?n]) (N[NUM='sg']) (NN[] apple)))
    (PP[])
      (IN[] (P[] from))
      (NP[NUM=?n])
        (DT[NUM=?n] (Det[NUM=?n] the))
        (Nom[NUM=?n]) (N[NUM='sg']) (NN[] fridge)))
    (PP[])
      (IN[] (P[] to))
      (NP[NUM=?n])
        (PRP[] his)
        (NP[NUM=?n]) (Nom[NUM=?n]) (N[NUM='sg']) (NN[] office))))))

(S[])
  (DATE[] (JJ[] Last) (WEEK[] week))
  (COMMA[] ,)
  (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
  (COMMA[] ,)
  (NP[NUM='sg'])
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] John)))
  (VP[NUM=?n, TENSE='past'])
    (RB[] finally)
    (TV[TENSE='past']) took
    (NP[NUM=?n])
      (DT[NUM=?n] (Det[NUM=?n] the))
      (Nom[NUM=?n]) (N[NUM='sg']) (NN[] apple))
    (PP[])

```

Commit Git TODO Duplicates Run Debug Python Console Terminal

Figure 37. Test scenario 6 result: *Last week, on Monday, John finally took the apple from the fridge to his office.*

Run: PreProcess

```

S[]
  (DATE[] (JJ[] Last) (WEEK[] week))
  (COMMA[],)
  (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
  (COMMA[],)
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John))))
  (VP[NUM=?n, TENSE='past']
    (RB[] finally)
    (TV[TENSE='past'] took)
    (NP[NUM=?n]
      (DT[NUM=?n] (Det[NUM=?n] the))
      (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))
    (PP[]
      (IN[] (P[] from))
      (NP[NUM=?n]
        (DT[NUM=?n] (Det[NUM=?n] the))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] fridge)))
      (PP[]
        (IN[] (P[] to))
        (NP[NUM=?n]
          (PRP[] his)
          (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] office)))))))))))
  [Earley Parse Process]

[].....| [0:1] 'Last'
[].....| [1:2] 'week'
[].....| [2:3] 'on'
[].....| [3:4] 'Monday'
[].....| [4:5] 'John'
[].....| [5:6] 'finally'
[].....| [6:7] 'took'
[].....| [7:8] 'the'
[].....| [8:9] 'apple'
[].....| [9:10] 'from'
[].....| [10:11] 'the'
[].....| [11:12] 'fridge'

```

Commit Git TODO Duplicates Run Debug Python Console Terminal

Figure 38. Test scenario 6 result: *Last week, on Monday, John finally took the apple from the fridge to his office.*

Run: PreProcess

```

[].....| [0:1] 'Last'
[].....| [1:2] 'week'
[].....| [2:3] 'on'
[].....| [3:4] 'Monday'
[].....| [4:5] 'John'
[].....| [5:6] 'finally'
[].....| [6:7] 'took'
[].....| [7:8] 'the'
[].....| [8:9] 'apple'
[].....| [9:10] 'from'
[].....| [10:11] 'the'
[].....| [11:12] 'fridge'
[].....| [12:13] 'to'
[].....| [13:14] 'his'
[].....| [14:15] 'office'
[].....| [0:1] JJ[] -> 'Last' *
[]>.....| [0:1] DATE[] -> JJ[] * WEEK[] {}
[].....| [1:2] WEEK[] -> 'week' *
[].....| [1:2] DATE[] -> WEEK[] *
[]>.....| [0:2] DATE[] -> JJ[] WEEK[] *
[]>.....| [0:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[]>.....| [0:2] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[]>.....| [0:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[]>.....| [1:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[]>.....| [1:2] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[]>.....| [1:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[].....| [2:3] P[] -> 'on' *
[].....| [2:3] IN[] -> P[] *
[]>.....| [2:3] PP[] -> IN[] * NP[] {}
[]>.....| [2:3] PP[] -> IN[] * DATE[] {}
[].....| [3:4] WEEK[] -> 'Monday' *
[].....| [3:4] DATE[] -> WEEK[] *
[]>.....| [3:4] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[]>.....| [3:4] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[]>.....| [3:4] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[]>.....| [2:4] PP[] -> IN[] DATE[] *
[]>.....| [2:4] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[]>.....| [2:4] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}

```

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Figure 39. Test scenario 6 result: *Last week, on Monday, John finally took the apple from the fridge to his office.*

Run: PreProcess

```

|...[-].....| [2:4] PP[] -> IN[] DATE[] *
|...[>.....| [2:4] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|...[->.....| [2:4] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|...[>.....| [2:4] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
|...[->.....| [2:4] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
|...[>.....| [4:5] Prop[NUM='sg'] -> 'John' *
|...[>.....| [4:5] NNP[NUM='sg'] -> PropN[NUM='sg'] *
|...[>.....| [4:5] NNP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|...[>.....| [4:5] Non[NUM='sg'] -> NNP[NUM='sg'] *
|...[>.....| [4:5] NPI[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
|...[>.....| [4:5] NP[NUM='sg'] -> Nom[NUM='sg'] *
|...[>.....| [4:5] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|...[>.....| [4:5] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|...[>.....| [4:5] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|...[>.....| [4:5] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|...[>.....| [5:6] RB[] -> 'finally' *
|...[>.....| [5:6] S[] -> RB[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|...[>.....| [5:6] VP[NUM=?n, TENSE=?t] -> RB[] * TV[NUM=?n, TENSE=?t] NP[] {}
|...[>.....| [6:7] TV[TENSE='past'] -> 'took' *
|...[>.....| [6:7] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
|...[->.....| [5:7] VP[NUM=?n, TENSE=?t] -> RB[] TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
|...[>.....| [7:8] Det[NUM=?n] -> 'the' *
|...[>.....| [7:8] DT[NUM=?n] -> Det[NUM=?n] *
|...[>.....| [7:8] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')}
|...[>.....| [7:8] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')}
|...[>.....| [7:8] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')}
|...[>.....| [8:9] NN[] -> 'apple' *
|...[>.....| [8:9] N[NUM='sg'] -> NN[] *
|...[>.....| [8:9] NPI[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|...[>.....| [8:9] Non[NUM=?n] -> NI[] * Nom[NUM=?n] {}
|...[>.....| [8:9] Non[NUM=?n] -> NI[] *
|...[>.....| [8:9] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
|...[>.....| [8:9] NP[NUM=?n] -> Nom[NUM=?n] *
|...[->.....| [7:9] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
|...[>.....| [7:9] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|...[>.....| [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|...[>.....| [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}

```

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Figure 40. Test scenario 6 result: Last week, on Monday, John finally took the apple from the fridge to his office.'

Run: PreProcess

```

|...[-].....| [7:9] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
|...[>.....| [7:9] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|...[>.....| [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|...[>.....| [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|...[>.....| [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|...[>.....| [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|...[>.....| [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|...[>.....| [6:9] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|...[>.....| [6:9] VP[NUM=?n, TENSE='past'] -> RB[] TV[NUM=?n, TENSE='past'] NP[] *
|...[>.....| [5:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|...[>.....| [5:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|...[>.....| [4:9] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|...[>.....| [4:9] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|...[>.....| [4:9] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|...[>.....| [6:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|...[>.....| [6:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|...[>.....| [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|...[>.....| [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|...[>.....| [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|...[>.....| [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|...[>.....| [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|...[>.....| [9:10] P[] -> 'from' *
|...[>.....| [9:10] IN[] -> P[] *
|...[>.....| [9:10] PP[] -> IN[] * NP[] {}
|...[>.....| [9:10] PP[] -> IN[] * DATE[] {}
|...[>.....| [10:11] Det[NUM=?n] -> 'the' *
|...[>.....| [10:11] DT[NUM=?n] -> Det[NUM=?n] *
|...[>.....| [10:11] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')}
|...[>.....| [10:11] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')}
|...[>.....| [10:11] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')}
|...[>.....| [11:12] NN[] -> 'fridge' *
|...[>.....| [11:12] N[NUM='sg'] -> NN[] *
|...[>.....| [11:12] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|...[>.....| [11:12] Non[NUM=?n] -> NI[] * Nom[NUM=?n] {}
|...[>.....| [11:12] Non[NUM=?n] -> NI[] *
|...[>.....| [11:12] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
|...[>.....| [11:12] NP[NUM=?n] -> Nom[NUM=?n] *
|...[>.....| [10:12] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *

```

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Figure 41. Test scenario 6 result: Last week, on Monday, John finally took the apple from the fridge to his office.'

Run: PreProcess

```

[...]
[10:12] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
[10:12] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[10:12] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[10:12] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[10:12] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[10:12] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[10:12] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[10:12] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[9:12] PP[] -> IN[] NP[] *
[9:12] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] *
[9:12] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[9:12] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[9:12] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[8:12] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
[7:12] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
[5:12] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[6:12] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[6:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[6:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
[5:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[5:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*}
[4:12] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[4:12] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[4:12] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[7:12] VP[NUM=?n] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[7:12] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {*}
[7:12] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[7:12] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] IN[] S[] {*}
[6:12] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
[5:12] VP[NUM=?n, TENSE='past'] -> RB[] TV[NUM=?n, TENSE='past'] NP[] *
[5:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*}
[5:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*}
[4:12] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[4:12] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[4:12] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {*}
[6:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*}
[6:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*}
[6:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*}
[6:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*}
[8:12] S[] -> NP[NUM=?n] * VP[NUM=?n] {*}

```

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Figure 42. Test scenario 6 result: Last week, on Monday, John finally took the apple from the fridge to his office.'

Run: PreProcess

```

[...]
[4:12] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[4:12] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[4:12] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[6:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*}
[6:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*}
[8:12] S[] -> NP[NUM=?n] * VP[NUM=?n] {*}
[8:12] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {*}
[8:12] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {*}
[8:12] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {*}
[8:12] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] IN[] S[] {*}
[8:12] S[] -> NP[NUM=?n] * VP[NUM=?n] {*}
[11:12] S[] -> NP[NUM=?n] * VP[NUM=?n] {*}
[11:12] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {*}
[11:12] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {*}
[11:12] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {*}
[11:12] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] IN[] S[] {*}
[11:12] S[] -> NP[NUM=?n] * VP[NUM=?n] {*}
[12:13] P[] -> 'to' *
[12:13] TO[] -> 'to' *
[12:13] IN[] -> P[] *
[12:13] PP[] -> IN[] * NP[] {}
[12:13] PP[] -> IN[] * DATE[] {}
[13:14] PRP[] -> 'his' *
[13:14] NP[NUM=?n] -> PRP[] *
[13:14] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
[13:14] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
[13:14] S[] -> NP[NUM=?n] * VP[NUM=?n] {*}
[13:14] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {*}
[13:14] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {*}
[13:14] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {*}
[13:14] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {*}
[12:14] PP[] -> IN[] NP[] *
[12:14] S[] -> PP[] * COMMMA[] NP[NUM=?n] VP[NUM=?n] {}
[12:14] S[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[12:14] S[] -> PP[] * COMMMA[] DATE[] COMMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[12:14] DATE[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[11:14] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
[10:14] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
[6:14] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[5:14] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *

```

Commit Git TODO Duplicates Run Debug Python Console Terminal

Figure 43. Test scenario 6 result: Last week, on Monday, John finally took the apple from the fridge to his office.'

Run: PreProcess

```

|.....[-----].| [6:14] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[-----].| [5:14] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[-----].| [5:14] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[-----].| [5:14] VP[NUM=?n, TENSE=?t] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[-----].| [4:14] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?: 'sg', ?n2: 'sg'}
|.....[-----].| [4:14] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[-----].| [6:14] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[-----].| [6:14] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[-----].| [10:14] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[---].| [10:14] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[---].| [10:14] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[---].| [10:14] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[---].| [10:14] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[---].| [9:14] PP[] -> IN[] NP[] *
|.....[---].| [9:14] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.....[---].| [9:14] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|.....[---].| [9:14] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
|.....[---].| [9:14] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
|.....[---].| [8:14] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
|.....[---].| [7:14] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
|.....[---].| [5:14] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[---].| [6:14] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[---].| [7:14] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[---].| [7:14] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[---].| [7:14] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[---].| [7:14] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n3: Variable('?n')}
|.....[---].| [6:14] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|.....[---].| [5:14] VP[NUM=?n, TENSE='past'] -> RB[] TV[NUM=?n, TENSE='past'] NP[] *
|.....[---].| [5:14] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[---].| [5:14] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[---].| [4:14] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[---].| [4:14] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?: 'sg', ?n2: 'sg'}
|.....[---].| [4:14] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[---].| [6:14] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[---].| [6:14] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[---].| [8:14] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}

```

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Figure 44. Test scenario 6 result: Last week, on Monday, John finally took the apple from the fridge to his office.'

Run: PreProcess

```

|.....[-----].| [6:14] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[-----].| [6:14] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[-----].| [8:14] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[-----].| [8:14] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[-----].| [8:14] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[-----].| [8:14] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n3: Variable('?n')}
|.....[-----].| [8:14] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[---].| [11:14] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[---].| [11:14] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[---].| [11:14] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[---].| [11:14] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[---].| [11:14] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[---].| [11:14] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n3: Variable('?n')}
|.....[---].| [14:15] NN[] -> 'office' *
|.....[---].| [14:15] NN[NUM='sg'] -> NN[] *
|.....[-->] [14:15] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|.....[-->] [14:15] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
|.....[-->] [14:15] Nom[NUM=?n] -> N[] *
|.....[-->] [14:15] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
|.....[-->] [14:15] NP[NUM=?n] -> Nom[NUM=?n] *
|.....[-->] [14:15] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[-->] [14:15] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[-->] [14:15] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[-->] [14:15] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[-->] [14:15] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[-->] [13:15] NP[NUM=?n] -> PRP[] NP[NUM=?n] *
|.....[-->] [13:15] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[-->] [13:15] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[-->] [13:15] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[-->] [13:15] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[-->] [13:15] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[-->] [12:15] PP[] -> IN[] NP[] *
|.....[-->] [12:15] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.....[-->] [12:15] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|.....[-->] [12:15] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
|.....[-->] [12:15] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
|.....[-->] [11:15] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
|.....[-->] [10:15] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
|.....[-----].| [6:15] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *

```

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Figure 45. Test scenario 6 result: Last week, on Monday, John finally took the apple from the fridge to his office.'

Run: PreProcess

```

|.....[-->] [12:15] PP[] -> IN[] NP[] *
|.....[-->] [12:15] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.....[-->] [12:15] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|.....[-->] [12:15] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
|.....[-->] [12:15] S[] -> NP[NUM=?n] -> Nom[NUM=?n] PP[] *
|.....[-->] [11:15] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
|.....[-->] [10:15] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
|.....[----->] [6:15] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[----->] [5:15] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[----->] [5:15] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[----->] [5:15] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[----->] [4:15] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[----->] [4:15] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[----->] [4:15] S[] -> NP[NUM=?n] VP[NUM=?n] * CCG[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[----->] [6:15] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[----->] [6:15] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[----->] [10:15] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[----->] [10:15] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[----->] [10:15] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[----->] [10:15] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[----->] [10:15] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[----->] [9:15] PP[] -> IN[] NP[] *
|.....[----->] [9:15] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.....[----->] [9:15] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
|.....[----->] [9:15] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
|.....[----->] [8:15] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
|.....[----->] [7:15] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
|.....[----->] [5:15] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[----->] [6:15] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[----->] [7:15] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[----->] [7:15] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[----->] [7:15] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n2')}
|.....[----->] [7:15] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[----->] [7:15] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n2')}
|.....[----->] [6:15] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|.....[----->] [5:15] VP[NUM=?n, TENSE='past'] -> RB[] TV[NUM=?n, TENSE='past'] NP[] *
|.....[----->] [5:15] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}

```

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Figure 46. Test scenario 6 result: Last week, on Monday, John finally took the apple from the fridge to his office.'

Run: PreProcess

```

|.....[--->] [10:15] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[--->] [9:15] PP[] -> IN[] NP[] *
|.....[--->] [9:15] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.....[--->] [9:15] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|.....[--->] [9:15] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
|.....[--->] [9:15] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
|.....[--->] [8:15] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
|.....[--->] [7:15] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] *
|.....[--->] [5:15] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[--->] [6:15] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[--->] [7:15] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[--->] [7:15] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[--->] [7:15] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n2')}
|.....[--->] [7:15] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[--->] [7:15] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n2')}
|.....[--->] [6:15] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|.....[--->] [5:15] VP[NUM=?n, TENSE='past'] -> RB[] TV[NUM=?n, TENSE='past'] NP[] *
|.....[--->] [5:15] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[--->] [5:15] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[--->] [4:15] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[--->] [4:15] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[--->] [4:15] S[] -> NP[NUM=?n] VP[NUM=?n] * CCG[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[--->] [6:15] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[--->] [6:15] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[--->] [8:15] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[--->] [8:15] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[--->] [11:15] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[--->] [11:15] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[--->] [11:15] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[--->] [11:15] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n2')}
|.....[--->] [11:15] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}

<generator object FeatureChart.parses at 0x7fb0d7ccb6d0>

```

Process finished with exit code 0

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Figure 47. Test scenario 6 result: Last week, on Monday, John finally took the apple from the fridge to his office.'

Run: PreProcess

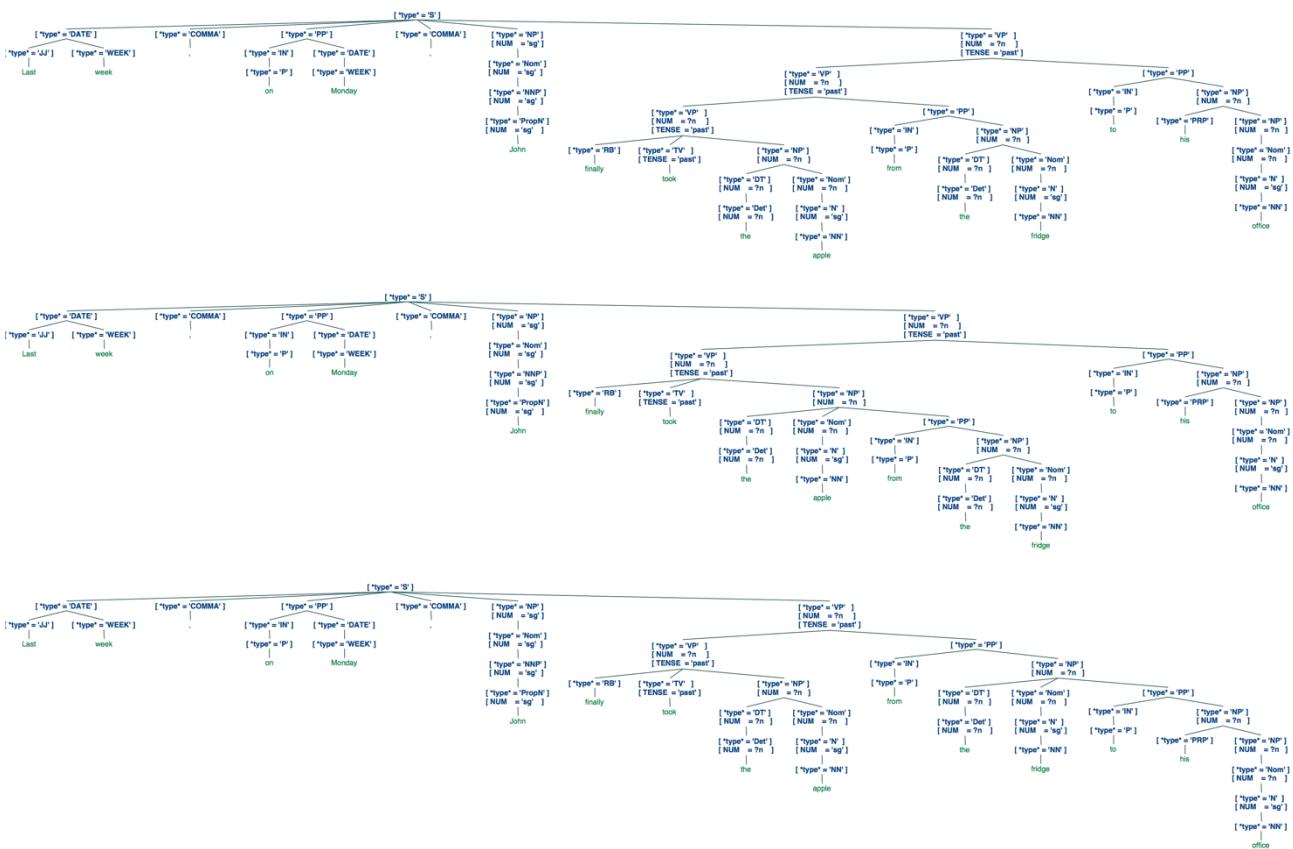
```

| . . . . . [--->] [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| . . . . . [--->] [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| . . . . . [--->] [7:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| . . . . . [--->] [7:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
| . . . . . [--->] [6:9] PPI -> IN[] NP[]
| . . . . . [--->] [6:9] S[] -> PPI * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| . . . . . [--->] [6:9] S[] -> PPI * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
| . . . . . [--->] [6:9] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
| . . . . . [-----] [5:9] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
| . . . . . [-----] [4:9] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
| . . . . . [-----] [3:9] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
| . . . . . [-----] [3:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
| . . . . . [-----] [2:9] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| . . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| . . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| . . . . . [-----] [4:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| . . . . . [-----] [4:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| . . . . . [-----] [4:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| . . . . . [-----] [4:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] INI[] S[] {?n2: Variable('?n')}
| . . . . . [-----] [3:9] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[]
| . . . . . [-----] [3:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
| . . . . . [-----] [2:9] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| . . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| . . . . . [-----] [2:9] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| . . . . . [-----] [5:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| . . . . . [-----] [5:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| . . . . . [-----] [5:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| . . . . . [-----] [5:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] INI[] S[] {?n2: Variable('?n')}
<generator object FeatureChart.parses at 0x7fa4479393c0>

```

Process finished with exit code 0

Figure 48. Test scenario 6 result: Last week, on Monday, John finally took the apple from the fridge to his office.'



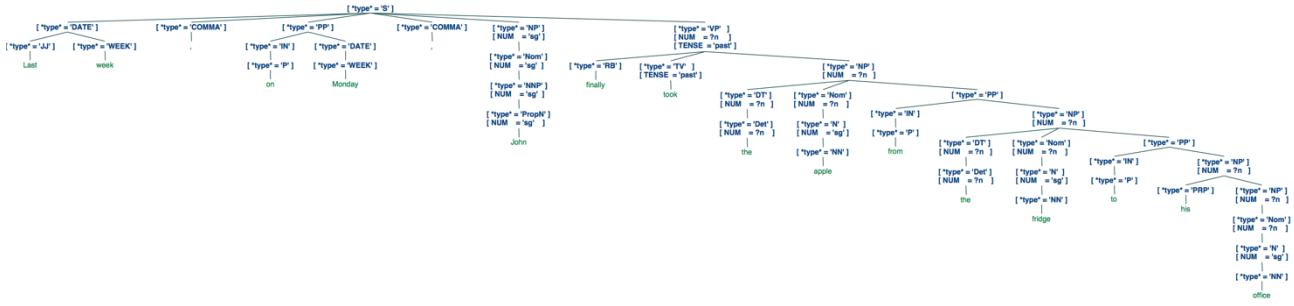


Figure 49. Test scenario 6 result: 'Last week, on Monday, John finally took the apple from the fridge to his office.'

1.7. Test Scenario 7

Given: User enters the text content: 'Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.'

When: The validation data correctly input.

Result: Program can run successfully, and the text preprocess pipeline and proofreading results given.

Conclusion: The program can preprocess and proofread the text content. Sentences split, pos tag, name entity, Earley parse and Earley parse process results are displayed as **Figures 50 ~ 64** shown below.

```
Run: PreProcess (1) ✘
/usr/local/bin/python3.9 /Users/zouhaochen/PycharmProjects/COMP_6751/Project2/PreProcess.py
Please enter the text you want to parse:
Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.

Options to the results: save/print
Do you want to save the parse tree? N
Do you want to print the parse tree? Y

[Sentences Splitting]
['Last Monday, John promised that he will put an apple in the fridge.', 'He will eat it on Tuesday at his desk.', 'It will be crunchy.']

[POS Tagging]
[[('Last', 'JJ'), ('Monday', 'NNP'), ('.', ','), ('John', 'NNP'), ('promised', 'VBD'), ('that', 'IN'), ('he', 'PRP'), ('will', 'MD'), ('put', 'VB'), ('an', 'DT'), ('apple', 'NN'), ('in', 'IN'), ('the', 'DT'), ('fridge', 'NN')], [('He', 'PRP'), ('will', 'MD'), ('eat', 'VB'), ('it', 'PRP'), ('on', 'IN'), ('Tuesday', 'NNP'), ('at', 'IN'), ('his', 'PRP$'), ('desk', 'NN')], [('It', 'PRP'), ('will', 'MD'), ('be', 'VB'), ('crunchy', 'JJ')]]

[Name Entities]
set()

[Earley Parsing]
(S[])
(DATE[] (JJ[] Last) (WEEK[] Monday))
(COMMA[],)
(NP[NUM='sg'])
(Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John)))
(TV[TENSE='past'] promised)
(INTRO[] that)
(S[])
(NP[NUM=?n] (PRP[] he))
(VP[NUM=?n, TENSE='inf']
(VP[NUM=?n, TENSE='inf']
(MD[TENSE='inf'] will)
(TV[TENSE='inf'] put)
(NP[NUM='sg']
(DT[NUM='sg'] (Det[NUM='sg'] an))
(Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))))
(PP[])
(IN[] (P[] in))

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```

Figure 50. Test scenario 7 result: 'Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.'

Run: PreProcess (1) ×

```

(S[]
  (NP[NUM=?n] (PRP[] he))
  (VP[NUM=?n, TENSE='inf']
    (VP[NUM=?n, TENSE='inf']
      (MD[TENSE='inf'] will)
      (TV[TENSE='inf'] put)
      (NP[NUM='sg']
        (DT[NUM='sg'] (Det[NUM='sg'] an))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))))
    (PP[])
      (IN[] (P[] in))
      (NP[NUM=?n]
        (DT[NUM=?n] (Det[NUM=?n] the))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] fridge)))))))
  (S[]
    (DATE[] (JJ[] Last) (WEEK[] Monday))
    (COMMA[],)
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John))))
    (TV[TENSE='past'] promised)
    (INTRO[] that)
  (S[]
    (NP[NUM=?n] (PRP[] he))
    (VP[NUM=?n, TENSE='inf']
      (MD[TENSE='inf'] will)
      (TV[TENSE='inf'] put)
      (NP[NUM='sg']
        (DT[NUM='sg'] (Det[NUM='sg'] an))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))
      (PP[])
        (IN[] (P[] in))
        (NP[NUM=?n]
          (DT[NUM=?n] (Det[NUM=?n] the))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] fridge)))))))
  (S[]
    (NP[NUM=?n] (PRP[] He))
    (VP[NUM=?n, TENSE='inf']
      (VP[NUM=?n, TENSE='inf']
        (VP[NUM=?n, TENSE='inf']
          (MD[TENSE='inf'] will)
          (TV[TENSE='inf'] eat)
          (NP[NUM=?n] (PRP[] it)))
        (PP[])
          (IN[] (P[] on))
          (DATE[] (WEEK[] Tuesday))))
    (PP[])
      (IN[] (P[] at))
      (NP[NUM=?n]
        (PRP[] his)
        (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))
  (S[]
    (NP[NUM=?n] (PRP[] It))
    (VP[NUM=?n, TENSE='inf']
      (MD[TENSE='inf'] will)
      (AUX[TENSE='inf'] be)
      (JJ[] crunchy)))
  [Earley Parse Process]

[0:1] 'Last'
[1:2] 'Monday'
[2:3] 'John'
[3:4] 'promised'
[4:5] 'that'
[5:6] 'he'
[6:7] 'will'
[7:8] 'put'
[8:9] 'an'
[9:10] 'apple'
[10:11] 'in'
[11:12] 'the'
[12:13] 'fridge'
[13:14] 'He'
[14:15] 'will'

```

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Figure 51. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

Run: PreProcess (1) ×

```

(S[]
  (NP[NUM=?n] (PRP[] He))
  (VP[NUM=?n, TENSE='inf']
    (VP[NUM=?n, TENSE='inf']
      (VP[NUM=?n, TENSE='inf']
        (MD[TENSE='inf'] will)
        (TV[TENSE='inf'] eat)
        (NP[NUM=?n] (PRP[] it)))
      (PP[])
        (IN[] (P[] on))
        (DATE[] (WEEK[] Tuesday))))
    (PP[])
      (IN[] (P[] at))
      (NP[NUM=?n]
        (PRP[] his)
        (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))
  (S[]
    (NP[NUM=?n] (PRP[] It))
    (VP[NUM=?n, TENSE='inf']
      (MD[TENSE='inf'] will)
      (AUX[TENSE='inf'] be)
      (JJ[] crunchy)))
  [Earley Parse Process]

[0:1] 'Last'
[1:2] 'Monday'
[2:3] 'John'
[3:4] 'promised'
[4:5] 'that'
[5:6] 'he'
[6:7] 'will'
[7:8] 'put'
[8:9] 'an'
[9:10] 'apple'
[10:11] 'in'
[11:12] 'the'
[12:13] 'fridge'
[13:14] 'He'
[14:15] 'will'

```

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Figure 52. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

Run: PreProcess (1) ×

```

I[].....| [0:1] 'Last'
I[].....| [1:2] 'Monday'
I[].....| [2:3] 'John'
I[].....| [3:4] 'promised'
I[].....| [4:5] 'that'
I[].....| [5:6] 'he'
I[].....| [6:7] 'will'
I[].....| [7:8] 'put'
I[].....| [8:9] 'an'
I[].....| [9:10] 'apple'
I[].....| [10:11] 'in'
I[].....| [11:12] 'the'
I[].....| [12:13] 'fridge'
I[].....| [13:14] 'He'
I[].....| [14:15] 'will'
I[].....| [15:16] 'eat'
I[].....| [16:17] 'it'
I[].....| [17:18] 'on'
I[].....| [18:19] 'Tuesday'
I[].....| [19:20] 'at'
I[].....| [20:21] 'his'
I[].....| [21:22] 'desk'
I[].....| [22:23] 'It'
I[].....| [23:24] 'will'
I[].....| [24:25] 'be'
I[].....| [25:26] 'crunchy'
I[].....| [0:1] JJ[] -> 'Last' *
I>.....| [0:1] DATE[] -> JJ[] * WEEK[] {}
I[].....| [1:2] WEEK[] -> 'Monday' *
I[].....| [1:2] DATE[] -> WEEK[] *
I[].....| [0:2] DATE[] -> JJ[] * WEEK[] *
I>.....| [0:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I>.....| [0:2] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I>.....| [0:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
I>.....| [1:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I>.....| [1:2] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I>.....| [1:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
I[].....| [2:3] PropN[NUM='sg'] -> 'John' *
I>.....| [2:3] NNP[NUM='sg'] -> PropN[NUM='sg'] *
I>.....| [2:3] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
I>.....| [2:3] Nom[NUM='sg'] -> NP[NUM='sg'] *
I>.....| [2:3] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
I>.....| [2:3] NP[NUM='sg'] -> Nom[NUM='sg'] *
I>.....| [2:3] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
I>.....| [2:3] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
I>.....| [2:3] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I>.....| [2:3] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I>.....| [2:3] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
I>.....| [3:4] TV[TENSE='past'] -> 'promised' *
I>.....| [3:4] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
I>.....| [2:4] S[] -> NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I>.....| [2:4] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
I>.....| [4:5] P[] -> 'that' *
I>.....| [4:5] INTRO[] -> 'that' *
I>.....| [2:5] S[] -> NP[NUM=?n] TV[NUM=?n] INTRO[] * S[] {?n: 'sg'}
I>.....| [2:5] S[] -> NP[NUM=?n] TV[NUM=?n] INTRO[] * S[] CC[] IN[] S[] {?n: 'sg'}
I>.....| [4:5] IN[] -> P[] *
I>.....| [4:5] PP[] -> IN[] * NP[] {}
I>.....| [4:5] PP[] -> IN[] * DATE[] {}
I>.....| [5:6] PRP[] -> 'he' *
I>.....| [5:6] NP[NUM=?n] -> PRP[] *
I>.....| [5:6] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
I>.....| [5:6] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
I>.....| [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I>.....| [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I>.....| [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I>.....| [5:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I>.....| [5:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I>.....| [4:6] PP[] -> IN[] NP[] *
I>.....| [4:6] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I>.....| [4:6] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
I>.....| [4:6] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}

```

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Figure 53. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

Run: PreProcess (1) ×

```

I[.].....| [1:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I[.].....| [1:2] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I[.].....| [1:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
I[.].....| [2:3] PropN[NUM='sg'] -> 'John' *
I[.].....| [2:3] NNP[NUM='sg'] -> PropN[NUM='sg'] *
I[.].....| [2:3] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
I[.].....| [2:3] Nom[NUM='sg'] -> NP[NUM='sg'] *
I[.].....| [2:3] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
I[.].....| [2:3] NP[NUM='sg'] -> Nom[NUM='sg'] *
I[.].....| [2:3] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
I[.].....| [2:3] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
I[.].....| [2:3] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I[.].....| [2:3] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I[.].....| [2:3] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
I[.].....| [3:4] TV[TENSE='past'] -> 'promised' *
I[.].....| [3:4] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
I[.].....| [2:4] S[] -> NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I[.].....| [2:4] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
I[.].....| [4:5] P[] -> 'that' *
I[.].....| [4:5] INTRO[] -> 'that' *
I[.].....| [2:5] S[] -> NP[NUM=?n] TV[NUM=?n] INTRO[] * S[] {?n: 'sg'}
I[.].....| [2:5] S[] -> NP[NUM=?n] TV[NUM=?n] INTRO[] * S[] CC[] IN[] S[] {?n: 'sg'}
I[.].....| [4:5] IN[] -> P[] *
I[.].....| [4:5] PP[] -> IN[] * NP[] {}
I[.].....| [4:5] PP[] -> IN[] * DATE[] {}
I[.].....| [5:6] PRP[] -> 'he' *
I[.].....| [5:6] NP[NUM=?n] -> PRP[] *
I[.].....| [5:6] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
I[.].....| [5:6] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
I[.].....| [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I[.].....| [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I[.].....| [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I[.].....| [5:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I[.].....| [5:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I[.].....| [4:6] PP[] -> IN[] NP[] *
I[.].....| [4:6] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I[.].....| [4:6] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
I[.].....| [4:6] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}

```

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Figure 54. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

Run: PreProcess (1) ×

```

[...][...] [4:6] PP[] -> IN[] NP[] *
[...][>...] [4:6] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[...][>...] [4:6] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[...][>...] [4:6] S[] -> PP[] * COMMA[] DATE[] COMMAt NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[...][>...] [4:6] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[...][>...] [6:7] MD[TENSE='inf'] -> 'will' *
[...][>...] [6:7] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * TV[TENSE='inf'] NP[] RB[] {?t: 'inf'}
[...][>...] [6:7] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * TV[TENSE='inf'] NP[] {?t: 'inf'}
[...][>...] [6:7] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] JJ[] {?t: 'inf'}
[...][>...] [6:7] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] {?t: 'inf'}
[...][>...] [6:7] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * IV[TENSE='inf'] {?t: 'inf'}
[...][>...] [7:8] TV[NUM='pl', TENSE='pres'] -> 'put' *
[...][>...] [7:8] TV[TENSE='inf'] -> 'put' *
[...][>...] [7:8] TV[TENSE='past'] -> 'put' *
[...][>...] [7:8] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n] * NP[] {?t: 'past'}
[...][>...] [7:8] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'inf'}
[...][>...] [6:8] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] * NP[] RB[] {?t: 'inf'}
[...][>...] [6:8] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] * NP[] {?t: 'inf'}
[...][>...] [7:8] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?n: 'pl', ?t: 'pres'}
[...][>...] [8:9] Det[NUM='sg'] -> 'an' *
[...][>...] [8:9] DT[NUM='sg'] -> Det[NUM='sg'] *
[...][>...] [8:9] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n: 'sg'}
[...][>...] [8:9] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n: 'sg'}
[...][>...] [8:9] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n: 'sg'}
[...][>...] [9:10] NN[] -> 'apple' *
[...][>...] [9:10] N[NUM='sg'] -> NN[]
[...][>...] [9:10] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
[...][>...] [9:10] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
[...][>...] [9:10] Nom[NUM=?n] -> NL[]
[...][>...] [9:10] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
[...][>...] [9:10] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
[...][>...] [8:10] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] *
[...][>...] [8:10] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n: 'sg', ?n2: 'sg'}
[...][>...] [8:10] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
[...][>...] [8:10] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[...][>...] [8:10] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[...][>...] [8:10] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[...][>...] [8:10] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[...][>...] [8:10] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}

```

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Figure 55. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

Run: PreProcess (1) ×

```

[...][...] [8:10] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] *
[...][>...] [8:10] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n: 'sg', ?n2: 'sg'}
[...][>...] [8:10] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
[...][>...] [8:10] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[...][>...] [8:10] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[...][>...] [8:10] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[...][>...] [8:10] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[...][>...] [7:10] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
[...][>...] [7:10] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
[...][>...] [6:10] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'inf'}
[...][>...] [6:10] VP[NUM=?n, TENSE='inf'] -> MD[TENSE='inf'] TV[TENSE='inf'] NP[] *
[...][>...] [7:10] VP[NUM='pl', TENSE='pres'] -> TV[NUM='pl', TENSE='pres'] NP[] *
[...][>...] [7:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pl', ?t: 'pres'}
[...][>...] [6:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[...][>...] [6:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[...][>...] [5:10] S[] -> NP[NUM=?n] VP[NUM=?n] *
[...][>...] [5:10] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[...][>...] [5:10] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[...][>...] [2:10] S[] -> NP[NUM='sg'] TV[NUM='sg'] INTRO[] S[] *
[...][>...] [2:10] S[] -> NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[...][>...] [7:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[...][>...] [7:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[...][>...] [7:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[...][>...] [7:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[...][>...] [9:10] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[...][>...] [9:10] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[...][>...] [9:10] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[...][>...] [9:10] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[...][>...] [9:10] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[...][>...] [10:11] PT[] -> 'in' *
[...][>...] [10:11] IN[] -> P[]
[...][>...] [10:11] PP[] -> IN[] * NP[] {}
[...][>...] [10:11] PP[] -> IN[] * DATE[] {}
[...][>...] [11:12] Det[NUM=?n] -> 'the' *
[...][>...] [11:12] DT[NUM=?n] -> Det[NUM=?n] *
[...][>...] [11:12] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')}
[...][>...] [11:12] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')}
[...][>...] [11:12] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')}

```

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Figure 56. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

```

Run: PreProcess (1) ×
|.....[.].....| [11:12] Det[NUM=?n] -> 'the' *
|.....[.].....| [11:12] DT[NUM=?n] -> Det[NUM=?n] *
|.....[>.....| [11:12] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')} *
|.....[>.....| [11:12] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')} *
|.....[.].....| [11:12] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')} *
|.....[.].....| [12:13] NN[] -> 'fridge' *
|.....[.].....| [12:13] N[NUM='sg'] -> NN[] *
|.....[>.....| [12:13] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'} *
|.....[.].....| [12:13] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
|.....[.].....| [12:13] Nom[NUM=?n] -> N[] *
|.....[>.....| [12:13] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')} *
|.....[.].....| [12:13] NP[NUM=?n] -> Nom[NUM=?n] *
|.....[.].....| [12:13] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
|.....[>.....| [11:13] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')} *
|.....[>.....| [11:13] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')} *
|.....[>.....| [11:13] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')} *
|.....[>.....| [11:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')} *
|.....[>.....| [11:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')} *
|.....[>.....| [11:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')} *
|.....[.].....| [10:13] PP[] -> IN[] NP[] *
|.....[>.....| [10:13] S[] -> PP[] * COMMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.....[>.....| [10:13] S[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|.....[>.....| [10:13] S[] -> PP[] * COMMMA[] DATE[] COMMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
|.....[>.....| [10:13] DATE[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
|.....[.].....| [9:13] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
|.....[.].....| [8:13] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] PP[] *
|.....[.].....| [7:13] VP[NUM='pl', TENSE='pres'] -> VP[NUM='pl', TENSE='pres'] PP[] *
|.....[.].....| [6:13] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
|.....[.].....| [7:13] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
|.....[.].....| [7:13] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[>.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'} *
|.....[>.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'} *
|.....[>.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'} *
|.....[>.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'} *
|.....[>.....| [6:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'} *
|.....[>.....| [6:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'} *
|.....[.].....| [5:13] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[>.....| [5:13] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')} *

```

Figure 57. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

```

Run: PreProcess (1) ×
|.....[.].....| [11:12] Det[NUM=?n] -> 'the' *
|.....[.].....| [11:12] DT[NUM=?n] -> Det[NUM=?n] *
|.....[>.....| [11:12] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')} *
|.....[>.....| [11:12] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')} *
|.....[>.....| [11:12] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')} *
|.....[.].....| [12:13] NN[] -> 'fridge' *
|.....[.].....| [12:13] N[NUM='sg'] -> NN[] *
|.....[>.....| [12:13] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'} *
|.....[.].....| [12:13] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
|.....[.].....| [12:13] Nom[NUM=?n] -> N[] *
|.....[>.....| [12:13] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')} *
|.....[.].....| [12:13] NP[NUM=?n] -> Nom[NUM=?n] *
|.....[.].....| [11:13] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
|.....[>.....| [11:13] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')} *
|.....[>.....| [11:13] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')} *
|.....[>.....| [11:13] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')} *
|.....[>.....| [11:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')} *
|.....[>.....| [11:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')} *
|.....[>.....| [11:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')} *
|.....[.].....| [10:13] PP[] -> IN[] NP[] *
|.....[>.....| [10:13] S[] -> PP[] * COMMMA[] NP[NUM=?n] VP[NUM=?n] {}
|.....[>.....| [10:13] S[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|.....[>.....| [10:13] S[] -> PP[] * COMMMA[] DATE[] COMMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
|.....[>.....| [10:13] DATE[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
|.....[.].....| [9:13] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
|.....[.].....| [8:13] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] PP[] *
|.....[.].....| [7:13] VP[NUM='pl', TENSE='pres'] -> VP[NUM='pl', TENSE='pres'] PP[] *
|.....[.].....| [6:13] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
|.....[.].....| [7:13] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
|.....[.].....| [7:13] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[>.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'} *
|.....[>.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'} *
|.....[>.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'} *
|.....[>.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'} *
|.....[>.....| [6:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'} *
|.....[>.....| [6:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'} *
|.....[.].....| [5:13] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[>.....| [5:13] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')} *

```

Figure 57. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

Run: PreProcess (1) ×

```

|.....[.....| [5:13] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[.....| [5:13] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[.....| [5:13] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[.....| [2:13] S[] -> NP[NUM='sg'] TV[NUM='sg'] INTRO[] S[] *
|.....[.....| [2:13] S[] -> NP[NUM=?n] TV[NUM=?n] INTRO[] S[] * CC[] IN[] S[] {?n: 'sg'}
|.....[.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pl', ?t: 'pres'}
|.....[.....| [8:13] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|.....[.....| [8:13] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|.....[.....| [8:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[.....| [8:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[.....| [8:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|.....[.....| [7:13] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|.....[.....| [7:13] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
|.....[.....| [6:13] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'inf'}
|.....[.....| [6:13] VP[NUM=?n, TENSE='inf'] -> MD[TENSE='inf'] TV[TENSE='inf'] NP[] *
|.....[.....| [7:13] VP[NUM='pl', TENSE='pres'] -> TV[NUM='pl', TENSE='pres'] NP[] *
|.....[.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: 'pl', ?t: 'pres'}
|.....[.....| [6:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
|.....[.....| [6:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
|.....[.....| [5:13] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[.....| [5:13] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[.....| [5:13] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*?n: Variable('?n'), ?t: 'inf'}
|.....[.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*?n3: Variable('?n'), ?t: 'inf'}
|.....[.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*?n2: Variable('?n'), ?t: 'past'}
|.....[.....| [7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*?n3: Variable('?n'), ?t: 'past'}
|.....[.....| [9:13] S[] -> NP[NUM=?n] * VP[NUM=?n] {*?n2: Variable('?n')}
|.....[.....| [9:13] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {*?n3: Variable('?n')}
|.....[.....| [9:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {*?n2: Variable('?n')}
|.....[.....| [9:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {*?n3: Variable('?n')}
|.....[.....| [9:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {*?n2: Variable('?n')}
|.....[.....| [9:13] S[] -> NP[NUM=?n] * VP[NUM=?n] {*?n2: Variable('?n')}
|.....[.....| [12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {*?n3: Variable('?n')}
|.....[.....| [12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {*?n2: Variable('?n')}
|.....[.....| [12:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {*?n3: Variable('?n')}
|.....[.....| [12:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {*?n2: Variable('?n')}
|.....[.....| [13:14] PRP[] -> 'He' *
|.....[.....| [13:14] NP[NUM=?n] -> PRP[] *

```

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Figure 58. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

Run: PreProcess (1) ×

```

|.....[.....| [13:14] PRP[] -> 'He' *
|.....[.....| [13:14] NP[NUM=?n] -> PRP[] *
|.....[.....| [13:14] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
|.....[.....| [13:14] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
|.....[.....| [13:14] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[.....| [13:14] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[.....| [13:14] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[.....| [13:14] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {*?n3: Variable('?n')}
|.....[.....| [13:14] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {*?n2: Variable('?n')}
|.....[.....| [14:15] MD[TENSE='inf'] -> 'will' *
|.....[.....| [14:15] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * TV[TENSE='inf'] NP[] RB[] {?t: 'inf'}
|.....[.....| [14:15] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * TV[TENSE='inf'] NP[] {?t: 'inf'}
|.....[.....| [14:15] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] JJ[] {?t: 'inf'}
|.....[.....| [14:15] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] {?t: 'inf'}
|.....[.....| [14:15] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * IV[TENSE='inf'] {?t: 'inf'}
|.....[.....| [15:16] TV[TENSE='inf'] -> 'eat' *
|.....[.....| [15:16] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'inf'}
|.....[.....| [14:16] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] * NP[] RB[] {?t: 'inf'}
|.....[.....| [14:16] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] * NP[] {?t: 'inf'}
|.....[.....| [16:17] PRP[] -> 'it' *
|.....[.....| [16:17] NP[NUM=?n] -> PRP[] *
|.....[.....| [16:17] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
|.....[.....| [16:17] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
|.....[.....| [16:17] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[.....| [16:17] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {*?n3: Variable('?n')}
|.....[.....| [16:17] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {*?n2: Variable('?n')}
|.....[.....| [16:17] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {*?n3: Variable('?n')}
|.....[.....| [16:17] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {*?n2: Variable('?n')}
|.....[.....| [15:17] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
|.....[.....| [14:17] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'inf'}
|.....[.....| [14:17] VP[NUM=?n, TENSE='inf'] -> MD[TENSE='inf'] TV[TENSE='inf'] NP[] *
|.....[.....| [14:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*?n2: Variable('?n'), ?t: 'inf'}
|.....[.....| [14:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*?n3: Variable('?n'), ?t: 'inf'}
|.....[.....| [13:17] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[.....| [13:17] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {*?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[.....| [13:17] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {*?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[.....| [15:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*?n2: Variable('?n'), ?t: 'inf'}
|.....[.....| [15:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {*?n3: Variable('?n'), ?t: 'inf'}

```

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Figure 59. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

```
PreProcess (1) > [15:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}  
[15:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}  
[17:18] P[] -> 'on' *  
[17:18] IN[] -> P[] *  
[17:18] PP[] -> IN[] * NP[] {}  
[17:18] PP[] -> IN[] * DATE[] {}  
[18:19] WEEK[] -> 'Tuesday' *  
[18:19] DATE[] -> WEEK[] *  
[18:19] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}  
[18:19] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}  
[18:19] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}  
[17:19] PP[] -> IN[] DATE[] *  
[17:19] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}  
[17:19] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}  
[17:19] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}  
[17:19] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}  
[14:19] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *  
[15:19] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *  
[15:19] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}  
[15:19] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}  
[14:19] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}  
[14:19] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}  
[13:19] S[] -> NP[NUM=?n] VP[NUM=?n] *  
[13:19] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}  
[13:19] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}  
[19:20] P[] -> 'at' *  
[19:20] IN[] -> P[] *  
[19:20] PP[] -> IN[] * NP[] {}  
[19:20] PP[] -> IN[] * DATE[] PP[] {}  
[20:21] PRP[] -> 'his' *  
[20:21] NP[NUM=?n] -> PRP[] *  
[20:21] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}  
[20:21] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}  
[20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}  
[20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}  
[20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}  
[20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}  
[20:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}\n
```

Figure 60. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

```
Run: PreProcess (1) ×
[...]
[20:21] PRP[] -> 'his' *
[20:21] NP[NUM=?n] -> PRP[] *
[20:21] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
[20:21] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
[20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[20:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[19:21] PP[] -> IN[] NP[] *
[19:21] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[19:21] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[19:21] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[19:21] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[15:21] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[14:21] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[14:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[14:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[13:21] S[] -> NP[NUM=?n] VP[NUM=?n] *
[13:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[13:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[15:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[15:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[21:22] NN[] -> 'desk' *
[21:22] NN[] -> NN[] *
[21:22] NP[NUM=?n] -> NN[] *
[21:22] NP[NUM=?n] -> N[] * CC[] NP[NUM=?n] {?n: 'sg'}
[21:22] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
[21:22] Nom[NUM=?n] -> N[] *
[21:22] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
[21:22] NP[NUM=?n] -> Nom[NUM=?n] *
[21:22] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[21:22] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[21:22] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[21:22] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[21:22] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[20:22] NP[NUM=?n] -> PRP[] NP[NUM=?n] *
[20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
```

Figure 61. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

Run: PreProcess (1) ×

```

[...]
[>...| [20:22] NP[NUM=?n] -> PRP[] NP[NUM=?n] *
[...]
[>...| [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[...]
[>...| [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[...]
[>...| [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[...]
[>...| [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[...]
[>...| [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] INTR0[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[...]
[>...| [19:22] PP[] -> IN[] NP[] *
[...]
[>...| [19:22] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[...]
[>...| [19:22] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[...]
[>...| [19:22] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[...]
[>...| [19:22] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[...]
[>...| [15:22] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[...]
[>...| [14:22] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] * {?n2: Variable('?n'), ?t: 'inf'}
[...]
[>...| [14:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[...]
[>...| [14:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[...]
[>...| [13:22] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[...]
[>...| [13:22] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[...]
[>...| [15:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[...]
[>...| [22:23] PRP[] -> 'It' *
[...]
[>...| [22:23] NP[NUM=?n] -> PRP[] *
[...]
[>...| [22:23] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
[...]
[>...| [22:23] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
[...]
[>...| [22:23] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[...]
[>...| [22:23] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[...]
[>...| [22:23] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[...]
[>...| [22:23] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[...]
[>...| [22:23] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[...]
[>...| [23:24] MD[TENSE='inf'] -> 'will' *
[...]
[>...| [23:24] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * TV[TENSE='inf'] NP[] RB[] {?t: 'inf'}
[...]
[>...| [23:24] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * TV[TENSE='inf'] NP[] {?t: 'inf'}
[...]
[>...| [23:24] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] JJ[] {?t: 'inf'}
[...]
[>...| [23:24] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] {?t: 'inf'}
[...]
[>...| [23:24] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * IV[TENSE='inf'] {?t: 'inf'}
[...]
[>...| [24:25] AUX[TENSE='inf'] -> 'be' *
[...]
[>...| [24:25] VP[NUM=?n, TENSE=?t] -> AUX[TENSE=?t] * JJ[] {?t: 'inf'}
[...]
[>...| [23:25] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] AUX[TENSE='inf'] * JJ[] {?t: 'inf'}

```

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Figure 62. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

Run: PreProcess (1) ×

```

[...]
[>...| [22:23] NP[NUM=?n] -> PRP[] *
[...]
[>...| [22:23] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
[...]
[>...| [22:23] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
[...]
[>...| [22:23] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[...]
[>...| [22:23] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[...]
[>...| [22:23] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[...]
[>...| [22:23] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[...]
[>...| [22:23] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[...]
[>...| [23:24] MD[TENSE='inf'] -> 'will' *
[...]
[>...| [23:24] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * TV[TENSE='inf'] NP[] RB[] {?t: 'inf'}
[...]
[>...| [23:24] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * TV[TENSE='inf'] NP[] {?t: 'inf'}
[...]
[>...| [23:24] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] JJ[] {?t: 'inf'}
[...]
[>...| [23:24] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] {?t: 'inf'}
[...]
[>...| [23:24] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * IV[TENSE='inf'] {?t: 'inf'}
[...]
[>...| [24:25] AUX[TENSE='inf'] -> 'be' *
[...]
[>...| [24:25] VP[NUM=?n, TENSE=?t] -> AUX[TENSE=?t] * JJ[] {?t: 'inf'}
[...]
[>...| [23:25] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] AUX[TENSE='inf'] * JJ[] {?t: 'inf'}
[...]
[>...| [23:25] VP[NUM=?n, TENSE='inf'] -> MD[TENSE='inf'] AUX[TENSE='inf'] *
[...]
[>...| [23:25] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[...]
[>...| [23:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[...]
[>...| [22:25] S[] -> NP[NUM=?n] VP[NUM=?n] *
[...]
[>...| [22:25] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[...]
[>...| [22:25] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[...]
[>...| [25:26] JJ[] -> 'crunchy' *
[...]
[>...| [25:26] DATE[] -> JJ[] * WEEK[] {}
[...]
[>...| [24:26] VP[NUM=?n, TENSE='inf'] -> AUX[TENSE='inf'] JJ[] *
[...]
[>...| [23:26] VP[NUM=?n, TENSE='inf'] -> MD[TENSE='inf'] AUX[TENSE='inf'] JJ[] *
[...]
[>...| [23:26] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[...]
[>...| [23:26] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[...]
[>...| [22:26] S[] -> NP[NUM=?n] VP[NUM=?n] *
[...]
[>...| [22:26] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[...]
[>...| [22:26] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[...]
[>...| [24:26] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[...]
[>...| [24:26] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}

```

Process finished with exit code 0

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Figure 63. Test scenario 7 result: ‘Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.’

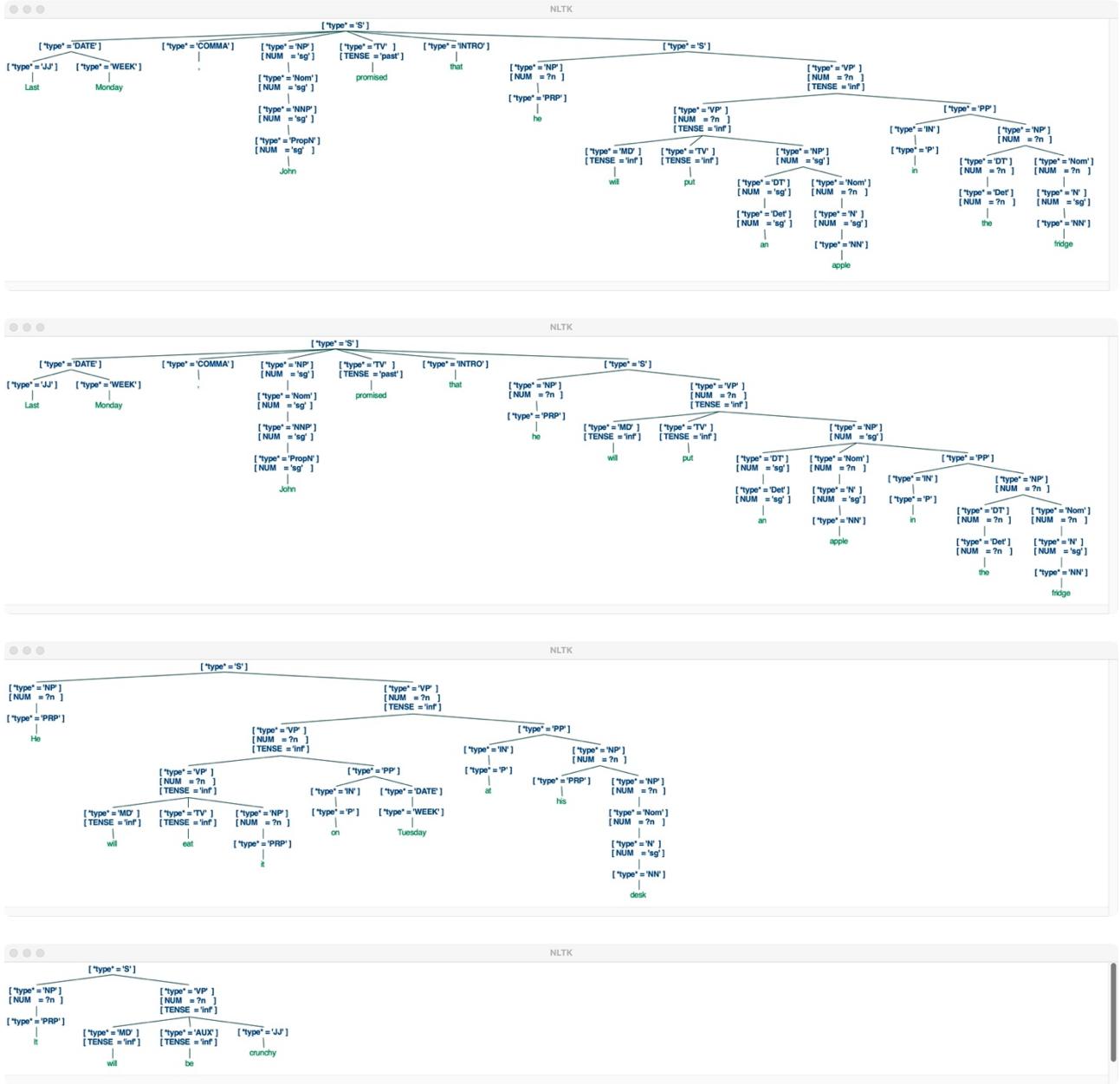


Figure 64. Test scenario 7 result: 'Last Monday, John promised that he will put an apple in the fridge. He will eat it on Tuesday at his desk. It will be crunchy.'

1.8. Test Scenario 8

Given: User enters the text content: 'On Monday, September 17, 2018, John O'Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O'Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.'

When: The validation data correctly input.

Result: Program can run successfully, and the text preprocess pipeline and proofreading results given.

Conclusion: The program can preprocess and proofread the text content. Sentences split, pos tag, name entity, Earley parse and Earley parse process results are displayed as Figures 65 ~ 107 shown below.

Run: PreProcess (1) ×

```
/usr/local/bin/python3.9 /Users/zouhaochen/PycharmProjects/COMP_6751/Project2/PreProcess.py
Please enter the text you want to parse:
On Monday, September 17, 2018, John O'Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O'Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.

Options to the results: save/print
Do you want to save the parse tree? N
Do you want to print the parse tree? Y

[Sentences Splitting]
[On Monday, September 17, 2018, John O'Malley promised his colleague Mary that he would put a replacement apple in the office fridge., "O'Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both.", 'But she was sick that day.']

[POS Tagging]
[[('On', 'IN'), ('Monday', 'NNP'), ('.', '.'), ('September', 'NNP'), ('17', 'CD'), ('.', '.'), ('2018', 'CD'), ('.', '.'), ("John O'Malley", 'NNP'), ('promised', 'VBD'), ('his', 'PRP$'), ('colleague', 'NN'), ('Mary', 'NNP'), ('that', 'IN'), ('he', 'PRP'), ('would', 'MD'), ('put', 'VB'), ('.', 'DT'), ('replacement', 'NN'), ('apple', 'NN'), ('in', 'IN'), ('the', 'DT'), ('office', 'NN'), ('fridge', 'NN')], [{"O'Malley": "NNP"}, {"intended": "VBD"}, {"to": "TO"}, {"share": "NN"}, {"it": "PRP"}, {"with": "IN"}, {"her": "PRP"}, {"on": "IN"}, {"Tuesday": "NNP"}, {"at": "IN"}, {"is": "PRP$"}, {"desk": "NN"}, {"and": "CC"}, {"anticipated": "VBD"}, {"that": "IN"}, {"the": "DT"}, {"crunchy": "NN"}, {"treat": "NN"}, {"would": "MD"}, {"delight": "VB"}, {"them": "PRP"}, {"both": "DT"}, {"But": "CC"}, {"she": "PRP"}, {"was": "VBD"}, {"sick": "JJ"}, {"that": "IN"}, {"day": "NN"]]

[Name Entities]
set()

[Earley Parsing]
(S[])
(PP[] (IN[] (P[] On)) (DATE[] (WEEK[] Monday)))
(COMMA[],)
(DATE[] (MONTH_STR[] September) (DAY[] 17) (SEP[] ,) (YEAR[] 2018))
(COMMA[],)
(NP[NUM='sg']
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
  (TV[TENSE='past'] promised)
  (NP[NUM='sg']
    (PRP[] his)
    (NP[NUM='sg']
      (Nom[NUM='sg']
        (N[NUM='sg'] (NN[] colleague))))))

Commit Git TODO Run Python Console Terminal
```

Figure 65. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```
[Earley Parsing]
(S[])
(PP[] (IN[] (P[] On)) (DATE[] (WEEK[] Monday)))
(COMMA[],)
(DATE[] (MONTH_STR[] September) (DAY[] 17) (SEP[] ,) (YEAR[] 2018))
(COMMA[],)
(NP[NUM='sg']
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
  (TV[TENSE='past'] promised)
  (NP[NUM='sg']
    (PRP[] his)
    (NP[NUM='sg']
      (Nom[NUM='sg']
        (N[NUM='sg'] (NN[] colleague))))))

(INTRO[] that)
(S[])
  (NP[NUM=?] (PRP[] he))
  (VP[NUM=? TENSE='past']
    (VP[NUM=? TENSE='past']
      (MD[TENSE='past'] would)
      (TV[TENSE='inf'] put)
      (NP[NUM='sg']
        (DT[NUM='sg'] (Det[NUM='sg'] a))
        (Nom[NUM=?n]
          (N[NUM='sg'] (NN[] replacement))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))))))

  (PP[])
    (IN[] (P[] in))
    (NP[NUM=?])
      (DT[NUM=?n] (Det[NUM=?n] the))
      (Nom[NUM=?n]
        (N[NUM='sg'] (NN[] office))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] fridge)))))))

(S[])
  (PP[] (IN[] (P[] On)) (DATE[] (WEEK[] Monday)))
  (COMMA[],)
  (DATE[] (MONTH_STR[] September) (DAY[] 17) (SEP[] ,) (YEAR[] 2018))

Commit Git TODO Run Python Console Terminal
```

Figure 66. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘
(S[]
  (PP[] (IN[] (P[] On)) (DATE[] (WEEK[] Monday)))
  (COMMA[] ,)
  (DATE[] (MONTH_STR[] September) (DAY[] 17) (SEP[] ,) (YEAR[] 2018))
  (COMMA[] ,)
  (NP[NUM='sg'])
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
  (TV[TENSE='past'] promised)
  (NP[NUM='sg'])
  (PRP[] his)
  (NP[NUM='sg'])
  (Nom[NUM='sg'])
  (N[NUM='sg'] (NN[] colleague))
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Mary))))
)
(INTRO[] that)
(S[]
  (NP[NUM=?n] (PRP[] he))
  (VP[NUM=?n, TENSE='past'])
  (MD[TENSE='past'] would)
  (TV[TENSE='inf'] put)
  (NP[NUM='sg'])
  (DT[NUM='sg']) (Det[NUM='sg'] a))
  (Nom[NUM=?n])
  (N[NUM='sg'] (NN[] replacement))
  (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))
)
(PP[])
  (IN[] (P[] in))
  (NP[NUM=?n])
  (DT[NUM=?n] (Det[NUM=?n] the))
  (Nom[NUM=?n])
  (N[NUM='sg'] (NN[] office))
  (Nom[NUM=?n] (N[NUM='sg'] (NN[] fridge))))
)
(S[]
  (NP[NUM='sg'])
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
  (VP[NUM=?n, TENSE='past'])
  (VP[NUM=?n, TENSE='past'])
  (IV[TENSE='past'] intended)
)
)

```

Commits: Git: TODO: Run: Python Console: Terminal:

Figure 67. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘
(S[]
  (NP[NUM='sg'])
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
  (VP[NUM=?n, TENSE='past'])
  (VP[NUM=?n, TENSE='past'])
  (IV[TENSE='past'] intended)
)
(TO[] to)
(VP[NUM=?n, TENSE='inf'])
(VP[NUM=?n, TENSE='inf'])
(VP[NUM=?n, TENSE='inf'])
(TV[TENSE='inf'] share)
(NP[NUM=?n] (PRP[] it))
(PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her)))
(PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
)
(PP[])
  (IN[] (P[] at))
  (NP[NUM=?n])
  (PRP[] his)
  (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))
)
(CC[] and)
(TV[TENSE='past'] anticipated)
(INTRO[] that)
(S[])
  (NP[NUM=?n])
  (DT[NUM=?n] (Det[NUM=?n] the))
  (JJ[] crunchy)
  (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] treat))))
)
(VP[NUM=?n, TENSE='past'])
(MD[TENSE='past'] would)
(TV[TENSE='inf'] delight)
(NP[NUM=?n] (PRP[] them))
(RB[] both))
)
(S[])
  (NP[NUM='sg'])
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley)))
)
(VP[NUM=?n, TENSE='past'])
(VP[NUM=?n, TENSE='past'])
(VP[NUM=?n, TENSE='past'])

```

Commits: Git: TODO: Run: Python Console: Terminal:

Figure 68. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg'])
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
  (VP[NUM=?n, TENSE='past'])
    (VP[NUM=?n, TENSE='past'])
      (VP[NUM=?n, TENSE='past'])
        (IV[TENSE='past'] intended)
        (TO[] to)
        (VP[NUM=?n, TENSE='inf'])
          (TV[TENSE='inf'] share)
          (NP[NUM=?n] (PRP[] it)))
        (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her)))
      (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
    (PP[])
      (IN[] (P[] at))
      (NP[NUM=?n])
        (PRP[] his)
        (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))
      (CC[] and)
      (TV[TENSE='past'] anticipated)
      (INTRO[] that)
    (S[])
      (NP[NUM=?n])
        (DT[NUM=?n] (Det[NUM=?n] the))
        (JJ[] crunchy)
        (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] treat))))
      (VP[NUM=?n, TENSE='past'])
        (MD[TENSE='past'] would)
        (TV[TENSE='inf'] delight)
        (NP[NUM=?n] (PRP[] them))
        (RB[] both)))
  (S[])
    (NP[NUM='sg'])
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley)))
    (VP[NUM=?n, TENSE='past'])
      (VP[NUM=?n, TENSE='past'])
        (VP[NUM=?n, TENSE='past'])
          (IV[TENSE='past'] intended)
          (TO[] to)
          (VP[NUM=?n, TENSE='inf'])
            (VP[NUM=?n, TENSE='inf'])
              (TV[TENSE='inf'] share)
              (NP[NUM=?n] (PRP[] it)))
            (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her)))
          (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
        (PP[])
          (IN[] (P[] at))
          (NP[NUM=?n])
            (PRP[] his)
            (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))
          (CC[] and)
          (TV[TENSE='past'] anticipated)
          (INTRO[] that)
        (S[])
          (NP[NUM=?n])
            (DT[NUM=?n] (Det[NUM=?n] the))
            (JJ[] crunchy)
            (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] treat))))
          (VP[NUM=?n, TENSE='past'])
            (MD[TENSE='past'] would)
            (TV[TENSE='inf'] delight)
            (NP[NUM=?n] (PRP[] them))
            (RB[] both)))
    (S[])
      (NP[NUM='sg'])
        (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley)))
      (VP[NUM=?n, TENSE='past'])
        (IV[TENSE='past'] intended)
        (TO[] to)

```

The screenshot shows a software interface with a toolbar at the top and a main window containing a tree view of a parse result. The tree structure represents a sentence with various parts of speech (NP, VP, PP, etc.) and their grammatical features (TENSE, NUM, etc.). The interface includes icons for file operations, a search bar, and tabs for Commit, Git, TODO, Run, Python Console, and Terminal.

Figure 69. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg'])
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
  (VP[NUM=?n, TENSE='past'])
    (VP[NUM=?n, TENSE='past'])
      (VP[NUM=?n, TENSE='past'])
        (IV[TENSE='past'] intended)
        (TO[] to)
        (VP[NUM=?n, TENSE='inf'])
          (VP[NUM=?n, TENSE='inf'])
            (TV[TENSE='inf'] share)
            (NP[NUM=?n] (PRP[] it)))
        (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her)))
      (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
    (PP[])
      (IN[] (P[] at))
      (NP[NUM=?n])
        (PRP[] his)
        (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))
      (CC[] and)
      (TV[TENSE='past'] anticipated)
      (INTRO[] that)
    (S[])
      (NP[NUM=?n])
        (DT[NUM=?n] (Det[NUM=?n] the))
        (JJ[] crunchy)
        (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] treat))))
      (VP[NUM=?n, TENSE='past'])
        (MD[TENSE='past'] would)
        (TV[TENSE='inf'] delight)
        (NP[NUM=?n] (PRP[] them))
        (RB[] both)))
  (S[])
    (NP[NUM='sg'])
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley)))
    (VP[NUM=?n, TENSE='past'])
      (IV[TENSE='past'] intended)
      (TO[] to)

```

This screenshot is identical to Figure 69, showing the same parse tree and software interface for the same test scenario.

Figure 70. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘
(S[])
  (NP[NUM='sg']
    (Nom[NUM='sg']) (NNP[NUM='sg']) (Prop[NUM='sg'] O'Malley)))
  (VP[NUM=?n, TENSE='past']
    (IV[TENSE='past'] intended)
    (TO[] to)
    (VP[NUM=?n, TENSE='inf']
      (VP[NUM=?n, TENSE='inf'])
      (VP[NUM=?n, TENSE='inf'])
      (VP[NUM=?n, TENSE='inf'])
        (TV[TENSE='inf'] share)
        (NP[NUM=?n] (PRP[] it)))
      (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her))))
      (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday))))
    (PP[])
      (IN[] (P[] at))
      (NP[NUM=?n])
        (PRP[] his)
        (NP[NUM=?n] (Nom[NUM=?n] (NN[NUM='sg'] (NN[] desk)))))
    (CC[] and)
    (TV[TENSE='past'] anticipated)
    (INTRO[] that)
  (S[])
    (NP[NUM=?n]
      (DT[NUM=?n] (Det[NUM=?n] the))
      (JJ[] crunchy)
      (NP[NUM=?n] (Nom[NUM=?n] (NN[NUM='sg'] (NN[] treat)))))
    (VP[NUM=?n, TENSE='past']
      (MD[TENSE='past'] would)
      (TV[TENSE='past'] delight)
      (NP[NUM=?n] (PRP[] them))
      (RB[] both))))
  (S[])
    (CC[] But)
    (NP[NUM=?n] (PRP[] she))
    (VP[NUM=?n, TENSE='past']
      (VP[NUM=?n, TENSE='past'] (AUX[TENSE='past'] was) (JJ[] sick))
    (PP[])

```

Figure 71. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘
[Earley Parse Process]

|[],.....| [0:1] 'On'
|.,[].....| [1:2] 'Monday'
|..[],....| [2:3] 'September'
|...[],....| [3:4] '17'
|....[],....| [4:5] '2018'
|....[],....| [5:6] 'John'
|....[],....| [6:7] 'O'Malley'
|....[],....| [7:8] 'promised'
|....[],....| [8:9] 'his'
|....[],....| [9:10] 'colleague'
|....[],....| [10:11] 'Mary'
|....[],....| [11:12] 'that'
|....[],....| [12:13] 'he'
|....[],....| [13:14] 'would'
|....[],....| [14:15] 'put'
|....[],....| [15:16] 'a'
|....[],....| [16:17] 'replacement'
|....[],....| [17:18] 'apple'
|....[],....| [18:19] 'in'
|....[],....| [19:20] 'the'
|....[],....| [20:21] 'office'
|....[],....| [21:22] 'fridge'
|....[],....| [22:23] 'O'Malley'
|....[],....| [23:24] 'intended'
|....[],....| [24:25] 'to'
|....[],....| [25:26] 'share'
|....[],....| [26:27] 'it'

```

Figure 72. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘
[...]
| [20:21] 'office'
| [21:22] 'fridge'
| [22:23] 'O'Malley'
| [23:24] 'intended'
| [24:25] 'to'
| [25:26] 'share'
| [26:27] 'it'
| [27:28] 'with'
| [28:29] 'her'
| [29:30] 'on'
| [30:31] 'Tuesday'
| [31:32] 'at'
| [32:33] 'his'
| [33:34] 'desk'
| [34:35] 'and'
| [35:36] 'anticipated'
| [36:37] 'that'
| [37:38] 'the'
| [38:39] 'crunchy'
| [39:40] 'treat'
| [40:41] 'would'
| [41:42] 'delight'
| [42:43] 'them'
| [43:44] 'both'
| [44:45] 'But'
| [45:46] 'she'
| [46:47] 'was'
| [47:48] 'sick'
| [48:49] 'that'
| [49:50] 'day'
| [0:1] P[] -> 'On' *
| [0:1] IN[] -> P[] *
| [0:1] PP[] -> IN[] * NP[] {}
| [0:1] PP[] -> IN[] * DATE[] {}
| [1:2] WEEK[] -> 'Monday' *
| [1:2] DATE[] -> WEEK[] *
| [1:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [1:2] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [0:2] PP[] -> IN[] DATE[] *
| [0:2] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [0:2] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
| [0:2] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
| [0:2] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
| [2:3] MONTH_STR[] -> 'September' *
| [2:3] DATE[] -> MONTH_STR[] * DAY[] SEP[] YEAR[] {}
| [2:3] DATE[] -> MONTH_STR[] * YEAR[] {}
| [2:3] DATE[] -> MONTH_STR[] * NN_NUM[] SEP[] YEAR[] {}
| [2:3] DATE[] -> MONTH_STR[] * NN_NUM[] {}
| [3:4] DAY[] -> '17' *
| [2:4] DATE[] -> MONTH_STR[] DAY[] * SEP[] YEAR[] {}
| [2:4] DATE[] -> MONTH_STR[] DAY[] *
| [2:4] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [2:4] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [2:4] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
| [4:5] YEAR[] -> '2018' *
| [4:5] DATE[] -> YEAR[] * SEP[] MONTH_NUM[] SEP[] DAY[] {}
| [4:5] DATE[] -> YEAR[] *
| [4:5] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [4:5] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [4:5] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
| [5:6] Prop[NUM='sg'] -> 'John' *
| [5:6] NNP[NUM='sg'] -> Prop[NUM='sg'] *
| [5:6] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
| [5:6] Nom[NUM='sg'] -> NNP[NUM='sg'] *
| [5:6] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
| [5:6] NP[NUM='sg'] -> Nom[NUM='sg'] *

```

Figure 73. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘
[...]
| [0:1] P[] -> 'On' *
| [0:1] IN[] -> P[] *
| [0:1] PP[] -> IN[] * NP[] {}
| [0:1] PP[] -> IN[] * DATE[] {}
| [1:2] WEEK[] -> 'Monday' *
| [1:2] DATE[] -> WEEK[] *
| [1:2] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [1:2] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [0:2] PP[] -> IN[] DATE[] *
| [0:2] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [0:2] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
| [0:2] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
| [0:2] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
| [2:3] MONTH_STR[] -> 'September' *
| [2:3] DATE[] -> MONTH_STR[] * DAY[] SEP[] YEAR[] {}
| [2:3] DATE[] -> MONTH_STR[] * YEAR[] {}
| [2:3] DATE[] -> MONTH_STR[] * NN_NUM[] SEP[] YEAR[] {}
| [2:3] DATE[] -> MONTH_STR[] * NN_NUM[] {}
| [3:4] DAY[] -> '17' *
| [2:4] DATE[] -> MONTH_STR[] DAY[] * SEP[] YEAR[] {}
| [2:4] DATE[] -> MONTH_STR[] DAY[] *
| [2:4] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [2:4] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [2:4] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
| [4:5] YEAR[] -> '2018' *
| [4:5] DATE[] -> YEAR[] * SEP[] MONTH_NUM[] SEP[] DAY[] {}
| [4:5] DATE[] -> YEAR[] *
| [4:5] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [4:5] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [4:5] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
| [5:6] Prop[NUM='sg'] -> 'John' *
| [5:6] NNP[NUM='sg'] -> Prop[NUM='sg'] *
| [5:6] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
| [5:6] Nom[NUM='sg'] -> NNP[NUM='sg'] *
| [5:6] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
| [5:6] NP[NUM='sg'] -> Nom[NUM='sg'] *

```

Figure 74. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```

I.....[...].....| [5:6] PropN[NUM='sg'] -> 'John' *
I.....[...].....| [5:6] NNP[NUM='sg'] -> PropN[NUM='sg'] *
I.....[>.....| [5:6] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
I.....[...].....| [5:6] NP[NUM='sg'] -> Non[NUM=?n] * PP[] {?n: 'sg'}
I.....[>.....| [5:6] NP[NUM='sg'] -> Non[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
I.....[...].....| [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
I.....[>.....| [5:6] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I.....[>.....| [5:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
I.....[>.....| [5:6] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
I.....[...].....| [6:7] PropN[NUM='sg'] -> 'OMalley' *
I.....[...].....| [6:7] NNP[NUM='sg'] -> PropN[NUM='sg'] *
I.....[>.....| [6:7] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
I.....[...].....| [6:7] Non[NUM='sg'] -> NNP[NUM='sg'] *
I.....[>.....| [6:7] NP[NUM=?n] -> Non[NUM=?n] * PP[] {?n: 'sg'}
I.....[...].....| [6:7] NP[NUM='sg'] -> Non[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
I.....[>.....| [6:7] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
I.....[...].....| [6:7] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I.....[>.....| [6:7] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I.....[>.....| [6:7] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] IN[] S[] {?n: 'sg'}
I.....[...].....| [7:8] TV[TENSE='past'] -> 'promised' *
I.....[>.....| [7:8] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
I.....[>.....| [6:8] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] {?n: 'sg'}
I.....[>.....| [6:8] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
I.....[...].....| [8:9] PRP[] -> 'his' *
I.....[...].....| [8:9] NP[NUM=?n] -> PRP[] *
I.....[>.....| [8:9] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
I.....[>.....| [8:9] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
I.....[>.....| [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I.....[>.....| [8:9] S[] -> NP[NUM=?n] DATE[] {?n3: Variable('?n')}
I.....[>.....| [8:9] S[] -> NP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I.....[>.....| [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n3: Variable('?n')}
I.....[>.....| [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I.....[>.....| [7:9] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE='past'] NP[] *
I.....[>.....| [7:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
I.....[>.....| [7:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
I.....[>.....| [7:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}

```

Commit Git TODO Run Python Console Terminal

Figure 75. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```

I.....[...].....| [7:9] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
I.....[>.....| [7:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
I.....[>.....| [7:9] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
I.....[...].....| [6:9] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I.....[>.....| [6:9] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I.....[...].....| [9:10] NN[] -> 'colleague' *
I.....[>.....| [9:10] N[NUM='sg'] -> NN[] *
I.....[>.....| [9:10] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
I.....[>.....| [9:10] Non[NUM=?n] -> N[] * Non[NUM=?n] {}
I.....[...].....| [9:10] Non[NUM=?n] -> N[] *
I.....[>.....| [9:10] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
I.....[...].....| [9:10] NP[NUM=?n] -> Nom[NUM=?n] *
I.....[>.....| [9:10] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I.....[>.....| [9:10] S[] -> NP[NUM=?n] DATE[] {?n3: Variable('?n')}
I.....[>.....| [9:10] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I.....[>.....| [9:10] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n3: Variable('?n')}
I.....[>.....| [9:10] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I.....[>.....| [9:10] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n3: Variable('?n')}
I.....[>.....| [9:10] S[] -> NP[NUM=?n] * PRP[] NP[NUM=?n] *
I.....[>.....| [8:10] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I.....[>.....| [8:10] S[] -> NP[NUM=?n] DATE[] {?n3: Variable('?n')}
I.....[>.....| [8:10] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I.....[>.....| [8:10] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I.....[>.....| [8:10] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I.....[>.....| [8:10] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n3: Variable('?n')}
I.....[>.....| [7:10] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE='past'] NP[] *
I.....[>.....| [7:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
I.....[>.....| [7:10] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
I.....[>.....| [6:10] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I.....[>.....| [6:10] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I.....[>.....| [6:10] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I.....[...].....| [10:11] PropN[NUM='sg'] -> 'Mary' *
I.....[>.....| [10:11] NNP[NUM='sg'] -> PropN[NUM='sg'] *
I.....[>.....| [10:11] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
I.....[...].....| [10:11] Non[NUM='sg'] -> NNP[NUM='sg'] *
I.....[>.....| [10:11] NP[NUM=?n] -> Non[NUM=?n] PP[] {?n: 'sg'}
I.....[...].....| [10:11] NP[NUM='sg'] -> Non[NUM='sg'] *
I.....[>.....| [9:11] Non[NUM='sg'] -> N[] Non[NUM='sg'] *
I.....[>.....| [9:11] NP[NUM=?n] -> Non[NUM=?n] PP[] {?n: 'sg'}

```

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Figure 76. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```

|.....[9:11] Nom[NUM='sg'] -> N[] Nom[NUM='sg'] *
|.....[9:11] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
|.....[9:11] NP[NUM='sg'] -> Nom[NUM='sg'] *
|.....[9:11] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|.....[9:11] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|.....[9:11] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[9:11] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[9:11] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|.....[8:11] NP[NUM='sg'] -> PRP[] NP[NUM='sg'] *
|.....[8:11] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|.....[8:11] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|.....[8:11] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[8:11] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[8:11] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|.....[7:11] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|.....[7:11] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[7:11] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[6:11] S[] -> NP[NUM='sg'] VP[NUM=?n] *
|.....[6:11] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[6:11] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[10:11] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|.....[10:11] S[] -> VP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|.....[10:11] S[] -> VP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[10:11] S[] -> VP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[10:11] S[] -> VP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|.....[11:12] P[] -> 'that' *
|.....[11:12] INTRO[] -> 'that' *
|.....[11:12] IN[] -> P[] *
|.....[11:12] PP[] -> IN[] * NP[] {}
|.....[11:12] PP[] -> IN[] * DATE[] {}
|.....[12:13] PRP[] -> 'he' *
|.....[12:13] NP[NUM=?n] -> PRP[] *
|.....[12:13] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
|.....[12:13] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
|.....[12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}

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```

Figure 77. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```

|.....[12:13] PRP[] -> 'he' *
|.....[12:13] NP[NUM=?n] -> PRP[] *
|.....[12:13] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
|.....[12:13] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
|.....[12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[12:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[12:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[11:13] PP[] -> IN[] NP[] *
|.....[11:13] S[] -> PP[] * COMM[] NP[NUM=?n] VP[NUM=?n] {}
|.....[11:13] S[] -> PP[] * COMM[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|.....[11:13] S[] -> PP[] * COMM[] DATE[] COMM[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
|.....[11:13] DATE[] -> PP[] * COMM[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
|.....[10:13] NP[NUM='sg'] -> Non[NUM='sg'] PP[] *
|.....[9:13] NP[NUM='sg'] -> Non[NUM='sg'] PP[] *
|.....[9:13] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[6:13] S[] -> NP[NUM='sg'] VP[NUM=?n] *
|.....[6:13] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[6:13] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[9:13] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|.....[9:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[9:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[9:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|.....[8:13] NP[NUM='sg'] -> PRP[] NP[NUM='sg'] *
|.....[8:13] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|.....[8:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[8:13] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[8:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|.....[7:13] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[]
|.....[7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[7:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[6:13] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[6:13] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[6:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
```

Figure 78. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘
[6:13] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[6:13] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[6:13] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[10:13] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
[10:13] S[] -> NP[NUM=?n] DATE[] {?n: 'sg'}
[10:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[10:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[10:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[13:14] MD[TENSE='past'] -> 'would' *
[13:14] >
[13:14] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * TV[TENSE='inf'] NP[] RB[] {?t: 'past'}
[13:14] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * VP[NUM=?n] NP[] {?t: 'past'}
[13:14] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] JJ[] {?t: 'past'}
[13:14] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] {?t: 'past'}
[13:14] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * IV[TENSE='inf'] {?t: 'past'}
[14:15] TV[NUM='pl', TENSE='pres'] -> 'put' *
[14:15] TV[TENSE='inf'] -> 'put' *
[14:15] TV[TENSE='past'] -> 'put' *
[14:15] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
[14:15] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'inf'}
[13:15] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] * NP[] RB[] {?t: 'past'}
[13:15] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] * NP[] {?t: 'past'}
[14:15] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?n: 'pl', ?t: 'pres'}
[15:16] Det[NUM='sg'] -> 'a' *
[15:16] DT[NUM='sg'] -> Det[NUM='sg'] *
[15:16] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n: 'sg'}
[15:16] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n: 'sg'}
[15:16] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n: 'sg'}
[16:17] NN[] -> 'replacement' *
[16:17] N[NUM='sg'] -> NN[] *
[16:17] NP[NUM=?n] -> N[NUM=?n] *
[16:17] Nom[NUM=?n] -> N[] *
[16:17] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
[16:17] NP[NUM=?n] -> Nom[NUM=?n] *
[15:17] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] *
[15:17] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] {?n: 'sg', ?n2: 'sg'}
[15:17] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
[15:17] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[15:17] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[15:17] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[14:17] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[]
[14:17] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
[13:17] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'past'}
[13:17] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] *
[14:17] VP[NUM='pl', TENSE='pres'] -> TV[NUM='pl', TENSE='pres'] NP[] *
[14:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pl', ?t: 'pres'}
[13:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[13:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[12:17] S[] -> NP[NUM=?n] VP[NUM=?n] *
[12:17] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[12:17] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[9:17] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[9:17] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[9:17] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[8:17] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[8:17] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[8:17] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[10:17] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[10:17] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[10:17] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[14:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[14:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[14:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[14:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[16:17] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[16:17] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[16:17] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[16:17] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[16:17] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[17:18] NN[] -> 'apple' *
[17:18] N[NUM='sg'] -> NN[] *

```

Figure 79. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘
[15:17] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] *
[15:17] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n: 'sg', ?n2: 'sg'}
[15:17] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
[15:17] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[15:17] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[15:17] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[14:17] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[]
[14:17] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
[13:17] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'past'}
[13:17] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] *
[14:17] VP[NUM='pl', TENSE='pres'] -> TV[NUM='pl', TENSE='pres'] NP[] *
[14:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pl', ?t: 'pres'}
[13:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[13:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[12:17] S[] -> NP[NUM=?n] VP[NUM=?n] *
[12:17] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[12:17] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[9:17] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[9:17] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[9:17] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[8:17] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[8:17] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[8:17] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[10:17] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[10:17] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[10:17] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[14:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[14:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[14:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[14:17] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[16:17] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[16:17] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[16:17] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[16:17] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[16:17] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[17:18] NN[] -> 'apple' *
[17:18] N[NUM='sg'] -> NN[] *

```

Figure 80. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘

[...]
| [17:18] NN[] -> 'apple' *
| [17:18] N[NUM='sg'] -> NN[] *
| [17:18] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
| [17:18] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
| [17:18] [...]
| [17:18] NP[NUM=?n] -> N[NUM=?n] *
| [16:18] [...]
| [16:18] Nom[NUM=?n] -> N[] Nom[NUM=?n] *
| [16:18] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
| [16:18] NP[NUM=?n] -> Nom[NUM=?n] *
| [15:18] [...]
| [15:18] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] *
| [15:18] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n: 'sg', ?n2: 'sg'}
| [15:18] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
| [15:18] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
| [15:18] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
| [15:18] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
| [15:18] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] IN[] S[] {?n: 'sg'}
| [14:18] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
| [14:18] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
| [13:18] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'past'}
| [13:18] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] *
| [14:18] VP[NUM='pl', TENSE='pres'] -> TV[NUM='pl', TENSE='pres'] NP[] *
| [14:18] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n: 'pl', ?t: 'pres'}
| [13:18] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
| [13:18] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
| [12:18] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
| [12:18] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
| [9:18] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [9:18] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [9:18] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [8:18] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [8:18] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [8:18] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [10:18] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [10:18] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [10:18] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [14:18] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'inf'}
```

Figure 81. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘

[...]
| [10:18] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [10:18] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [10:18] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [14:18] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'inf'}
| [14:18] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'inf'}
| [14:18] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
| [14:18] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
| [16:18] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| [16:18] S[] -> NP[NUM=?n] * VP[NUM=?n] * DATE[] {?n3: Variable('?n')}
| [16:18] S[] -> NP[NUM=?n] * VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| [16:18] S[] -> NP[NUM=?n] * VP[NUM=?n] * CC[] IN[] S[] {?n2: Variable('?n')}
| [16:18] S[] -> NP[NUM=?n] * VP[NUM=?n] * CC[] IN[] S[] IN[] S[] {?n2: Variable('?n')}
| [16:18] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] IN[] S[] {?n2: Variable('?n')}
| [17:18] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| [17:18] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| [17:18] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] IN[] S[] {?n3: Variable('?n')}
| [17:18] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] IN[] S[] IN[] S[] {?n2: Variable('?n')}
| [18:19] P[] -> 'in' *
| [18:19] IN[] -> P[] *
| [18:19] P[] -> IN[] * NP[] {}
| [18:19] PP[] -> IN[] * DATE[] {}
| [19:20] Det[NUM=?n] -> 'the' *
| [19:20] DT[NUM=?n] -> Det[NUM=?n] *
| [19:20] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')}
| [19:20] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')}
| [19:20] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')}
| [20:21] NN[] -> 'office' *
| [20:21] NN['sg'] -> NN[] *
| [20:21] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
| [20:21] NP[NUM=?n] -> N[] * Nom[NUM=?n] {}
| [20:21] NP[NUM=?n] -> N[] * Nom[NUM=?n] *
| [20:21] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
| [20:21] NP[NUM=?n] -> Nom[NUM=?n] *
| [19:21] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
| [19:21] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| [19:21] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
```

Figure 82. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

The screenshot shows a software interface with a title bar "Run: PreProcess (1)". Below the title bar is a tree view of the generated parse trees. The root node is a complex NLP structure involving NP, NUM, VP, DATE, CC, TV, and IN. The tree branches down into various sub-nodes, each representing a different grammatical structure or dependency relation. At the bottom of the interface, there are several tabs: Commit, Git, TODO, Run, Python Console, and Terminal.

```

[19:21] S[] -> NP[NUM=?n] * DT[NUM=?n] Nom[NUM=?n] *
[19:21] S[] -> NP[NUM=?n] * DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[19:21] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[19:21] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[19:21] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[19:21] S[] -> NP[NUM=?n] * VP[NUM=?n] TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[19:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[18:21] PP[] -> IN[] NP[] *
[18:21] PP[] * COMMMA[] NP[NUM=?n] VP[NUM=?n] {}
[18:21] S[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[18:21] DATE[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[17:21] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
[16:21] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
[15:21] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] PP[] *
[14:21] VP[NUM='pl', TENSE='pres'] -> VP[NUM='pl', TENSE='pres'] PP[] *
[13:21] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[14:21] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[14:21] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[14:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[14:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[14:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[14:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[13:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[13:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[12:21] S[] -> NP[NUM=?n] VP[NUM=?n] *
[12:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[12:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[12:21] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[9:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[9:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[8:21] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[8:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[8:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[8:21] S[] -> NP[NUM=?n] VP[NUM=?n] *
[10:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[10:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[10:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pl', ?t: 'pres'}

```

Figure 83. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

The screenshot shows a software interface with a title bar "Run: PreProcess (1)". Below the title bar is a tree view of the generated parse trees. The root node is a complex NLP structure involving NP, NUM, VP, DATE, CC, TV, and IN. The tree branches down into various sub-nodes, each representing a different grammatical structure or dependency relation. At the bottom of the interface, there are several tabs: Commit, Git, TODO, Run, Python Console, and Terminal.

```

[10:21] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[10:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[10:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[10:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pl', ?t: 'pres'}
[15:21] S[] -> NP[NUM=?n] VP[NUM=?n] {?n: 'sg'}
[15:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg'}
[15:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[15:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[14:21] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
[14:21] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
[14:21] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'past'}
[13:21] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] *
[14:21] VP[NUM='pl', TENSE='pres'] -> TV[NUM='pl', TENSE='pres'] NP[] *
[13:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pl', ?t: 'pres'}
[13:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[13:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[12:21] S[] -> NP[NUM=?n] VP[NUM=?n] *
[12:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[12:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[9:21] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[9:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[9:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[8:21] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[8:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[8:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[8:21] S[] -> NP[NUM=?n] VP[NUM=?n] *
[10:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[10:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[10:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[14:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[14:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[14:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[16:21] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[16:21] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[16:21] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[16:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[16:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}

```

Figure 84. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```

[1:1] .[>.....| [16:21] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[1:1] .[>.....| [16:21] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[1:1] .[>.....| [16:21] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[1:1] .[>.....| [16:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[1:1] .[>.....| [16:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[1:1] .[>.....| [17:21] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[1:1] .[>.....| [17:21] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[1:1] .[>.....| [17:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[1:1] .[>.....| [17:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[1:1] .[>.....| [20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[1:1] .[>.....| [20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[1:1] .[>.....| [20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[1:1] .[>.....| [20:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[1:1] .[>.....| [20:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[1:1] .[>.....| [21:22] NN[] -> 'fridge' *
[1:1] .[>.....| [21:22] NN[] -> 'sugar' *
[1:1] .[>.....| [21:22] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sugar'}
[1:1] .[>.....| [21:22] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
[1:1] .[>.....| [21:22] Nom[NUM=?n] -> N[] *
[1:1] .[>.....| [21:22] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
[1:1] .[>.....| [21:22] NP[NUM=?n] -> Nom[NUM=?n] *
[1:1] .[>.....| [28:22] Nom[NUM=?n] -> N[] Nom[NUM=?n] *
[1:1] .[>.....| [28:22] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
[1:1] .[>.....| [28:22] NP[NUM=?n] -> Nom[NUM=?n] *
[1:1] .[>.....| [19:22] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
[1:1] .[>.....| [19:22] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1:1] .[>.....| [19:22] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[1:1] .[>.....| [19:22] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[1:1] .[>.....| [19:22] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[1:1] .[>.....| [19:22] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[1:1] .[>.....| [19:22] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[1:1] .[>.....| [18:22] PP[] -> IN[] NP[] *
[1:1] .[>.....| [18:22] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[1:1] .[>.....| [18:22] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[1:1] .[>.....| [18:22] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[1:1] .[>.....| [17:22] NP[NUM=?n] -> Nom[NUM=?n] PP[] *

```

Commit Git TODO Run Python Console Terminal

Figure 85. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```

[1:1] .[>.....| [18:22] PP[] -> IN[] NP[] *
[1:1] .[>.....| [18:22] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[1:1] .[>.....| [18:22] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[1:1] .[>.....| [18:22] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[1:1] .[>.....| [18:22] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[1:1] .[>.....| [17:22] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
[1:1] .[>.....| [16:22] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
[1:1] .[>.....| [15:22] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] PP[] *
[1:1] .[>.....| [15:22] VP[NUM='pl', TENSE='pres'] -> VP[NUM='pl', TENSE='pres'] PP[] *
[1:1] .[>.....| [13:22] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[1:1] .[>.....| [14:22] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[1:1] .[>.....| [14:22] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[1:1] .[>.....| [14:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[1:1] .[>.....| [14:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[1:1] .[>.....| [14:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[1:1] .[>.....| [14:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[1:1] .[>.....| [13:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[1:1] .[>.....| [13:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[1:1] .[>.....| [12:22] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:1] .[>.....| [12:22] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1:1] .[>.....| [12:22] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1:1] .[>.....| [9:22] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1:1] .[>.....| [9:22] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:1] .[>.....| [9:22] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:1] .[>.....| [8:22] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1:1] .[>.....| [8:22] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:1] .[>.....| [8:22] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:1] .[>.....| [10:22] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1:1] .[>.....| [10:22] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:1] .[>.....| [10:22] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:1] .[>.....| [10:22] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:1] .[>.....| [14:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pl', ?t: 'pres'}
[1:1] .[>.....| [14:22] S[] -> NP[NUM=?n] VP[NUM=?n] {?n: 'sg'}
[1:1] .[>.....| [15:22] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n: 'sg'}
[1:1] .[>.....| [15:22] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[1:1] .[>.....| [15:22] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n: 'sg'}
[1:1] .[>.....| [15:22] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[1:1] .[>.....| [14:22] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
[1:1] .[>.....| [14:22] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *

```

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Figure 86. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘
|.....|. [14:22] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|.....|. [14:22] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
|.....|. [>]. [13:22] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'past'}
|.....|. [13:22] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] *
|.....|. [14:22] VP[NUM='pL', TENSE='pres'] -> TV[NUM='pL', TENSE='pres'] NP[] *
|.....|. [>]. [13:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pL', ?t: 'pres'}
|.....|. [>]. [13:22] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....|. [>]. [12:22] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....|. [>]. [12:22] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....|. [>]. [12:22] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....|. [>]. [9:22] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....|. [>]. [9:22] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....|. [>]. [8:22] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....|. [>]. [8:22] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....|. [>]. [8:22] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....|. [>]. [10:22] S[] -> NP[NUM='sg'] VP[NUM=?n] *
|.....|. [>]. [10:22] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....|. [>]. [10:22] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....|. [>]. [14:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
|.....|. [>]. [14:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
|.....|. [>]. [14:22] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....|. [>]. [16:22] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....|. [>]. [16:22] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n2: Variable('?n')}
|.....|. [>]. [16:22] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....|. [>]. [16:22] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....|. [>]. [16:22] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')} IN[] S[] {?n2: Variable('?n')}
|.....|. [>]. [17:22] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....|. [>]. [17:22] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....|. [>]. [17:22] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....|. [>]. [17:22] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....|. [>]. [17:22] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....|. [>]. [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....|. [>]. [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....|. [>]. [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....|. [>]. [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
Run: Commit ⌂ Git ⌂ TODO ▶ Run Python Console Terminal

```

Figure 87. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘
|.....|. [>]. [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....|. [>]. [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....|. [>]. [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....|. [>]. [20:22] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....|. [>]. [20:22] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....|. [>]. [21:22] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....|. [>]. [21:22] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....|. [>]. [21:22] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] IN[] S[] {?n2: Variable('?n')}
|.....|. [>]. [21:22] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....|. [>]. [21:22] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....|. [>]. [21:22] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....|. [>]. [21:22] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....|. [>]. [21:22] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] IN[] S[] {?n2: Variable('?n')}
|.....|. [>]. [22:23] PropN[NUM='sg'] -> 'OMalley' *
|.....|. [>]. [22:23] NNP[NUM='sg'] -> PropN[NUM='sg'] *
|.....|. [22:23] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|.....|. [>]. [22:23] NonNUM='sg' -> NNP[NUM='sg'] *
|.....|. [>]. [22:23] NP[NUM=?n] -> NonNUM=?n * PP[] {?n: 'sg'}
|.....|. [>]. [22:23] NP[NUM='sg'] -> NonNUM='sg' *
|.....|. [21:23] NonNUM='sg' -> NI[] NonNUM='sg' *
|.....|. [>]. [21:23] NP[NUM=?n] -> NonNUM=?n * PP[] {?n: 'sg'}
|.....|. [>]. [21:23] NP[NUM='sg'] -> NonNUM='sg' *
|.....|. [20:23] NonNUM='sg' -> NI[] NonNUM='sg' *
|.....|. [>]. [20:23] NP[NUM=?n] -> NonNUM=?n * PP[] {?n: 'sg'}
|.....|. [>]. [20:23] NP[NUM='sg'] -> NonNUM='sg' *
|.....|. [>]. [19:23] NP[NUM='sg'] -> DT[NUM='sg'] NonNUM='sg' *
|.....|. [19:23] NP[NUM=?n] -> DT[NUM=?n] NonNUM=?n * PP[] {?n: 'sg', ?n3: 'sg'}
|.....|. [>]. [19:23] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|.....|. [>]. [19:23] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|.....|. [19:23] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....|. [>]. [19:23] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....|. [>]. [19:23] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|.....|. [>]. [18:23] PP[] -> IN[] NP[] *
|.....|. [>]. [18:23] S[] -> PP[] * COMM[] NP[NUM=?n] VP[NUM=?n] {}
|.....|. [>]. [18:23] S[] -> PP[] * COMM[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
|.....|. [>]. [18:23] S[] -> PP[] * COMM[] DATE[] COMM[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
|.....|. [>]. [18:23] DATE[] -> PP[] * COMM[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
|.....|. [>]. [17:23] NP[NUM=?n] -> NonNUM=?n PP[] *
|.....|. [16:23] NP[NUM=?n] -> NonNUM=?n PP[] *
|.....|. [15:23] NP[NUM='sg'] -> DT[NUM='sg'] NonNUM='sg' PP[] *
|.....|. [14:23] VP[NUM='pL', TENSE='pres'] -> VP[NUM='pL', TENSE='pres'] PP[] *
Run: Commit ⌂ Git ⌂ TODO ▶ Run Python Console Terminal

```

Figure 88. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```

|.....[.].....| [17:23] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
|.....[.].....| [16:23] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
|.....[.].....| [15:23] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] PP[] *
|.....[.].....| [14:23] VP[NUM=p1', TENSE='pres'] -> VP[NUM=p1', TENSE='pres'] PP[] *
|.....[.].....| [13:23] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[.].....| [14:23] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[.].....| [14:23] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
|.....[.].....| [14:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[.].....| [14:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[.].....| [14:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'inf'}
|.....[.].....| [14:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'inf'}
|.....[.].....| [13:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[.].....| [13:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[.].....| [12:23] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[.].....| [12:23] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[.].....| [12:23] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[.].....| [9:23] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[.].....| [9:23] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [9:23] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [8:23] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[.].....| [8:23] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [8:23] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [10:23] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[.].....| [10:23] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [10:23] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [14:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n: 'p1', ?t: 'pres'}
|.....[.].....| [15:23] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[.].....| [15:23] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n: 'sg'}
|.....[.].....| [15:23] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[.].....| [15:23] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg'}
|.....[.].....| [15:23] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] IN[] S[] {?n: 'sg'}
|.....[.].....| [14:23] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|.....[.].....| [14:23] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
|.....[.].....| [13:23] VP[NUM=?n, TENSE=?t] -> MD[TENSE='past'] TV[TENSE='past'] NP[] *
|.....[.].....| [13:23] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] *
|.....[.].....| [14:23] VP[NUM=?n, TENSE='pres'] -> TV[NUM=p1', TENSE='pres'] NP[] *
|.....[.].....| [14:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n: 'p1', ?t: 'pres'}
|.....[.].....| [13:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}

```

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Figure 89. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```

|.....[.].....| [14:23] VP[NUM='p1', TENSE='pres'] -> TV[NUM='p1', TENSE='pres'] NP[] *
|.....[.].....| [14:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n: 'p1', ?t: 'pres'}
|.....[.].....| [13:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[.].....| [13:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[.].....| [12:23] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[.].....| [12:23] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[.].....| [12:23] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[.].....| [9:23] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[.].....| [9:23] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [9:23] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [8:23] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[.].....| [8:23] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [8:23] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [10:23] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[.].....| [10:23] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [10:23] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[.].....| [10:23] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [10:23] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [10:23] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[.].....| [10:23] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [10:23] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [14:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'inf'}
|.....[.].....| [14:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'inf'}
|.....[.].....| [14:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[.].....| [14:23] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[.].....| [16:23] S[] -> NP[NUM=?n] VP[NUM=?n] {?n2: Variable('?n')}
|.....[.].....| [16:23] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[.].....| [16:23] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[.].....| [16:23] S[] -> NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[.].....| [16:23] S[] -> NP[NUM=?n] TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[.].....| [17:23] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[.].....| [17:23] S[] -> NP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[.].....| [17:23] S[] -> NP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[.].....| [17:23] S[] -> NP[NUM=?n] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[.].....| [17:23] S[] -> NP[NUM=?n] TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[.].....| [17:23] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n: 'sg'}
|.....[.].....| [20:23] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[.].....| [20:23] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n: 'sg'}
|.....[.].....| [20:23] S[] -> NP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[.].....| [20:23] S[] -> NP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[.].....| [21:23] S[] -> NP[NUM=?n] VP[NUM=?n] {?n: 'sg'}
|.....[.].....| [21:23] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n: 'sg'}
|.....[.].....| [21:23] S[] -> NP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}

```

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Figure 90. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```

[21:23] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
[21:23] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[21:23] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[21:23] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[21:23] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[22:23] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[22:23] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[22:23] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[23:24] IV[TENSE='past'] -> 'intended' *
[23:24] VP[NUM=?n, TENSE=?t] -> IV[TENSE=?t] * TO[] VP[TENSE='inf'] {?t: 'past'}
[23:24] VP[NUM=?n, TENSE=?t] -> IV[TENSE='past'] *
[23:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[23:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[19:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[19:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[19:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[15:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[15:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[15:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[16:24] S[] -> NP[NUM=?n] VP[NUM=?n] *
[16:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[16:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[17:24] S[] -> NP[NUM=?n] VP[NUM=?n] *
[17:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[17:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[20:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[20:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[20:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[21:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[21:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[21:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[22:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[22:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[22:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[24:25] P[] -> 'to' *
[24:25] TO[] -> 'to' *

```

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Figure 91. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```

[24:25] P[] -> 'to' *
[24:25] TO[] -> 'to' *
[23:25] VP[NUM=?n, TENSE=?t] -> IV[TENSE=?t] TO[] * VP[TENSE='inf'] {?t: 'past'}
[24:25] IN[] -> P[] *
[24:25] PP[] -> IN[] * NP[] {}
[24:25] PP[] -> IN[] * DATE[] {}
[25:26] TV[TENSE='inf'] -> 'share' *
[25:26] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'inf'}
[26:27] PRP[] -> 'it' *
[26:27] NP[NUM=?n] -> PRP[] *
[26:27] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
[26:27] NP[NUM=?n] -> PRP[] * DATE[] PRP[] {}
[26:27] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[26:27] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[26:27] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[26:27] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n3: Variable('?n')}
[26:27] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[25:27] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
[25:27] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[25:27] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[23:27] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] TO[] VP[TENSE='inf'] *
[23:27] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[23:27] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[19:27] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[19:27] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[19:27] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[15:27] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[15:27] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[15:27] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[16:27] S[] -> NP[NUM=?n] VP[NUM=?n] *
[16:27] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[16:27] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[17:27] S[] -> NP[NUM=?n] VP[NUM=?n] *
[17:27] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[17:27] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[20:27] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[20:27] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[20:27] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}

```

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Figure 92. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```

[...]
| [20:27] S[] -> NP[NUM=?n] VP[NUM='sg'] *
| [20:27] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [20:27] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [21:27] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [...]
| [21:27] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [21:27] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [22:27] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [...]
| [22:27] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [22:27] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [27:28] P[] -> 'with' *
| [...]
| [...] | [27:28] IN[] -> P[] *
| [...]
| [...] | [27:28] PP[] -> IN[] * NP[] {}
| [...]
| [...] | [27:28] PP[] -> IN[] * DATE[] {}
| [...]
| [...] | [28:29] PRP[] -> 'her' *
| [...]
| [...] | [28:29] NP[NUM=?n] -> PRP[] *
| [...]
| [...] | [28:29] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
| [...]
| [...] | [28:29] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
| [...]
| [...] | [28:29] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| [...]
| [...] | [28:29] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
| [...]
| [...] | [28:29] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
| [...]
| [...] | [28:29] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
| [...]
| [...] | [28:29] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
| [...]
| [...] | [27:29] PP[] -> IN[] NP[] *
| [...]
| [...] | [27:29] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [...]
| [...] | [27:29] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
| [...]
| [...] | [27:29] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
| [...]
| [...] | [27:29] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] []
| [...]
| [...] | [25:29] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
| [...]
| [...] | [23:29] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
| [...]
| [...] | [23:29] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
| [...]
| [...] | [23:29] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
| [...]
| [...] | [19:29] S[] -> NP[NUM='sg'] VP[NUM=?n] *
| [...]
| [...] | [19:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [19:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [15:29] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [...]
| [...] | [15:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [15:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [16:29] S[] -> NP[NUM=?n] VP[NUM=?n] *

```

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Figure 93. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Run: PreProcess (1) ×

```

[...]
| [15:29] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [...]
| [15:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [15:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [16:29] S[] -> NP[NUM=?n] VP[NUM=?n] *
| [...]
| [...] | [16:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
| [...]
| [...] | [16:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
| [...]
| [...] | [17:29] S[] -> NP[NUM=?n] VP[NUM=?n] *
| [...]
| [...] | [17:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
| [...]
| [...] | [17:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
| [...]
| [...] | [20:29] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [...]
| [...] | [20:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [20:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [21:29] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [...]
| [...] | [21:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [21:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [22:29] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [...]
| [...] | [22:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [22:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [25:29] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
| [...]
| [...] | [25:29] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
| [...]
| [...] | [23:29] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] TO[] VP[TENSE='inf'] *
| [...]
| [...] | [23:29] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
| [...]
| [...] | [23:29] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
| [...]
| [...] | [19:29] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [...]
| [...] | [19:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [19:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [15:29] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
| [...]
| [...] | [15:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [15:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [...] | [16:29] S[] -> NP[NUM=?n] VP[NUM=?n] *

```

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Figure 94. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ×
[1] . . . . . []
[1] . . . . . | [20:29] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1] . . . . . | [20:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [20:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [21:29] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1] . . . . . | [21:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [21:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [22:29] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1] . . . . . | [22:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [22:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [29:30] P[] -> 'on' *
[1] . . . . . | [29:30] IN[] -> P[] *
[1] . . . . . | [29:30] PP[] -> IN[] * NP[] {}
[1] . . . . . | [29:30] PP[] -> IN[] * DATE[] {}
[1] . . . . . | [30:31] WEEK[] -> 'Tuesday' *
[1] . . . . . | [30:31] DATE[] -> WEEK[] *
[1] . . . . . | [30:31] S[] -> DATE[] * COMMMA[] NP[NUM=?n] VP[NUM=?n] {}
[1] . . . . . | [30:31] S[] -> DATE[] * COMMMA[] PP[] COMMMA[] NP[NUM=?n] VP[NUM=?n] {}
[1] . . . . . | [30:31] S[] -> DATE[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[1] . . . . . | [29:31] PP[] -> IN[] DATE[] *
[1] . . . . . | [29:31] S[] -> PP[] * COMMMA[] NP[NUM=?n] VP[NUM=?n] {}
[1] . . . . . | [29:31] S[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[1] . . . . . | [29:31] S[] -> PP[] * COMMMA[] DATE[] COMMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[1] . . . . . | [29:31] DATE[] -> PP[] * COMMMA[] NP[NUM=?n] VP[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[1] . . . . . | [23:31] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[1] . . . . . | [25:31] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[1] . . . . . | [25:31] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[1] . . . . . | [25:31] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[1] . . . . . | [23:31] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] TO[] VP[TENSE='inf'] *
[1] . . . . . | [23:31] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[1] . . . . . | [23:31] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[1] . . . . . | [19:31] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1] . . . . . | [19:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [19:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [15:31] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1] . . . . . | [15:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [15:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [16:31] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1] . . . . . | [16:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}

```

Figure 95. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ×
[1] . . . . . | [15:31] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1] . . . . . | [15:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [15:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [16:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1] . . . . . | [16:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1] . . . . . | [17:31] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1] . . . . . | [17:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1] . . . . . | [17:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1] . . . . . | [20:31] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1] . . . . . | [20:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [20:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [21:31] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1] . . . . . | [21:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [21:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [22:31] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1] . . . . . | [22:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [22:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [23:31] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1] . . . . . | [23:31] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[1] . . . . . | [23:31] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[1] . . . . . | [19:31] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1] . . . . . | [19:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [19:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [15:31] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[1] . . . . . | [15:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [15:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1] . . . . . | [16:31] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1] . . . . . | [16:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1] . . . . . | [16:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1] . . . . . | [17:31] S[] -> NP[NUM=?n] VP[NUM=?n] *

```

Figure 96. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ×
[1:31] S[] -> NP[NUM=?n] VP[NUM='sg'] *
[1:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:31] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:31] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:31] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:31] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:32] P[] -> 'at' *
[1:32] IN[] -> P[] *
[1:32] PP[] -> IN[] * NP[] {}
[1:32] PP[] -> IN[] * DATE[] {}
[1:32] PRP[] -> 'his' *
[1:32] NP[NUM=?n] -> PRP[] *
[1:32] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
[1:32] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
[1:32] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[1:32] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[1:32] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[1:32] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[1:32] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[1:32] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:32] PP[] -> IN[] NP[] *
[1:32] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] INTRO[] S[] {}
[1:32] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[1:32] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] MONTH_STR[] NN_NUM[] YEAR[] {}
[1:32] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[1:32] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[1:32] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
[1:32] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
[1:32] VP[NUM=?n] VP[NUM=?n] *
[1:32] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:32] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:32] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:32] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *

```

Figure 97. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ×
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[1:33] S[] -> NP[NUM=?n] VP[NUM=?n] *

```

Figure 98. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```
|.....| [21:33] S[] -> NP[NUM='sg'] VP[NUM='sg'] *  
|.....| [21:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}  
|.....| [21:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}  
|.....| [22:33] S[] -> NP[NUM='sg'] VP[NUM='sg'] *  
|.....| [22:33] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}  
|.....| [22:33] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}  
|.....| [33:34] NN[] -> 'desk' *  
|.....| [33:34] N[NUM='sg'] -> NN[] *  
|.....| [33:34] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}  
|.....| [33:34] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}  
|.....| [33:34] Nom[NUM=?n] -> N[] *  
|.....| [33:34] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}  
|.....| [33:34] NP[NUM=?n] -> Nom[NUM=?n] *  
|.....| [33:34] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}  
|.....| [33:34] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}  
|.....| [33:34] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}  
|.....| [33:34] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}  
|.....| [33:34] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}  
|.....| [32:34] NP[NUM=?n] -> PRP[] NP[NUM=?n] *  
|.....| [32:34] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}  
|.....| [32:34] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}  
|.....| [32:34] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}  
|.....| [32:34] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}  
|.....| [32:34] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}  
|.....| [31:34] PP[] -> IN[] NP[] *  
|.....| [31:34] S[] -> PP[] * COMM[] NP[NUM=?n] VP[NUM=?n] {}  
|.....| [31:34] S[] -> PP[] * COMM[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}  
|.....| [31:34] S[] -> PP[] * COMM[] DATE[] COMM[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}  
|.....| [31:34] S[] -> PP[] * COMM[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}  
|.....| [25:34] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *  
|.....| [23:34] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *  
|.....| [23:34] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}  
|.....| [23:34] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}  
|.....| [19:34] S[] -> NP[NUM='sg'] VP[NUM='sg'] *  
|.....| [19:34] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}  
|.....| [19:34] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}  
|.....| [15:34] S[] -> NP[NUM='sg'] VP[NUM='sg'] *  
|.....| [15:34] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
```

Figure 99. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

Figure 100. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ×
[...]
| [20:34] S[] -> NP[NUM=?n] VP[NUM='sg'] *
| [...]
| [20:34] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [21:34] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [21:34] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [21:34] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [22:34] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [22:34] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [22:34] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [22:34] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [34:35] CC[] -> 'and' *
| [...]
| [34:35] S[] -> CC[] * NP[NUM=?n] VP[NUM=?n] {}
| [...]
| [33:35] NP[NUM=?n] -> N[NUM=?n] CC[] NP[NUM=?n] {?n: 'sg'}
| [...]
| [19:35] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [15:35] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [17:35] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n: Variable('?n'), ?n3: Variable('?n')}
| [...]
| [20:35] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [21:35] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [22:35] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [35:36] TV[TENSE='past'] -> 'anticipated' *
| [...]
| [35:36] VP[NUM=?n], TENSE=?t -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
| [...]
| [19:36] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] * INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [15:36] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] * INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [16:36] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] * INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
| [...]
| [17:36] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] * INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
| [...]
| [20:36] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] * INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [21:36] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] * INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [22:36] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] * INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [36:37] P[] -> 'that' *
| [...]
| [36:37] IN[] -> 'that' *
| [...]
| [36:37] INTRO[] -> 'that' *
| [...]
| [19:37] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] * S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [15:37] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] * S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [16:37] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] * S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
| [...]
| [17:37] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] * S[] {*n2: Variable('?n'), ?n3: Variable('?n')}
| [...]
| [20:37] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] * S[] {*n: 'sg', ?n2: 'sg'}
| [...]
| [21:37] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] * S[] {*n: 'sg', ?n2: 'sg'}
| [...]
| [22:37] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] * S[] {*n: 'sg', ?n2: 'sg'}
| [...]
| [36:37] IN[] -> P[] *

```

Figure 101. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ×
[...]
| [20:37] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] * S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [21:37] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] * S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [22:37] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] * S[] {?n: 'sg', ?n2: 'sg'}
| [...]
| [36:37] IN[] -> P[] *
| [...]
| [36:37] PP[] -> IN[] * NP[] {}
| [...]
| [36:37] PP[] -> IN[] * DATE[] {}
| [...]
| [37:38] Det[NUM=?n] -> 'the' *
| [...]
| [37:38] DT[NUM=?n] -> Det[NUM=?n] *
| [...]
| [37:38] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')}
| [...]
| [37:38] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {*n3: Variable('?n')}
| [...]
| [37:38] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')}
| [...]
| [38:39] JJ[] -> 'crunchy' *
| [...]
| [38:39] DATE[] -> JJ[] * WEEK[] {}
| [...]
| [37:39] NP[NUM=?n] -> DT[NUM=?n] JJ[] * NP[NUM=?n] {?n2: Variable('?n')}
| [...]
| [39:40] NN[] -> 'treat' *
| [...]
| [39:40] N[NUM='sg'] -> NN[] *
| [...]
| [39:40] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
| [...]
| [39:40] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
| [...]
| [39:40] Nom[NUM=?n] -> N[] *
| [...]
| [39:40] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {*n2: Variable('?n')}
| [...]
| [39:40] NP[NUM=?n] -> Nom[NUM=?n] *
| [...]
| [39:40] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
| [...]
| [39:40] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {*n3: Variable('?n')}
| [...]
| [39:40] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {*n2: Variable('?n')}
| [...]
| [39:40] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {*n3: Variable('?n')}
| [...]
| [39:40] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {*n2: Variable('?n')}
| [...]
| [37:40] NP[NUM=?n] -> DT[NUM=?n] JJ[] NP[NUM=?n] *
| [...]
| [37:40] S[] -> NP[NUM=?n] * VP[NUM=?n] {*n2: Variable('?n')}
| [...]
| [37:40] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {*n3: Variable('?n')}
| [...]
| [37:40] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {*n2: Variable('?n')}
| [...]
| [37:40] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {*n3: Variable('?n')}
| [...]
| [37:40] S[] -> NP[NUM=?n] * CC[] IN[] S[] {*n2: Variable('?n')}
| [...]
| [36:40] PP[] -> IN[] NP[] {}
| [...]
| [36:40] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
| [...]
| [36:40] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
| [...]
| [36:40] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
| [...]
| [36:40] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {*n2: Variable('?n')}
| [...]
| [40:41] MD[TENSE='past'] -> 'would' *

```

Figure 102. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ×
[...]
[36:48] PP[] -> IN[] NP[] *
[36:48] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[36:48] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[36:48] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[36:48] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[40:41] MD[TENSE='past'] -> 'would' *
[40:41] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * TV[TENSE='inf'] NP[] RB[] {?t: 'past'}
[40:41] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * TV[TENSE='inf'] NP[] {?t: 'past'}
[40:41] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] CC[] {?t: 'past'}
[40:41] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] {?t: 'past'}
[40:41] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * IV[TENSE='inf'] {?t: 'past'}
[41:42] TV[TENSE='inf'] -> 'delight' *
[41:42] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'inf'}
[40:42] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] * NP[] RB[] {?t: 'past'}
[40:42] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] * NP[] {?t: 'past'}
[42:43] PRP[] -> 'them' *
[42:43] NP[NUM=?n] -> PRP[] *
[42:43] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
[42:43] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
[42:43] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[42:43] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[42:43] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[42:43] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[41:43] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
[40:43] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'past'}
[40:43] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] *
[40:43] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[40:43] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n5: Variable('?n'), ?t: 'past'}
[39:43] S[] -> NP[NUM=?n] VP[NUM=?n] *
[39:43] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[39:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[37:43] S[] -> NP[NUM=?n] VP[NUM=?n] *
[37:43] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[37:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[19:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[15:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[16:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[17:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[20:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[21:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[22:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[41:43] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[41:43] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[43:44] RB[] -> 'both' *
[43:44] S[] -> RB[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[40:44] VP[NUM=?n, TENSE=?t] -> RB[] * TV[NUM=?n, TENSE=?t] NP[] {}
[40:44] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] RB[] *
[40:44] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[40:44] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[39:44] S[] -> NP[NUM=?n] VP[NUM=?n] *
[39:44] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[39:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[37:44] S[] -> NP[NUM=?n] VP[NUM=?n] *
[37:44] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[37:44] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[19:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[15:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[16:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[17:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[20:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[21:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[22:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[44:45] CC[] -> 'But' *
[44:45] S[] -> CC[] * NP[NUM=?n] VP[NUM=?n] {}
[39:45] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[37:45] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[45:46] PRP[] -> 'she' *
[45:46] NP[NUM=?n] -> PRP[]
[45:46] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}

```

Figure 103. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ×
[...]
[37:43] S[] -> NP[NUM=?n] VP[NUM=?n] *
[37:43] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[37:43] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[19:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[15:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[16:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[17:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[20:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[21:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[22:43] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[41:43] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[41:43] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[43:44] RB[] -> 'both' *
[43:44] S[] -> RB[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[40:44] VP[NUM=?n, TENSE=?t] -> RB[] * TV[NUM=?n, TENSE=?t] NP[] {}
[40:44] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] RB[] *
[40:44] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[40:44] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[39:44] S[] -> NP[NUM=?n] VP[NUM=?n] *
[39:44] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[39:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[37:44] S[] -> NP[NUM=?n] VP[NUM=?n] *
[37:44] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[37:44] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[19:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[15:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[16:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[17:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[20:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[21:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[22:44] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] *
[44:45] CC[] -> 'But' *
[44:45] S[] -> CC[] * NP[NUM=?n] VP[NUM=?n] {}
[39:45] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[37:45] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[45:46] PRP[] -> 'she' *
[45:46] NP[NUM=?n] -> PRP[]
[45:46] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}

```

Figure 104. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘

[...]
[45:46] PRP[] -> 'she' *
[45:46] NP[NUM=?n] -> PRP[] *
[45:46] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
[45:46] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[45:46] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[45:46] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[45:46] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[45:46] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}, {?n3: Variable('?n')}
[44:46] S[] -> CC[] NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[46:47] AUX[TENSE='past'] -> 'was' *
[46:47] VP[NUM=?n, TENSE=?t] -> AUX[TENSE=?t] * JJ[] {?t: 'past'}
[47:48] JJ[] -> 'sick' *
[47:48] DATE[] -> JJ[] * WEEK[] {}
[46:48] VP[NUM=?n, TENSE=?t] -> AUX[TENSE='past'] JJ[] *
[46:48] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[46:48] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[45:48] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[45:48] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[45:48] S[] -> CC[] NP[NUM=?n] VP[NUM=?n] *
[48:49] PT[] -> 'that' *
[48:49] INTRO[] -> 'that' *
[48:49] IN[] -> P[] *
[48:49] PP[] -> IN[] * NP[] {}
[48:49] PP[] -> IN[] * DATE[] {}
[49:50] NN[] -> 'day' *
[49:50] NN['sg'] -> NN[] *
[49:50] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
[49:50] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
[49:50] Nom[NUM=?n] -> N[] *
[49:50] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
[49:50] NP[NUM=?n] -> Nom[NUM=?n] *
[49:50] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[49:50] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[49:50] S[] -> VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[49:50] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[49:50] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}

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```

Figure 105. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

```

Run: PreProcess (1) ✘

[...]
[46:48] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[45:48] S[] -> NP[NUM=?n] VP[NUM=?n] *
[45:48] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[45:48] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[44:48] S[] -> CC[] NP[NUM=?n] VP[NUM=?n] *
[48:49] PT[] -> 'that' *
[48:49] INTRO[] -> 'that' *
[48:49] IN[] -> P[] *
[48:49] PP[] -> IN[] * NP[] {}
[48:49] PP[] -> IN[] * DATE[] {}
[49:50] NN[] -> 'day' *
[49:50] NN['sg'] -> NN[] *
[49:50] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
[49:50] Non[NUM=?n] -> N[] * Nom[NUM=?n] {}
[49:50] Non[NUM=?n] -> N[] *
[49:50] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
[49:50] NP[NUM=?n] -> Nom[NUM=?n] *
[49:50] NP[NUM=?n] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[49:50] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[49:50] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[49:50] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[49:50] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}

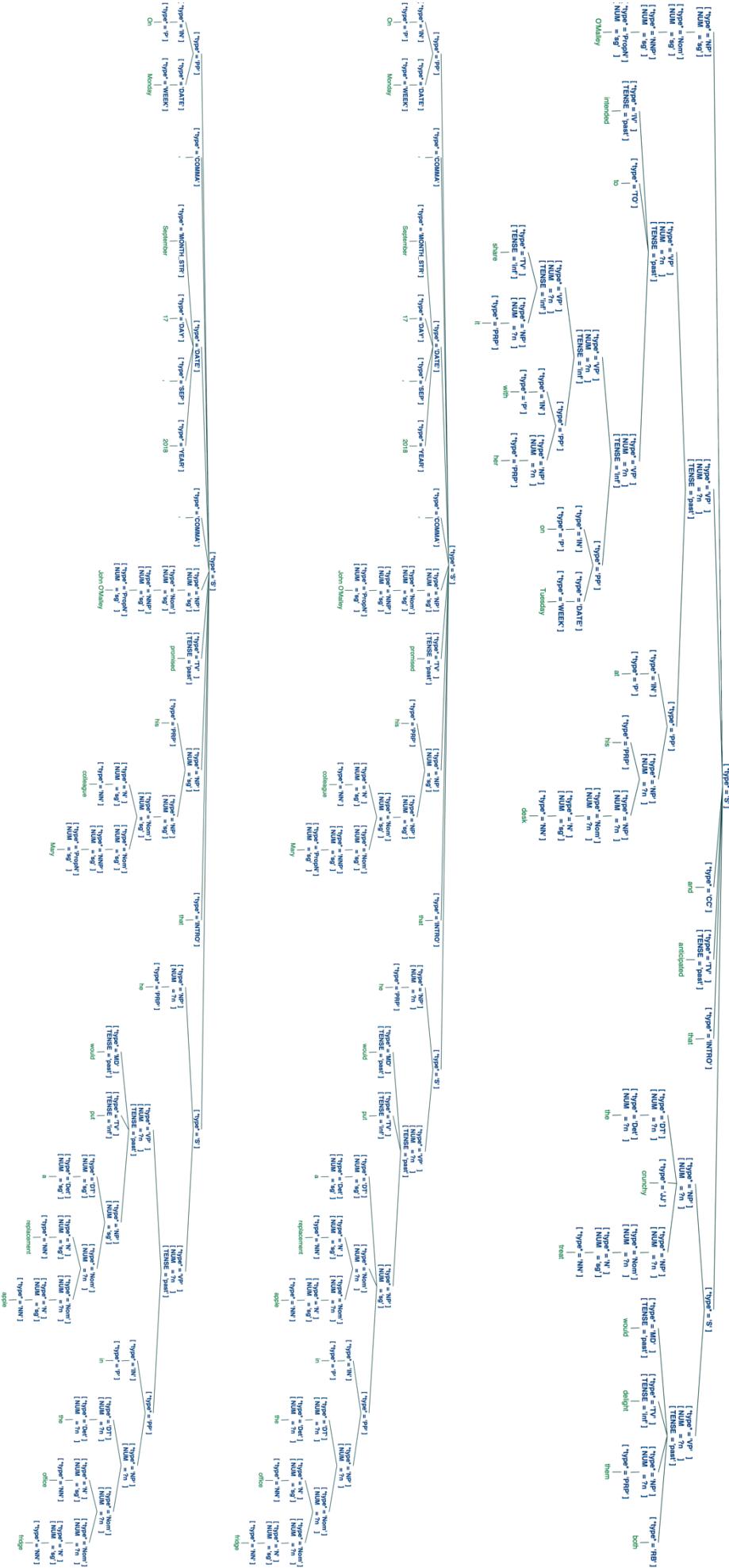
[48:50] PP[] -> IN[] NP[] *
[48:50] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[48:50] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[48:50] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[48:50] S[] -> NP[NUM=?n] * VP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[46:50] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[46:50] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[46:50] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[45:50] S[] -> NP[NUM=?n] VP[NUM=?n] *
[45:50] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[45:50] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[44:50] S[] -> CC[] NP[NUM=?n] VP[NUM=?n] *

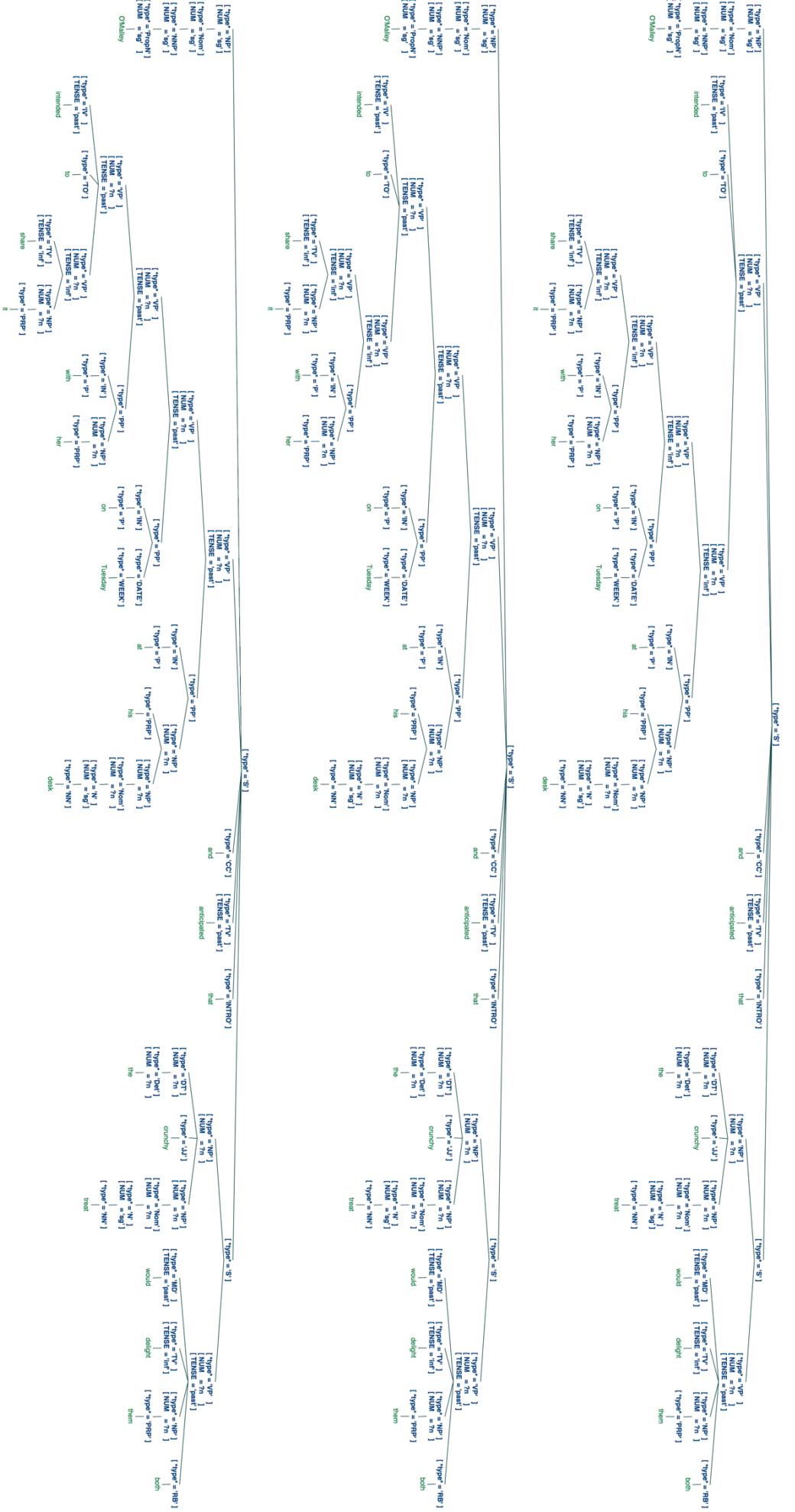
<generator object FeatureChart.parses at 0x7fc7153bce40>

Process finished with exit code 0

```

Figure 106. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’





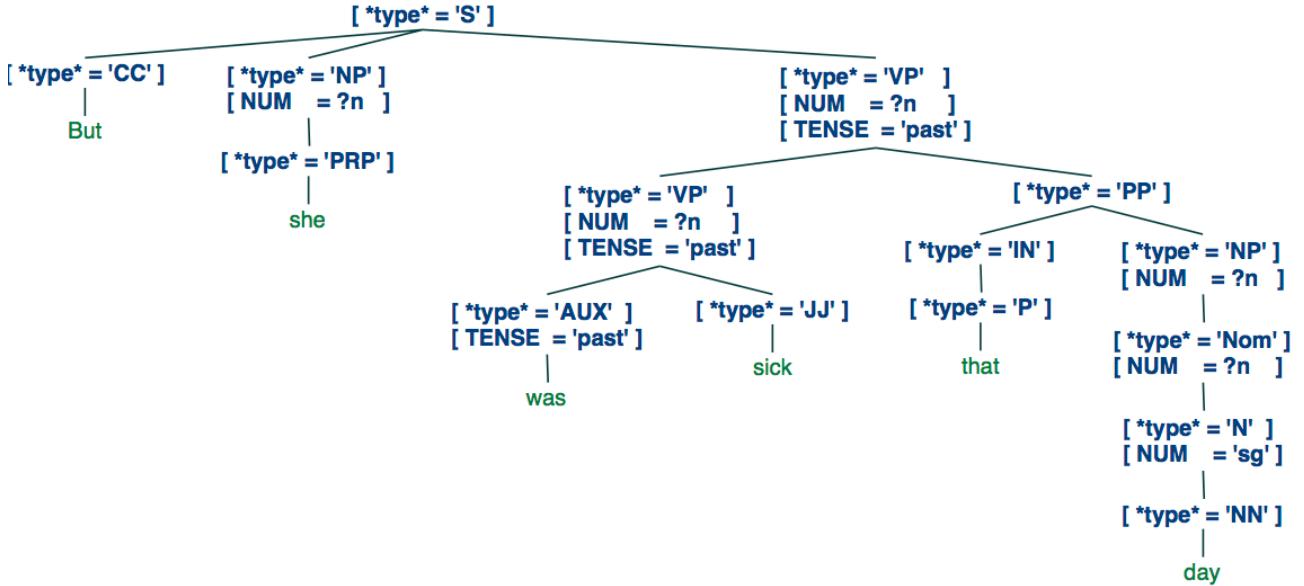


Figure 107. Test scenario 8 result: ‘On Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge. O’Malley intended to share it with her on Tuesday at his desk and anticipated that the crunchy treat would delight them both. But she was sick that day.’

1.9. Test Scenario 9

Given: User enters the text content: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

When: The validation data correctly input.

Result: Program can run successfully, and the text preprocess pipeline and proofreading results given.

Conclusion: The program can preprocess and proofread the text content. Sentences split, pos tag, name entity, Earley parse and Earley parse process results are displayed as Figures 108 ~ 158 shown below.

```

Run: PreProcess (1) ✘
/usr/local/bin/python3.9 /Users/zouhaochen/PycharmProjects/COMP_6751/Project2/PreProcess.py
Please enter the text you want to parse:
Sue said that on Monday, September 17, 2018, John O'Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O'Malley intended to share it with her on Tuesday at his desk.

Options to the results: save/print
Do you want to save the parse tree? N
Do you want to print the parse tree? Y

[Sentences Splitting]
["Sue said that on Monday, September 17, 2018, John O'Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O'Malley intended to share it with her on Tuesday at his desk."]

[POS Tagging]
[("Sue", "NNP"), ("said", "VBD"), ("that", "IN"), ("on", "IN"), ("Monday", "NNP"), (",", ","), ("September", "NNP"), ("17", "CD"), (",", ","), ("2018", "CD"), (",", ","), ("John O'Malley", "NNP"), ("promised", "VBD"), ("his", "PRP$"), ("colleague", "NN"), ("Mary", "NNP"), ("that", "IN"), ("he", "PRP"), ("would", "MD"), ("put", "VB"), ("a", "DT"), ("replacement", "NN"), ("apple", "NN"), ("in", "IN"), ("the", "DT"), ("office", "NN"), ("fridge", "NN"), ("and", "CC"), ("that", "IN"), ("O'Malley", "NNP"), ("intended", "VBD"), ("to", "TO"), ("share", "NN"), ("it", "PRP"), ("with", "IN"), ("her", "PRP"), ("on", "IN"), ("Tuesday", "NNP"), ("at", "IN"), ("his", "PRP$"), ("desk", "NN")]

[Name Entities]
{"John O'Malley", "O'Malley", "Sue"}

[Earley Parsing]
($)
  (NP[NUM='sg']
    (Non[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue)))
    (TV[TENSE='past'] said)
    (INTRO[] that)
  ($)
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[]
      (MONTH_STR[] September)
      (DAY[] 17)
      (SEP[],)
      (YEAR[] 2018))
    (COMMA[],)

```

Figure 108. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

The screenshot shows the Earley Parsing interface with the title "PreProcess (1)". The main pane displays a complex parse tree for a sentence. The root node is S[], which contains several nested nodes representing parts of speech and their grammatical features. Some key nodes include:

- (NP[NUM='sg'])
- (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg']) sue))
- (TV[TENSE='past']) said)
- (INTRO[] that)
- (S[])
 - (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
 - (COMMA[] ,)
 - (DATE[])
 - (MONTH_STR[] September)
 - (DAY[] 17)
 - (SEP[] ,)
 - (YEAR[] 2018))
 - (COMMA[] ,)
 - (NP[NUM='sg'])
 - (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg']) John O'Malley))
 - (TV[TENSE='past']) promised)
 - (NP[NUM='sg'])
 - (PRP[] his)
 - (NP[NUM='sg'])
 - (Nom[NUM='sg']) (NN[] colleague))
 - (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg']) Mary))))
 - (INTRO[] that)
 - (S[])
 - (NP[NUM=?n] (PRP[] he))
 - (VP[NUM=?n, TENSE='past'])
 - (VP[NUM=?n, TENSE='past'])
 - (MD[TENSE='past']) would)
 - (TV[TENSE='inf']) put)
 - (NP[NUM='sg'])
 - (DT[NUM='sg']) (Det[NUM='sg']) a))
 - (Nom[NUM=?n]
 - (N[NUM='sg']) (NN[] replacement))
 - (Nom[NUM=?n] (N[NUM='sg']) (NN[] apple))))
 - (PP[])
 - (IN[] (P[] in))
 - (NP[NUM=?n]
 - (DT[NUM=?n] (Det[NUM=?n] the))
 - (Nom[NUM=?n]
 - (N[NUM='sg']) (NN[] office))
 - (Nom[NUM=?n] (N[NUM='sg']) (NN[] fridge))))
 - (CC[] and)
 - (IN[] (P[] that))
 - (S[])
 - (NP[NUM='sg'])
 - (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg']) O'Malley))
 - (VP[NUM=?n, TENSE='past'])
 - (VP[NUM=?n, TENSE='past'])
 - (IV[TENSE='past']) intended)
 - (TO[] to)
 - (VP[NUM=?n, TENSE='inf'])
 - (VP[NUM=?n, TENSE='inf'])
 - (VP[NUM=?n, TENSE='inf'])
 - (TV[TENSE='inf']) share)
 - (NP[NUM=?n] (PRP[] it))
 - (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her)))
 - (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
 - (PP[])
 - (IN[] (P[] at))
 - (NP[NUM=?n]
 - (PRP[] his)

Figure 109. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

This screenshot shows the same Earley Parsing interface as Figure 109, but with a different grammar structure. The parse tree is similar, but the internal node labels and feature sets are different, reflecting the changes in the grammar. The main differences are in the node labels like NP, VP, and PP, and the specific feature values assigned to them.

Figure 110. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg']) O'Malley)))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past'])
    (IV[TENSE='past'] intended)
    (TO[] to)
    (VP[NUM=?n, TENSE='inf'])
    (VP[NUM=?n, TENSE='inf'])
    (VP[NUM=?n, TENSE='inf'])
    (TV[TENSE='inf'] share)
    (NP[NUM=?n] (PRP[] it))
    (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her)))
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday))))
  )
  (PP[])
  (IN[] (P[] at))
  (NP[NUM=?n]
    (PRP[] his)
    (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))
  )
)
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg']) Sue)))
  (TV[TENSE='past'] said)
  (INTRO[] that)
)
(S[]
  (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
  (COMMA[],)
  (DATE[])
  (MONTH_STR[] September)
  (DAY[] 17)
  (SEP[],)
  (YEAR[] 2018))
  (COMMA[],)
  (NP[NUM='sg']
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg']) John O'Malley)))
  (TV[TENSE='past'] promised)
  (NP[NUM='sg'])
  (PRP[] his)
)
)

```

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Figure 111. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg']) O'Malley)))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past'])
    (IV[TENSE='past'] said)
    (INTRO[] that)
)
  (S[]
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[])
    (MONTH_STR[] September)
    (DAY[] 17)
    (SEP[],)
    (YEAR[] 2018))
    (COMMA[],)
    (NP[NUM='sg']
      (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg']) John O'Malley)))
    (TV[TENSE='past'] promised)
    (NP[NUM='sg'])
    (PRP[] his)
    (NP[NUM='sg'])
      (Nom[NUM='sg'])
        (N[NUM='sg'] (NN[] colleague))
        (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg']) Mary)))
  )
  (INTRO[] that)
)
(S[]
  (NP[NUM=?n] (PRP[] he))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past'])
    (MD[TENSE='past'] would)
    (TV[TENSE='inf'] put)
    (NP[NUM='sg'])
      (DT[NUM='sg'] (Det[NUM='sg'] a))
      (Nom[NUM=?n])
        (N[NUM='sg'] (NN[] replacement))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))
  )
  (PP[])
  (IN[] (P[] in))
  (NP[NUM=?n])
)

```

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Figure 112. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
  (S[])
    (NP[NUM='sg'])
      (Nom[NUM='sg']) (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley)))
    (VP[NUM=?n, TENSE='past'])
      (VP[NUM=?n, TENSE='past'])
        (VP[NUM=?n, TENSE='past'])
          (VP[NUM=?n, TENSE='past'])
            (VP[NUM=?n, TENSE='past'])
              (VP[NUM=?n, TENSE='past'])
                (VP[NUM=?n, TENSE='past'])
                  (VP[NUM=?n, TENSE='past'])
                    (VP[NUM=?n, TENSE='past'])
                      (VP[NUM=?n, TENSE='past'])
                        (VP[NUM=?n, TENSE='past'])
                          (VP[NUM=?n, TENSE='past'])
                            (VP[NUM=?n, TENSE='past'])
                              (VP[NUM=?n, TENSE='past'])
                                (VP[NUM=?n, TENSE='past'])
                                  (VP[NUM=?n, TENSE='past'])
                                    (VP[NUM=?n, TENSE='past'])
                                      (VP[NUM=?n, TENSE='past'])
                                        (VP[NUM=?n, TENSE='past'])
                                          (VP[NUM=?n, TENSE='past'])
                                            (VP[NUM=?n, TENSE='past'])
                                              (VP[NUM=?n, TENSE='past'])
                                                (VP[NUM=?n, TENSE='past'])
                                                  (VP[NUM=?n, TENSE='past'])
                                                    (VP[NUM=?n, TENSE='past'])
                                                      (VP[NUM=?n, TENSE='past'])
                                                        (VP[NUM=?n, TENSE='past'])
                                                          (VP[NUM=?n, TENSE='past'])
                                                            (VP[NUM=?n, TENSE='past'])
                                                              (VP[NUM=?n, TENSE='past'])
                                                                (VP[NUM=?n, TENSE='past'])
                                                                  (VP[NUM=?n, TENSE='past'])
                                                                    (VP[NUM=?n, TENSE='past'])
                                                                      (VP[NUM=?n, TENSE='past'])
                                                                        (VP[NUM=?n, TENSE='past'])
                                                                          (VP[NUM=?n, TENSE='past'])
                                                                            (VP[NUM=?n, TENSE='past'])
                                                                              (VP[NUM=?n, TENSE='past'])
                                                                                (VP[NUM=?n, TENSE='past'])
                                                                                  (VP[NUM=?n, TENSE='past'])
                                                                                    (VP[NUM=?n, TENSE='past'])
                                                                                      (VP[NUM=?n, TENSE='past'])
                                                                                      (VP[NUM=?n, TENSE='past'])
                        (IN[ ] (P[ ] in))
                        (NP[NUM=?n])
                          (DT[NUM=?n]) (Det[NUM=?n] the)
                        (Nom[NUM=?n])
                          (N[NUM='sg']) (NN[ ]) replacement)
                        (Nom[NUM=?n]) (N[NUM='sg']) (NN[ ]) apple))))))))
    (PP[])
      (IN[ ] (P[ ] that))
    (S[])
      (NP[NUM='sg'])
        (Nom[NUM='sg']) (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley)))
    (VP[NUM=?n, TENSE='past'])
      (VP[NUM=?n, TENSE='past'])
        (VP[NUM=?n, TENSE='past'])
          (IV[TENSE='past']) intended)
        (TO[ ]) to)
      (VP[NUM=?n, TENSE='inf'])
        (TV[TENSE='inf']) share)
      (NP[NUM=?n]) (PRP[ ]) it))))
    (PP[ ]) (IN[ ]) (P[ ]) with)) (NP[NUM=?n] (PRP[ ]) her)))
    (PP[ ]) (IN[ ]) (P[ ]) on)) (DATE[ ]) (WEEK[ ]) Tuesday)))
  (PP[ ])
    (IN[ ]) (P[ ]) at))
    (NP[NUM=?n])
      (PRP[ ]) his)
    (NP[NUM=?n]) (Nom[NUM=?n] (N[NUM='sg']) (NN[ ]) desk)))))))
  (S[])
    (NP[NUM='sg'])
      (Nom[NUM='sg']) (NNP[NUM='sg'] (PropN[NUM='sg'] Sue)))
    (TV[TENSE='past']) said)
    (INTRO[ ]) that)
  (S[])
    (PP[ ]) (IN[ ]) (P[ ]) on)) (DATE[ ]) (WEEK[ ]) Monday)))
    (COMMA[ ],)
    (DATE[ ])
      (MONTH_STR[ ]) September)
      (DAY[ ]) 17)
      (SEP[ ],)
      (YEAR[ ]) 2018))
    (COMMA[ ],)
    (NP[NUM='sg'])
      (Nom[NUM='sg']) (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley)))
    (TV[TENSE='past']) promised)
    (NP[NUM='sg'])
      (PRP[ ]) his)

```

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Figure 113. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
  (S[])
    (NP[NUM='sg'])
      (Nom[NUM='sg']) (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley)))
    (VP[NUM=?n, TENSE='past'])
      (VP[NUM=?n, TENSE='past'])
        (VP[NUM=?n, TENSE='past'])
          (VP[NUM=?n, TENSE='past'])
            (VP[NUM=?n, TENSE='past'])
              (VP[NUM=?n, TENSE='past'])
                (VP[NUM=?n, TENSE='past'])
                  (VP[NUM=?n, TENSE='past'])
                    (VP[NUM=?n, TENSE='past'])
                      (VP[NUM=?n, TENSE='past'])
                        (VP[NUM=?n, TENSE='past'])
                          (VP[NUM=?n, TENSE='past'])
                            (VP[NUM=?n, TENSE='past'])
                              (VP[NUM=?n, TENSE='past'])
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                                                                                  (VP[NUM=?n, TENSE='past'])
                                                                                    (VP[NUM=?n, TENSE='past'])
                                                                                      (VP[NUM=?n, TENSE='past'])
                                                                                      (VP[NUM=?n, TENSE='past'])
                        (IN[ ] (P[ ] in))
                        (NP[NUM=?n])
                          (DT[NUM=?n]) (Det[NUM=?n] the)
                        (Nom[NUM=?n])
                          (N[NUM='sg']) (NN[ ]) replacement)
                        (Nom[NUM=?n]) (N[NUM='sg']) (NN[ ]) apple))))))))
    (PP[])
      (IN[ ]) (P[ ]) that))
    (S[])
      (NP[NUM='sg'])
        (Nom[NUM='sg']) (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley)))
    (VP[NUM=?n, TENSE='past'])
      (VP[NUM=?n, TENSE='past'])
        (VP[NUM=?n, TENSE='past'])
          (IV[TENSE='past']) intended)
        (TO[ ]) to)
      (VP[NUM=?n, TENSE='inf'])
        (TV[TENSE='inf']) share)
      (NP[NUM=?n]) (PRP[ ]) it))))
    (PP[ ]) (IN[ ]) (P[ ]) with)) (NP[NUM=?n] (PRP[ ]) her)))
    (PP[ ]) (IN[ ]) (P[ ]) on)) (DATE[ ]) (WEEK[ ]) Tuesday)))
  (PP[ ])
    (IN[ ]) (P[ ]) at))
    (NP[NUM=?n])
      (PRP[ ]) his)
    (NP[NUM=?n]) (Nom[NUM=?n] (N[NUM='sg']) (NN[ ]) desk)))))))
  (S[])
    (NP[NUM='sg'])
      (Nom[NUM='sg']) (NNP[NUM='sg'] (PropN[NUM='sg'] Sue)))
    (TV[TENSE='past']) said)
    (INTRO[ ]) that)
  (S[])
    (PP[ ]) (IN[ ]) (P[ ]) on)) (DATE[ ]) (WEEK[ ]) Monday)))
    (COMMA[ ],)
    (DATE[ ])
      (MONTH_STR[ ]) September)
      (DAY[ ]) 17)
      (SEP[ ],)
      (YEAR[ ]) 2018))
    (COMMA[ ],)
    (NP[NUM='sg'])
      (Nom[NUM='sg']) (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley)))
    (TV[TENSE='past']) promised)
    (NP[NUM='sg'])
      (PRP[ ]) his)

```

Commit Git TODO Run Python Console Terminal

Figure 114. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue))))
  (T[V[TENSE='past']] said)
  (INTRO[] that)
  (S[]
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[] ,)
    (DATE[])
    (MONTH_STR[] September)
    (DAY[] 17)
    (SEP[] ,)
    (YEAR[] 2018))
    (COMMA[] ,)
    (NP[NUM='sg'])
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
  (T[V[TENSE='past']] promised)
  (NP[NUM='sg'])
  (PRP[] his)
  (NP[NUM='sg'])
  (Nom[NUM='sg'])
  (N[NUM='sg'] (NN[] colleague))
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Mary)))))
  (INTRO[] that)
  (S[]
    (NP[NUM=?n] (PRP[] he))
    (VP[NUM=?n, TENSE='past']
      (VP[NUM=?n, TENSE='past']
        (MD[TENSE='past'] would)
        (T[V[TENSE='inf']] put)
        (NP[NUM='sg'])
        (DT[NUM='sg'] (Det[NUM='sg'] a))
        (Nom[NUM=?n]
          (N[NUM='sg'] (NN[] replacement))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))))
    (PP[])
    (IN[] (P[] in))
    (NP[NUM=?n])
  )

```

The screenshot shows the PreProcess (1) window with the generated parse tree for Test scenario 9. The tree structure is complex, reflecting the hierarchical nature of the sentence. It includes nodes for various parts of speech like NP, VP, PP, and T, along with their specific grammatical features such as tense and number. The tree starts with a main S node, which branches into clauses and phrases describing Sue's action, the time it happened, and the subsequent promises made by John O'Malley.

Figure 115. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM=?n] (PRP[] he))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past']
      (MD[TENSE='past'] would)
      (T[V[TENSE='inf']] put)
      (NP[NUM='sg'])
      (DT[NUM='sg'] (Det[NUM='sg'] a))
      (Nom[NUM=?n]
        (N[NUM='sg'] (NN[] replacement))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))))
    (PP[])
    (IN[] (P[] in))
    (NP[NUM=?n])
    (DT[NUM=?n] (Det[NUM=?n] the))
    (Nom[NUM=?n]
      (N[NUM='sg'] (NN[] office))
      (Nom[NUM=?n] (N[NUM='sg'] (NN[] fridge))))))
  )
  (CC[] and)
  (IN[] (P[] that))
  (S[]
    (NP[NUM='sg'])
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past']
      (IV[TENSE='past'] intended)
      (TO[] to)
      (VP[NUM=?n, TENSE='inf']
        (VP[NUM=?n, TENSE='inf']
          (T[V[TENSE='inf']] share)
          (NP[NUM=?n] (PRP[] it)))
        (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her))))
      (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday))))
    (PP[])
    (IN[] (P[] at))
    (NP[NUM=?n])
    (PRP[] his)
  )

```

This screenshot is identical to Figure 115, showing the same parse tree for Test scenario 9. The structure is identical, reflecting the same sentence structure and grammatical analysis.

Figure 116. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM=?n] (PRP[] he))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past']
      (MD[TENSE='past'] would)
      (TV[TENSE='inf'] put)
      (NP[NUM=?n]
        (DT[NUM='sg']) (Det[NUM='sg'] a))
      (Nom[NUM=?n]
        (N[NUM='sg'] (NN[] replacement))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))))
    (PP[])
      (IN[] (P[] in))
      (NP[NUM=?n]
        (DT[NUM=?n] (Det[NUM=?n] the))
        (Nom[NUM=?n]
          (N[NUM='sg'] (NN[] office))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] fridge)))))))
  (CC[] and)
  (IN[] (P[] that))
  (S[]
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
    (VP[NUM=?n, TENSE='past']
      (VP[NUM=?n, TENSE='past']
        (VP[NUM=?n, TENSE='past']
          (IV[TENSE='past'] intended)
          (TO[] to)
          (VP[NUM=?n, TENSE='inf'])
          (VP[NUM=?n, TENSE='inf']
            (TV[TENSE='inf'] share)
            (NP[NUM=?n] (PRP[] it))))
        (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her))))
      (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday))))
    (PP[])
      (IN[] (P[] at))
      (NP[NUM=?n]
        (PRP[] his)
        (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))
  (S[]
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue))))
    (TV[TENSE='past'] said)
    (INTRO[] that)
  (S[])
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[]
      (MONTH_STR[] September)
      (DAY[] 17)
      (SEP[],)
      (YEAR[] 2018))
    (COMMA[],)
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
    (TV[TENSE='past'] promised)
    (NP[NUM='sg'])
    (PRP[] his)
  )
)

```

The screenshot shows the PreProcess tool interface with the title "PreProcess (1)". The main window displays a complex parse tree for a sentence. The tree starts with an S node, which contains various NP, VP, CC, IN, and S nodes. The text within the nodes is in a specific format, likely a domain-specific language or a type of XML. At the bottom of the interface, there are standard software navigation buttons: Commit, Git, TODO, Run, Python Console, and Terminal.

Figure 117. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past']
      (VP[NUM=?n, TENSE='past']
        (IV[TENSE='past'] intended)
        (TO[] to)
        (VP[NUM=?n, TENSE='inf'])
        (VP[NUM=?n, TENSE='inf']
          (TV[TENSE='inf'] share)
          (NP[NUM=?n] (PRP[] it))))
      (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her))))
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday))))
  (PP[])
    (IN[] (P[] at))
    (NP[NUM=?n]
      (PRP[] his)
      (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))
  (S[]
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue))))
    (TV[TENSE='past'] said)
    (INTRO[] that)
  (S[])
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[]
      (MONTH_STR[] September)
      (DAY[] 17)
      (SEP[],)
      (YEAR[] 2018))
    (COMMA[],)
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
    (TV[TENSE='past'] promised)
    (NP[NUM='sg'])
    (PRP[] his)
  )
)

```

This screenshot is similar to Figure 117, showing the same parse tree for the same sentence. However, it includes additional context at the bottom of the tree, specifically the date (September 17, 2018) and the year (2018), which are enclosed in parentheses after the month and day respectively. The rest of the structure is identical to Figure 117.

Figure 118. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Run: PreProcess (1) ×

```

(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue))))
  (T[V[TENSE='past']] said)
  (INTRO[] that)
  (S[]
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[] ,)
    (DATE[])
    (MONTH_STR[] September)
    (DAY[] 17)
    (SEP[] ,)
    (YEAR[] 2018))
    (COMMA[] ,)
    (NP[NUM='sg'])
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
  (T[V[TENSE='past']] promised)
  (NP[NUM='sg'])
  (PRP[] his)
  (NP[NUM='sg'])
  (Nom[NUM='sg'])
  (N[NUM='sg'] (NN[] colleague))
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Mary)))))
  (INTRO[] that)
  (S[]
    (NP[NUM=?n] (PRP[] he))
    (VP[NUM=?n, TENSE='past']
      (VP[NUM=?n, TENSE='past']
        (MD[TENSE='past'] would)
        (T[V[TENSE='past']] would)
        (T[V[TENSE='inf']] put)
        (NP[NUM='sg'])
        (DT[NUM='sg'] (Det[NUM='sg'] a))
        (Nom[NUM=?n]
          (N[NUM='sg'] (NN[] replacement))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))))
    )
    (PP[])
    (IN[] (P[] in))
    (NP[NUM=?n])
  )
)

```

Commit ⌘ ⌘ Git ⌘ ⌘ TODO ⌘ ⌘ Run Python Console Terminal

Figure 119. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Run: PreProcess (1) ×

```

(S[]
  (NP[NUM=?n] (PRP[] he))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past']
      (MD[TENSE='past'] would)
      (T[V[TENSE='inf']] put)
      (NP[NUM='sg'])
      (DT[NUM='sg'] (Det[NUM='sg'] a))
      (Nom[NUM=?n]
        (N[NUM='sg'] (NN[] replacement))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))))
    )
  (PP[])
  (IN[] (P[] in))
  (NP[NUM=?n]
    (DT[NUM=?n] (Det[NUM=?n] the))
    (Nom[NUM=?n]
      (N[NUM='sg'] (NN[] office))
      (Nom[NUM=?n] (N[NUM='sg'] (NN[] fridge))))))
)
(CC[] and)
(IN[] (P[] that))
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
  (VP[NUM=?n, TENSE='past']
    (IV[V[TENSE='past']] intended)
    (TO[] to)
    (VP[NUM=?n, TENSE='inf']
      (VP[NUM=?n, TENSE='inf']
        (VP[NUM=?n, TENSE='inf']
          (VP[NUM=?n, TENSE='inf']
            (T[V[TENSE='inf']] share)
            (NP[NUM=?n] (PRP[] it)))
          (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her))))
        )
        (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
      )
    )
  )
  (PP[])
  (IN[] (P[] at))
  (NP[NUM=?n]
    (PRP[] his)
  )
)

```

Commit ⌘ ⌘ Git ⌘ ⌘ TODO ⌘ ⌘ Run Python Console Terminal

Figure 120. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
  (VP[NUM=?n, TENSE='past']
    (IV[TENSE='past'] intended)
    (TO[] to)
    (VP[NUM=?n, TENSE='inf']
      (VP[NUM=?n, TENSE='inf'])
      (VP[NUM=?n, TENSE='inf'])
      (VP[NUM=?n, TENSE='inf'])
      (TV[TENSE='inf'] share)
      (NP[NUM=?n] (PRP[] it)))
    (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her)))
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
  (PP[]
    (IN[] (P[] at))
    (NP[NUM=?n])
    (PRP[] his)
    (NP[NUM=?n] (Nom[NUM=?n] (NN[NUM='sg'] (NN[] desk)))))))
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue))))
  (TV[TENSE='past'] said)
  (INTRO[] that)
  (S[]
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[])
    (MONTH_STR[] September)
    (DAY[] 17)
    (SEP[],)
    (YEAR[] 2018))
    (COMMA[],)
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
    (TV[TENSE='past'] promised)
    (NP[NUM='sg']
      (PRP[] his)
      (NP[NUM='sg']
        (Nom[NUM='sg']
          (N[NUM='sg'] (NN[] colleague))
          (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Mary)))))))
  (INTRO[] that)
  (S[]
    (NP[NUM=?n] (PRP[] he))
    (VP[NUM=?n, TENSE='past']
      (MD[TENSE='past'] would)
      (TV[TENSE='inf'] put)
      (NP[NUM='sg']
        (DT[NUM='sg'] (Det[NUM='sg'] a))
        (Nom[NUM=?n]
          (N[NUM='sg'] (NN[] replacement))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))))
    (PP[]
      (IN[] (P[] in))
      (NP[NUM=?n]
        (DT[NUM=?n] (Det[NUM=?n] the)))))))

```

The screenshot shows the PreProcess tool interface with the title "PreProcess (1)". The main window displays a complex parse tree for a sentence. The tree starts with an S-node containing various NP, VP, PP, and IN nodes, many of which contain NPs or PRPs. The interface includes a toolbar with icons for file operations like Open, Save, and Print, and a bottom navigation bar with tabs for Commit, Git, TODO, Run, Python Console, and Terminal.

Figure 121. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
  (TV[TENSE='past'] said)
  (INTRO[] that)
  (S[]
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[])
    (MONTH_STR[] September)
    (DAY[] 17)
    (SEP[],)
    (YEAR[] 2018))
    (COMMA[],)
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
    (TV[TENSE='past'] promised)
    (NP[NUM='sg']
      (PRP[] his)
      (NP[NUM='sg']
        (Nom[NUM='sg']
          (N[NUM='sg'] (NN[] colleague))
          (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Mary)))))))
  (INTRO[] that)
  (S[]
    (NP[NUM=?n] (PRP[] he))
    (VP[NUM=?n, TENSE='past']
      (MD[TENSE='past'] would)
      (TV[TENSE='inf'] put)
      (NP[NUM='sg']
        (DT[NUM='sg'] (Det[NUM='sg'] a))
        (Nom[NUM=?n]
          (N[NUM='sg'] (NN[] replacement))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))))
    (PP[]
      (IN[] (P[] in))
      (NP[NUM=?n]
        (DT[NUM=?n] (Det[NUM=?n] the)))))))

```

This screenshot is similar to Figure 121, but it shows some parts of the parse tree collapsed. The collapsed sections are indicated by ellipses (...). The interface elements are identical to Figure 121.

Figure 122. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ✘
(S[]
  (NP[NUM=?n] (PRP[] he))
  (VP[NUM=?n, TENSE='past']
    (MD[TENSE='past'] would)
    (TV[TENSE='inf'] put)
    (NP[NUM='sg']
      (DT[NUM='sg'] (Det[NUM='sg'] a))
      (Nom[NUM=?n]
        (N[NUM='sg'] (NN[] replacement))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))
    )
  )
  (PP[])
    (IN[] (P[] in))
    (NP[NUM=?n]
      (DT[NUM=?n] (Det[NUM=?n] the))
      (Nom[NUM=?n]
        (N[NUM='sg'] (NN[] office))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] fridge)))))))
)
(CC[] and)
(IN[] (P[] that))
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
  )
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past']
      (IV[TENSE='past'] intended)
      (TO[] to)
      (VP[NUM=?n, TENSE='inf']
        (VP[NUM=?n, TENSE='inf']
          (VP[NUM=?n, TENSE='inf']
            (VP[NUM=?n, TENSE='inf']
              (TV[TENSE='inf'] share)
              (NP[NUM=?n] (PRP[] it)))
            )
          )
        )
      )
      (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her))))
      (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday))))
    )
  )
  (PP[])
    (IN[] (P[] at))
    (NP[NUM=?n]
      (PRP[] his)
      (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))
)
)
)

```

The screenshot shows the PreProcess (1) interface with the generated parse tree. The tree structure is as follows:

- Root node: S[]
- Children of S[]:
 - NP[NUM=?n] (PRP[] he)
 - VP[NUM=?n, TENSE='past']:
 - MD[TENSE='past'] would
 - TV[TENSE='inf'] put
 - NP[NUM='sg']:
 - DT[NUM='sg'] (Det[NUM='sg'] a)
 - Nom[NUM=?n]:
 - N[NUM='sg'] (NN[] replacement)
 - Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))
 - PP[]:
 - IN[] (P[] in)
 - NP[NUM=?n]:
 - DT[NUM=?n] (Det[NUM=?n] the)
 - Nom[NUM=?n]:
 - N[NUM='sg'] (NN[] office)
 - Nom[NUM=?n] (N[NUM='sg'] (NN[] fridge)))
- CC[] and
- IN[] (P[] that)
- S[]:
 - NP[NUM='sg']:
 - Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley)))
 - VP[NUM=?n, TENSE='past']:
 - VP[NUM=?n, TENSE='past']:
 - IV[TENSE='past'] intended
 - TO[] to
 - VP[NUM=?n, TENSE='inf']:
 - VP[NUM=?n, TENSE='inf']:
 - VP[NUM=?n, TENSE='inf']:
 - VP[NUM=?n, TENSE='inf']:
 - TV[TENSE='inf'] share
 - (NP[NUM=?n] (PRP[] it)))
 - PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her)))
 - PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
 - PP[]:
 - IN[] (P[] at)
 - NP[NUM=?n]:
 - PRP[] his
 - (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))

Figure 123. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ✘
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
  )
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past']
      (IV[TENSE='past'] intended)
      (TO[] to)
      (VP[NUM=?n, TENSE='inf']
        (VP[NUM=?n, TENSE='inf']
          (VP[NUM=?n, TENSE='inf']
            (VP[NUM=?n, TENSE='inf']
              (TV[TENSE='inf'] share)
              (NP[NUM=?n] (PRP[] it)))
            )
          )
        )
      )
      (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her))))
      (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday))))
    )
  )
  (PP[])
    (IN[] (P[] at))
    (NP[NUM=?n]
      (PRP[] his)
      (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))
)
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue))))
  )
  (TV[TENSE='past'] said)
  (INTRO[] that)
  (S[]
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[]
      (MONTH_STR[] September)
      (DAY[] 17)
      (SEP[],)
      (YEAR[] 2018))
    )
    (COMMA[],)
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
    )
    (TV[TENSE='past'] promised)
    (NP[NUM='sg'])
    (PRP[] his)
  )
)
)

```

The screenshot shows the PreProcess (1) interface with the generated parse tree. The tree structure is as follows:

- Root node: S[]
- Children of S[]:
 - NP[NUM=?n, TENSE='past']:
 - Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley)))
 - VP[NUM=?n, TENSE='past']:
 - IV[TENSE='past'] intended
 - TO[] to
 - VP[NUM=?n, TENSE='inf']:
 - VP[NUM=?n, TENSE='inf']:
 - VP[NUM=?n, TENSE='inf']:
 - VP[NUM=?n, TENSE='inf']:
 - TV[TENSE='inf'] share
 - (NP[NUM=?n] (PRP[] it)))
 - PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her)))
 - PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
 - PP[]:
 - IN[] (P[] at)
 - NP[NUM=?n]:
 - PRP[] his
 - (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))
- S[]:
 - NP[NUM=?n, TENSE='past']:
 - Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue)))
 - TV[TENSE='past'] said
 - INTRO[] that
 - S[]:
 - PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
 - COMMA[],
 - DATE[]:
 - MONTH_STR[] September
 - DAY[] 17
 - SEP[],
 - YEAR[] 2018
 - COMMA[],
 - NP[NUM='sg']:
 - Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley)))
 - TV[TENSE='past'] promised
 - NP[NUM='sg']
 - PRP[] his

Figure 124. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg'] (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue))))
  (TV[TENSE='past'] said)
  (INTRO[] that)
  (S[]
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[])
      (MONTH_STR[] September)
      (DAY[] 17)
      (SEP[],)
      (YEAR[] 2018))
    (COMMA[],)
    (NP[NUM='sg'] (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
    (TV[TENSE='past'] promised)
    (NP[NUM='sg'] (PRP[] his)
      (NP[NUM='sg'] (Nom[NUM='sg'] (NN[] colleague))
        (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Mary)))))
    (INTRO[] that)
    (S[]
      (NP[NUM=?n] (PRP[] he))
      (VP[NUM=?n, TENSE='past']
        (MD[TENSE='past'] would)
        (TV[TENSE='inf'] put)
        (NP[NUM='sg'] (DT[NUM='sg'] (Det[NUM='sg'] a))
          (Nom[NUM=?n]
            (N[NUM='sg'] (NN[] replacement))
            (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))
        (PP[])
          (IN[] (P[] in))
          (NP[NUM=?n]
            (DT[NUM=?n] (Det[NUM=?n] the)))
      (CC[] and)
      (IN[] (P[] that))
      (S[]
        (NP[NUM='sg'] (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
        (VP[NUM=?n, TENSE='past']
          (VP[NUM=?n, TENSE='past']
            (VP[NUM=?n, TENSE='past']
              (VP[NUM=?n, TENSE='past']
                (IV[TENSE='past'] intended)
                (TO[] to)
                (VP[NUM=?n, TENSE='inf']
                  (TV[TENSE='inf'] share)
                  (NP[NUM=?n] (PRP[] it)))
                (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her)))
              (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
            (PP[])
              (IN[] (P[] at))
              (NP[NUM=?n]
                (PRP[] his)
                (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk))))))))
      (Commit) ⌘ ⌘ Git ⌘ ⌘ TODO ⌘ ⌘ Run Python Console Terminal

```

Figure 125. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg'] (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue))))
  (TV[TENSE='past'] said)
  (INTRO[] that)
  (S[]
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[])
      (MONTH_STR[] September)
      (DAY[] 17)
      (SEP[],)
      (YEAR[] 2018))
    (COMMA[],)
    (NP[NUM='sg'] (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
    (TV[TENSE='past'] promised)
    (NP[NUM='sg'] (PRP[] his)
      (NP[NUM='sg'] (Nom[NUM='sg'] (NN[] colleague))
        (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Mary)))))
    (INTRO[] that)
    (S[]
      (NP[NUM=?n] (PRP[] he))
      (VP[NUM=?n, TENSE='past']
        (MD[TENSE='past'] would)
        (TV[TENSE='inf'] put)
        (NP[NUM='sg'] (DT[NUM='sg'] (Det[NUM='sg'] a))
          (Nom[NUM=?n]
            (N[NUM='sg'] (NN[] replacement))
            (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))
        (PP[])
          (IN[] (P[] in))
          (NP[NUM=?n]
            (DT[NUM=?n] (Det[NUM=?n] the)))
      (CC[] and)
      (IN[] (P[] that))
      (S[]
        (NP[NUM='sg'] (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
        (VP[NUM=?n, TENSE='past']
          (VP[NUM=?n, TENSE='past']
            (VP[NUM=?n, TENSE='past']
              (VP[NUM=?n, TENSE='past']
                (VP[NUM=?n, TENSE='past']
                  (IV[TENSE='past'] intended)
                  (TO[] to)
                  (VP[NUM=?n, TENSE='inf']
                    (TV[TENSE='inf'] share)
                    (NP[NUM=?n] (PRP[] it)))
                  (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her)))
                (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
              (PP[])
                (IN[] (P[] at))
                (NP[NUM=?n]
                  (PRP[] his)
                  (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk))))))))
      (Commit) ⌘ ⌘ Git ⌘ ⌘ TODO ⌘ ⌘ Run Python Console Terminal

```

Figure 126. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

The screenshot shows the PreProcess tool interface with the title "PreProcess (1) ×". The main area displays a complex parse tree for a sentence. The root node is a sentence (S[]). It branches into several components, including NP[NUM='sg'], VP[NUM=?n, TENSE='past'], and PP[IN[] (P[] with)]. The NP node further contains NP[NUM='sg'], which is followed by (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))). The VP node contains VP[NUM=?n, TENSE='past'], which is followed by (VP[NUM=?n, TENSE='past']) intended. The PP node contains (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] it))). This pattern repeats for multiple clauses, showing Sue's statement about John O'Malley and his colleague Mary.

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley))))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past'])
    (VP[NUM=?n, TENSE='past'])
      (IV[TENSE='past'] intended)
      (TO[] to)
      (VP[NUM=?n, TENSE='inf']
        (TV[TENSE='inf'] share)
        (NP[NUM=?n] (PRP[] it)))
    (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] it))))
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
  (PP[])
    (IN[] (P[] at))
    (NP[NUM=?n])
    (PRP[] his)
    (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue))))
  (TV[TENSE='past'] said)
  (INTRO[] that)
  (S[]
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[])
      (MONTH_STR[] September)
      (DAY[] 17)
      (SEP[],)
      (YEAR[] 2018))
    (COMMA[],)
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
    (TV[TENSE='past'] promised)
    (NP[NUM='sg']
      (PRP[] his)
      (NP[NUM='sg']
        (Nom[NUM='sg']
          (N[NUM='sg'] (NN[] colleague))
          (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Mary)))))))
  (INTRO[] that)
  (S[]
    (NP[NUM=?n] (PRP[] he))
    (VP[NUM=?n, TENSE='past']
      (MD[TENSE='past'] would)
      (TV[TENSE='inf'] put)
      (NP[NUM='sg']
        (DT[NUM='sg'] (Det[NUM='sg'] a))
        (Nom[NUM=?n]
          (N[NUM='sg'] (NN[] replacement))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))))
    (PP[])
      (IN[] (P[] in))
      (NP[NUM=?n]
        (DT[NUM=?n] (Det[NUM=?n] the)))
  
```

Figure 127. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

This screenshot is similar to Figure 127, showing the same parse tree for Test scenario 9. However, it includes additional annotations in the form of comments (//) explaining specific parts of the tree. These annotations describe the semantic roles and intentions expressed in the sentence, such as Sue's statement, the date (September 17, 2018), the action (putting a replacement apple in the fridge), and the intended recipient (Mary).

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue))))
  (TV[TENSE='past'] said)
  (INTRO[] that)
  (S[]
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[])
      (MONTH_STR[] September)
      (DAY[] 17)
      (SEP[],)
      (YEAR[] 2018))
    (COMMA[],)
    (NP[NUM='sg']
      (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley))))
    (TV[TENSE='past'] promised)
    (NP[NUM='sg']
      (PRP[] his)
      (NP[NUM='sg']
        (Nom[NUM='sg']
          (N[NUM='sg'] (NN[] colleague))
          (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Mary)))))))
  (INTRO[] that)
  (S[]
    (NP[NUM=?n] (PRP[] he))
    (VP[NUM=?n, TENSE='past']
      (MD[TENSE='past'] would)
      (TV[TENSE='inf'] put)
      (NP[NUM='sg']
        (DT[NUM='sg'] (Det[NUM='sg'] a))
        (Nom[NUM=?n]
          (N[NUM='sg'] (NN[] replacement))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple)))))
    (PP[])
      (IN[] (P[] in))
      (NP[NUM=?n]
        (DT[NUM=?n] (Det[NUM=?n] the)))
  
```

Figure 128. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM=?n] (PRP[] he))
  (VP[NUM=?n, TENSE='past']
    (MD[TENSE='past'] would)
    (TV[TENSE='inf'] put)
    (NP[NUM='sg'])
    (DT[NUM='sg'] (Det[NUM='sg'] a))
    (Nom[NUM=?n]
      (N[NUM='sg'] (NN[] replacement))
      (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))
    (PP[])
    (IN[] (P[] in))
    (NP[NUM=?n]
      (DT[NUM=?n] (Det[NUM=?n] the))
      (Nom[NUM=?n]
        (N[NUM='sg'] (NN[] office))
        (Nom[NUM=?n] (N[NUM='sg'] (NN[] fridge))))))
  (CC[] and)
  (IN[] (P[] that))
  (S[]
    (NP[NUM='sg'])
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley)))
    (VP[NUM=?n, TENSE='past']
      (VP[NUM=?n, TENSE='past']
        (IV[TENSE='past'] intended)
        (TO[] to)
        (VP[NUM=?n, TENSE='inf']
          (VP[NUM=?n, TENSE='inf']
            (TV[TENSE='inf'] share)
            (NP[NUM=?n] (PRP[] it)))
          (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her))))
        (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday))))
      (PP[])
      (IN[] (P[] at))
      (NP[NUM=?n]
        (PRP[] his)
        (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))
  (S[])
    (NP[NUM='sg'])
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue)))
    (TV[TENSE='past'] said)
    (INTRO[] that)
  (S[])
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[]
      (MONTH_STR[] September)
      (DAY[] 17)
      (SEP[],)
      (YEAR[] 2018))
    (COMMA[],)
    (NP[NUM='sg'])
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley)))
    (TV[TENSE='past'] promised)
    (NP[NUM='sg'])
    (PRP[] his)
)

```

The screenshot shows the PreProcess tool interface with a parse tree for a complex sentence. The tree starts with an S node containing several NP, VP, and CC nodes. One VP node contains an IV node (intended), a TO node (to), and another VP node with a TV node (share). Another VP node contains an IN node (with) and an NP node with a PRP node (her). A PP node contains an IN node (on) and a DATE node (Tuesday). The tree also includes a S node for Sue's statement, an S node for the date (September 17, 2018), and a final S node for John O'Malley's promise.

Figure 129. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg'])
  (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley)))
  (VP[NUM=?n, TENSE='past']
    (VP[NUM=?n, TENSE='past']
      (IV[TENSE='past'] intended)
      (TO[] to)
      (VP[NUM=?n, TENSE='inf']
        (VP[NUM=?n, TENSE='inf']
          (TV[TENSE='inf'] share)
          (NP[NUM=?n] (PRP[] it)))
        (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her))))
      (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday))))
    (PP[])
    (IN[] (P[] at))
    (NP[NUM=?n]
      (PRP[] his)
      (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))
  (S[])
    (NP[NUM='sg'])
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] Sue)))
    (TV[TENSE='past'] said)
    (INTRO[] that)
  (S[])
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[],)
    (DATE[]
      (MONTH_STR[] September)
      (DAY[] 17)
      (SEP[],)
      (YEAR[] 2018))
    (COMMA[],)
    (NP[NUM='sg'])
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] John O'Malley)))
    (TV[TENSE='past'] promised)
    (NP[NUM='sg'])
    (PRP[] his)
)

```

This screenshot is identical to Figure 129, showing the same parse tree for the test scenario. The structure is identical, reflecting the same sentence components and their hierarchical relationships.

Figure 130. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] Sue)))
  (TV[TENSE='past'] said)
  (INTRO[] that)
  (S[]
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[] ,)
    (DATE[])
    (MONTH_STR[] September)
    (DAY[] 17)
    (SEP[] ,)
    (YEAR[] 2018))
    (COMMA[] ,)
  (NP[NUM='sg']
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] John O'Malley)))
  (TV[TENSE='past'] promised)
  (NP[NUM='sg']
    (PRP[] his)
    (NP[NUM='sg'])
    (Nom[NUM='sg'])
    (N[NUM='sg'] (NN[] colleague))
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] Mary))))
  (INTRO[] that)
  (S[]
    (NP[NUM=?n] (PRP[] he))
    (VP[NUM=?n, TENSE='past']
      (MD[TENSE='past'] would)
      (TV[TENSE='inf'] put)
      (NP[NUM='sg']
        (DT[NUM='sg'] (Det[NUM='sg'] a))
        (Nom[NUM=?n]
          (N[NUM='sg'] (NN[] replacement))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))
      )
      (PP[])
      (IN[] (P[] in))
      (NP[NUM=?n]
        (DT[NUM=?n] (Det[NUM=?n] the)))
    )
    (CC[] and)
    (IN[] (P[] that))
    (S[]
      (NP[NUM='sg']
        (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] O'Malley)))
      (VP[NUM=?n, TENSE='past']
        (IV[TENSE='past'] intended)
        (TO[] to)
        (VP[NUM=?n, TENSE='inf']
          (VP[NUM=?n, TENSE='inf']
            (VP[NUM=?n, TENSE='inf']
              (VP[NUM=?n, TENSE='inf']
                (TV[TENSE='inf'] share)
                (NP[NUM=?n] (PRP[] it)))
              (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her))))
              (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday))))
            )
            (PP[])
            (IN[] (P[] at))
            (NP[NUM=?n]
              (PRP[] his)
              (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))
        )
      )
    )
  )
)

```

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Figure 131. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] Sue)))
  (TV[TENSE='past'] said)
  (INTRO[] that)
  (S[]
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Monday)))
    (COMMA[] ,)
    (DATE[])
    (MONTH_STR[] September)
    (DAY[] 17)
    (SEP[] ,)
    (YEAR[] 2018))
    (COMMA[] ,)
  (NP[NUM='sg']
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] John O'Malley)))
  (TV[TENSE='past'] promised)
  (NP[NUM='sg']
    (PRP[] his)
    (NP[NUM='sg'])
    (Nom[NUM='sg'])
    (N[NUM='sg'] (NN[] colleague))
    (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] Mary))))
  (INTRO[] that)
  (S[]
    (NP[NUM=?n] (PRP[] he))
    (VP[NUM=?n, TENSE='past']
      (MD[TENSE='past'] would)
      (TV[TENSE='inf'] put)
      (NP[NUM='sg']
        (DT[NUM='sg'] (Det[NUM='sg'] a))
        (Nom[NUM=?n]
          (N[NUM='sg'] (NN[] replacement))
          (Nom[NUM=?n] (N[NUM='sg'] (NN[] apple))))
      )
      (PP[])
      (IN[] (P[] in))
      (NP[NUM=?n]
        (DT[NUM=?n] (Det[NUM=?n] the)))
    )
    (CC[] and)
    (IN[] (P[] that))
    (S[]
      (NP[NUM='sg']
        (Nom[NUM='sg']) (NNP[NUM='sg']) (PropN[NUM='sg'] O'Malley)))
      (VP[NUM=?n, TENSE='past']
        (IV[TENSE='past'] intended)
        (TO[] to)
        (VP[NUM=?n, TENSE='inf']
          (VP[NUM=?n, TENSE='inf']
            (VP[NUM=?n, TENSE='inf']
              (VP[NUM=?n, TENSE='inf']
                (TV[TENSE='inf'] share)
                (NP[NUM=?n] (PRP[] it)))
              (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her))))
              (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday))))
            )
            (PP[])
            (IN[] (P[] at))
            (NP[NUM=?n]
              (PRP[] his)
              (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[] desk)))))))
        )
      )
    )
  )
)

```

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Figure 132. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Run: PreProcess (1) ×

```
(S[]
  (NP[NUM='sg']
    (Nom[NUM='sg'] (NNP[NUM='sg'] (PropN[NUM='sg'] O'Malley)))
  (VP[NUM=?n, TENSE='past']
    (IV[TENSE='past'] intended)
    (TO[] to)
  (VP[NUM=?n, TENSE='inf']
    (VP[NUM=?n, TENSE='inf'])
    (VP[NUM=?n, TENSE='inf'])
      (TV[TENSE='inf'] share)
      (NP[NUM=?n] (PRP[] it)))
    (PP[] (IN[] (P[] with)) (NP[NUM=?n] (PRP[] her)))
    (PP[] (IN[] (P[] on)) (DATE[] (WEEK[] Tuesday)))
  (PP[])
    (IN[] (P[] at))
    (NP[NUM=?n]
      (PRP[] his)
      (NP[NUM=?n] (Nom[NUM=?n] (N[NUM='sg'] (NN[desk]))))))))))
```

Earley Parse Process

```
I[].....I [0:1] 'Sue'
I[].....I [1:2] 'said'
I..[].....I [2:3] 'that'
I...[].....I [3:4] 'on'
I....[].....I [4:5] 'Monday'
I....[].....I [5:6] 'September'
I....[].....I [6:7] '17'
I....[].....I [7:8] '2018'
I....[].....I [8:9] 'John'
I....[].....I [9:10] 'O'Malley'
I....[].....I [10:11] 'promised'
I....[].....I [11:12] 'his'
I....[].....I [12:13] 'colleague'
I....[].....I [13:14] 'Mary'
I....[].....I [14:15] 'that'
I....[].....I [15:16] 'he'
I....[].....I [16:17] 'would'
I....[].....I [17:18] 'put'
I....[].....I [18:19] 'a'
I....[].....I [19:20] 'replacement'
I....[].....I [20:21] 'apple'
I....[].....I [21:22] 'in'
I....[].....I [22:23] 'the'
I....[].....I [23:24] 'office'
I....[].....I [24:25] 'fridge'
I....[].....I [25:26] 'and'
I....[].....I [26:27] 'that'
I....[].....I [27:28] 'O'Malley'
I....[].....I [28:29] 'intended'
I....[].....I [29:30] 'to'
I....[].....I [30:31] 'share'
I....[].....I [31:32] 'it'
I....[].....I [32:33] 'with'
I....[].....I [33:34] 'her'
I....[].....I [34:35] 'on'
I....[].....I [35:36] 'Tuesday'
I....[].....I [36:37] 'at'
I....[].....I [37:38] 'his'
```

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Figure 133. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Run: PreProcess (1) ×

```
I[].....I [0:1] 'Sue'
I[].....I [1:2] 'said'
I..[].....I [2:3] 'that'
I...[].....I [3:4] 'on'
I....[].....I [4:5] 'Monday'
I....[].....I [5:6] 'September'
I....[].....I [6:7] '17'
I....[].....I [7:8] '2018'
I....[].....I [8:9] 'John'
I....[].....I [9:10] 'O'Malley'
I....[].....I [10:11] 'promised'
I....[].....I [11:12] 'his'
I....[].....I [12:13] 'colleague'
I....[].....I [13:14] 'Mary'
I....[].....I [14:15] 'that'
I....[].....I [15:16] 'he'
I....[].....I [16:17] 'would'
I....[].....I [17:18] 'put'
I....[].....I [18:19] 'a'
I....[].....I [19:20] 'replacement'
I....[].....I [20:21] 'apple'
I....[].....I [21:22] 'in'
I....[].....I [22:23] 'the'
I....[].....I [23:24] 'office'
I....[].....I [24:25] 'fridge'
I....[].....I [25:26] 'and'
I....[].....I [26:27] 'that'
I....[].....I [27:28] 'O'Malley'
I....[].....I [28:29] 'intended'
I....[].....I [29:30] 'to'
I....[].....I [30:31] 'share'
I....[].....I [31:32] 'it'
I....[].....I [32:33] 'with'
I....[].....I [33:34] 'her'
I....[].....I [34:35] 'on'
I....[].....I [35:36] 'Tuesday'
I....[].....I [36:37] 'at'
I....[].....I [37:38] 'his'
```

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Figure 134. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Figure 135. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Figure 136. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Run: PreProcess (1) ×

```

I.....[.].....| [8:9] PropN[NUM='sg'] -> 'John' *
I.....[.].....| [8:9] NNP[NUM='sg'] -> PropN[NUM='sg'] *
I.....[.>.....| [8:9] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
I.....[.].....| [8:9] Nom[NUM='sg'] -> NNP[NUM='sg'] *
I.....[.>.....| [8:9] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
I.....[.].....| [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
I.....[.>.....| [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
I.....[.>.....| [8:9] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I.....[.>.....| [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I.....[.>.....| [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I.....[.].....| [8:9] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] IN[] S[] {?n: 'sg'}
I.....[.].....| [9:10] PropN[NUM='sg'] -> 'OMalley' *
I.....[.].....| [9:10] NNP[NUM='sg'] -> PropN[NUM='sg'] *
I.....[.>.....| [9:10] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
I.....[.].....| [9:10] Nom[NUM='sg'] -> NNP[NUM='sg'] *
I.....[.>.....| [9:10] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
I.....[.].....| [9:10] NP[NUM=?n] -> Nom[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
I.....[.].....| [9:10] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
I.....[.>.....| [9:10] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I.....[.>.....| [9:10] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n: 'sg'}
I.....[.>.....| [9:10] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
I.....[.].....| [9:10] TV[TENSE='past'] -> 'promised' *
I.....[.>.....| [10:11] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
I.....[.>.....| [9:11] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] {?n: 'sg'}
I.....[.>.....| [9:11] S[] -> NP[NUM=?n] TV[NUM=?n] * INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
I.....[.].....| [11:12] PRP[] -> 'his' *
I.....[.].....| [11:12] NP[NUM=?n] -> PRP[] *
I.....[.>.....| [11:12] NP[NUM=?n] -> PRP[] * NP[NUM=?n] *
I.....[.].....| [11:12] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
I.....[.>.....| [11:12] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I.....[.>.....| [11:12] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I.....[.>.....| [11:12] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I.....[.>.....| [11:12] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I.....[.>.....| [11:12] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I.....[.].....| [10:12] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
I.....[.>.....| [10:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
I.....[.].....| [10:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
I.....[.>.....| [10:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}

```

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Figure 137. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Run: PreProcess (1) ×

```

I.....[.].....| [10:12] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
I.....[.>.....| [10:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
I.....[.>.....| [10:12] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
I.....[.].....| [9:12] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I.....[.>.....| [9:12] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I.....[.].....| [9:12] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I.....[.].....| [12:13] NN[] -> 'colleague' *
I.....[.].....| [12:13] N[NUM='sg'] -> NN[] *
I.....[.>.....| [12:13] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
I.....[.>.....| [12:13] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
I.....[.].....| [12:13] Nom[NUM=?n] -> N[] *
I.....[.>.....| [12:13] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
I.....[.].....| [12:13] NP[NUM=?n] -> Nom[NUM=?n] *
I.....[.>.....| [12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I.....[.>.....| [12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I.....[.>.....| [12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I.....[.>.....| [12:13] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I.....[.>.....| [12:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I.....[.].....| [11:13] NP[NUM=?n] -> PRP[] NP[NUM=?n] *
I.....[.>.....| [11:13] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
I.....[.].....| [11:13] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
I.....[.>.....| [11:13] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
I.....[.>.....| [11:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
I.....[.>.....| [11:13] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
I.....[.].....| [10:13] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
I.....[.>.....| [10:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
I.....[.>.....| [10:13] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
I.....[.].....| [9:13] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I.....[.>.....| [9:13] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I.....[.].....| [9:13] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I.....[.].....| [13:14] PropN[NUM='sg'] -> 'Mary' *
I.....[.].....| [13:14] NNP[NUM='sg'] -> PropN[NUM='sg'] *
I.....[.>.....| [13:14] NP[NUM=?n] -> NNP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
I.....[.].....| [13:14] Nom[NUM='sg'] -> NNP[NUM='sg'] *
I.....[.>.....| [13:14] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
I.....[.].....| [13:14] NP[NUM='sg'] -> Nom[NUM='sg'] *
I.....[.].....| [12:14] Nom[NUM='sg'] -> N[] Nom[NUM='sg'] *
I.....[.>.....| [12:14] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}

```

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Figure 138. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```
Run: PreProcess (1) ×

[12:14] [] → [12:14] Num[NUM='sg'] → N[] Num[NUM='sg'] *
[12:14] [>...] Num[NUM=?n] → Nom[NUM=?n] * PP[] {?n: 'sg'}
[12:14] [] → [12:14] NP[NUM='sg'] → Nom[NUM='sg'] *
[12:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
[12:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[12:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[12:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[12:14] [>...] S[] → NP[NUM='sg'] → PRP[] NP[NUM='sg'] *
[11:14] S[] → NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
[11:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[11:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[11:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] CC[] IN[] S[] {?n: 'sg'}
[11:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[11:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[11:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[11:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[10:14] VP[NUM=?n, TENSE='past'] → TV[NUM=?n, TENSE='past'] NP[] *
[10:14] VP[NUM=?n, TENSE=?t] → VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[10:14] VP[NUM=?n, TENSE=?t] → VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[9:14] S[] → NP[NUM='sg'] VP[NUM='sg'] *
[9:14] [>...] S[] → NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[9:14] [>...] S[] → NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[9:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
[13:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[13:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[13:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] CC[] IN[] S[] {?n: 'sg'}
[13:14] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[14:15] P[] → 'that' *
[14:15] [>...] INTRO[] → 'that' *
[14:15] [>...] IN[] → P[] *
[14:15] [>...] PP[] → IN[] * NP[] {}
[14:15] [>...] PP[] → IN[] * DATE[] {}
[15:16] [>...] PRP[] → 'he' *
[15:16] [>...] NP[NUM=?n] → PRP[] *
[15:16] [>...] NP[NUM=?n] → PRP[] * NP[NUM=?n] {}
[15:16] [>...] NP[NUM=?n] → PRP[] * DATE[] PP[] {}
[15:16] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[15:16] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[15:16] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[15:16] [>...] S[] → NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}

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```

Figure 139. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```
PreProcess (1) > [15:16] PRP[] -> 'he' *
[15:16] NP[NUM=?n] -> PRP[] *
[15:16] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
[15:16] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
[15:16] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[15:16] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[15:16] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[15:16] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n3: Variable('?n')}
[15:16] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[14:16] PP[] -> IN[] NP[] *
[14:16] S[] -> PP[] * COMMMA[] NP[NUM=?n] VP[NUM=?n] {}
[14:16] S[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[14:16] S[] -> PP[] * COMMMA[] DATE[] COMMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[14:16] DATE[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[13:16] NP[NUM='sg'] -> Nom[NUM='sg'] PP[] *
[12:16] NP[NUM='sg'] -> Nom[NUM='sg'] VP[] *
[10:16] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[10:16] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[10:16] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[9:16] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[9:16] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[9:16] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[12:16] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
[12:16] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[12:16] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[12:16] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[11:16] NP[NUM='sg'] -> PRP[] NP[NUM='sg'] *
[11:16] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
[11:16] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[11:16] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[11:16] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[11:16] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] IN[] S[] {?n: 'sg'}
[10:16] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
[10:16] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[10:16] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[9:16] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[9:16] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
```

Figure 140. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
[...]
|. [9:16] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|. [>...]
|. [9:16] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|. [>...]
|. [9:16] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. [>...]
|. [13:16] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|. [>...]
|. [13:16] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|. [>...]
|. [13:16] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. [>...]
|. [13:16] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|. [>...]
|. [13:16] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|. [>...]
|. [16:17] MD[TENSE='past'] -> 'would' *
|. [>...]
|. [16:17] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * TV[TENSE='inf'] NP[] {?t: 'past'}
|. [>...]
|. [16:17] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * VP[NUM=?n] NP[] {?t: 'past'}
|. [>...]
|. [16:17] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] JJ[] {?t: 'past'}
|. [>...]
|. [16:17] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * AUX[TENSE='inf'] {?t: 'past'}
|. [>...]
|. [16:17] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] * IV[TENSE='inf'] {?t: 'past'}
|. [>...]
|. [17:18] TV[NUM='pl', TENSE='pres'] -> 'put' *
|. [>...]
|. [17:18] TV[TENSE='inf'] -> 'put' *
|. [>...]
|. [17:18] TV[TENSE='past'] -> 'put' *
|. [>...]
|. [17:18] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'past'}
|. [>...]
|. [17:18] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'inf'}
|. [>...]
|. [16:18] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] * NP[] RB[] {?t: 'past'}
|. [>...]
|. [16:18] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] * NP[] {?t: 'past'}
|. [>...]
|. [17:18] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?n: 'pl', ?t: 'pres'}
|. [>...]
|. [18:19] Det[NUM='sg'] -> 'a' *
|. [>...]
|. [18:19] DT[NUM='sg'] -> Det[NUM='sg'] *
|. [>...]
|. [18:19] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n: 'sg'}
|. [>...]
|. [18:19] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n: 'sg'}
|. [>...]
|. [18:19] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n: 'sg'}
|. [>...]
|. [19:20] NN[] -> 'replacement' *
|. [>...]
|. [19:20] N[NUM='sg'] -> NN[] *
|. [>...]
|. [19:20] NP[NUM=?n] -> NP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|. [>...]
|. [19:20] NP[NUM=?n] -> N[] *
|. [>...]
|. [19:20] NP[NUM=?n] -> NP[NUM=?n] * PP[] {?n2: Variable('?n')}
|. [>...]
|. [19:20] NP[NUM=?n] -> NP[NUM=?n] *
|. [>...]
|. [18:26] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] *
|. [>...]
|. [18:26] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] PP[] {?n: 'sg', ?n2: 'sg'}
|. [>...]
|. [18:26] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|. [>...]
|. [18:26] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}

```

Figure 141. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
[...]
|. [18:20] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] *
|. [>...]
|. [18:20] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n: 'sg', ?n2: 'sg'}
|. [>...]
|. [18:20] NP[NUM=?n] -> VP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|. [>...]
|. [18:20] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|. [>...]
|. [18:20] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|. [>...]
|. [18:20] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|. [>...]
|. [17:20] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|. [>...]
|. [17:20] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
|. [>...]
|. [16:20] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'past'}
|. [>...]
|. [16:20] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] *
|. [>...]
|. [17:20] VP[NUM='pl', TENSE='pres'] -> TV[NUM='pl', TENSE='pres'] NP[] *
|. [>...]
|. [17:20] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pl', ?t: 'pres'}
|. [>...]
|. [16:20] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|. [>...]
|. [16:20] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|. [>...]
|. [15:20] S[] -> NP[NUM=?n] VP[NUM=?n] *
|. [>...]
|. [15:20] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|. [>...]
|. [15:20] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|. [>...]
|. [12:20] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|. [>...]
|. [12:20] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|. [>...]
|. [12:20] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. [>...]
|. [11:20] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|. [>...]
|. [11:20] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|. [>...]
|. [11:20] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. [>...]
|. [11:20] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. [>...]
|. [13:20] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|. [>...]
|. [13:20] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|. [>...]
|. [13:20] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|. [>...]
|. [17:20] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
|. [>...]
|. [17:20] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
|. [>...]
|. [17:20] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|. [>...]
|. [17:20] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|. [>...]
|. [19:20] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|. [>...]
|. [19:20] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: Variable('?n')}
|. [>...]
|. [19:20] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg', ?n2: Variable('?n')}
|. [>...]
|. [19:20] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg', ?n2: Variable('?n')}
|. [>...]
|. [20:21] NN[] -> 'apple' *
|. [>...]
|. [20:21] N[NUM='sg'] -> NN[] *

```

Figure 142. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Run: PreProcess (1) ×

```

|.....[.].....| [20:21] NN[] -> 'apple' *
|.....[.].....| [20:21] N[NUM=?n] -> NN[] *
|.....[.>.....| [20:21] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|.....[.].....| [20:21] Nom[NUM=?n] -> NI[] * Nom[NUM=?n] {}
|.....[.].....| [20:21] Nom[NUM=?n] -> NI[] *
|.....[.].....| [20:21] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
|.....[.].....| [20:21] NP[NUM=?n] -> Nom[NUM=?n] *
|.....[.].....| [19:21] Nom[NUM=?n] -> NI[] * Nom[NUM=?n] *
|.....[.].....| [19:21] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
|.....[.].....| [19:21] NP[NUM=?n] -> Nom[NUM=?n] *
|.....[.].....| [18:21] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] *
|.....[.].....| [18:21] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [18:21] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
|.....[.>.....| [18:21] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
|.....[.].....| [18:21] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[.>.....| [18:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[.].....| [18:21] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
|.....[.].....| [17:21] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
|.....[.].....| [17:21] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
|.....[.>.....| [16:21] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'past'}
|.....[.].....| [16:21] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] *
|.....[.].....| [17:21] VP[NUM='pl', TENSE='pres'] -> TV[NUM='pl', TENSE='pres'] NP[] *
|.....[.>.....| [17:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pl', ?t: 'pres'}
|.....[.>.....| [16:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[.].....| [15:21] S[] -> VP[NUM=?n] INTRO[] S[] {?n: 'sg'}
|.....[.>.....| [15:21] S[] -> NP[NUM=?n] VP[NUM=?n] *
|.....[.].....| [15:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[.].....| [12:21] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[.>.....| [12:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [12:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [11:21] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[.>.....| [11:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [11:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [13:21] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
|.....[.>.....| [13:21] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [13:21] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
|.....[.].....| [17:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}

```

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Figure 143. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Run: PreProcess (1) ×

```

|.....[.>.....| [17:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
|.....[.>.....| [17:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
|.....[.>.....| [17:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
|.....[.>.....| [17:21] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
|.....[.].....| [19:21] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[.>.....| [19:21] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[.].....| [19:21] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[.>.....| [19:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[.].....| [19:21] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[.>.....| [20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[.].....| [20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[.>.....| [20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[.].....| [20:21] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[.>.....| [20:21] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
|.....[.].....| [21:22] P[] -> 'in' *
|.....[.].....| [21:22] IN[] -> P[] *
|.....[.>.....| [21:22] P[] -> IN[] * NP[] {}
|.....[.].....| [21:22] P[] -> IN[] * DATE[] {}
|.....[.].....| [22:23] Det[NUM=?n] -> 'the' *
|.....[.].....| [22:23] DT[NUM=?n] -> Det[NUM=?n] *
|.....[.].....| [22:23] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] {?n2: Variable('?n')}
|.....[.>.....| [22:23] NP[NUM=?n] -> DT[NUM=?n] * Nom[NUM=?n] PP[] {?n3: Variable('?n')}
|.....[.>.....| [22:23] NP[NUM=?n] -> DT[NUM=?n] * JJ[] NP[NUM=?n] {?n2: Variable('?n')}
|.....[.].....| [23:24] NN[] -> 'office' *
|.....[.].....| [23:24] N[NUM='sg'] -> NN[] *
|.....[.>.....| [23:24] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
|.....[.].....| [23:24] Nom[NUM=?n] -> NI[] * Nom[NUM=?n] {}
|.....[.].....| [23:24] Nom[NUM=?n] -> NI[] *
|.....[.>.....| [23:24] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
|.....[.].....| [23:24] NP[NUM=?n] -> Nom[NUM=?n] *
|.....[.].....| [22:24] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
|.....[.>.....| [22:24] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
|.....[.].....| [22:24] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
|.....[.>.....| [22:24] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
|.....[.].....| [22:24] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
|.....[.>.....| [22:24] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
|.....[.].....| [21:24] PP[] -> IN[] NP[] *
|.....[.].....| [21:24] PP[] -> IN[] *

```

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Figure 144. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Run: PreProcess (1) ×

```

I.....[.].....| [21:24] PP[] -> IN[] NP[] *
I.....[.>.....| [21:24] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I.....[.>.....| [21:24] S[] -> PP[] * COMMAs[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
I.....[.>.....| [21:24] S[] -> PP[] * COMMAs[] DATE[] COMMAs[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
I.....[.>.....| [19:24] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
I.....[.>.....| [19:24] NP[NUM=?n] -> Nom[NUM=?n] NP[] *
I.....[.>.....| [18:24] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] PP[] *
I.....[.>.....| [18:24] VP[NUM='pl', TENSE='pres'] -> VP[NUM='pl', TENSE='pres'] PP[] *
I.....[.>.....| [16:24] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
I.....[.>.....| [17:24] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
I.....[.>.....| [17:24] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
I.....[.>.....| [17:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
I.....[.>.....| [17:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
I.....[.>.....| [17:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'inf'}
I.....[.>.....| [17:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'inf'}
I.....[.>.....| [16:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
I.....[.>.....| [16:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
I.....[.>.....| [15:24] S[] -> NP[NUM=?n] VP[NUM=?n] *
I.....[.>.....| [15:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
I.....[.>.....| [15:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
I.....[.>.....| [12:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I.....[.>.....| [12:24] S[] -> NP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I.....[.>.....| [12:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I.....[.>.....| [11:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I.....[.>.....| [11:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I.....[.>.....| [11:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I.....[.>.....| [13:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I.....[.>.....| [13:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I.....[.>.....| [13:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I.....[.>.....| [17:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n: 'pl', ?t: 'pres'}
I.....[.>.....| [18:24] S[] -> NP[NUM=?n] VP[NUM=?n] {?n: 'sg'}
I.....[.>.....| [18:24] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n: 'sg'}
I.....[.>.....| [18:24] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I.....[.>.....| [18:24] S[] -> NP[NUM=?n] VP[NUM=?n] IN[] S[] {?n: 'sg'}
I.....[.>.....| [17:24] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
I.....[.>.....| [17:24] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *

```

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Figure 145. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Run: PreProcess (1) ×

```

I.....[.].....| [21:24] PP[] -> IN[] NP[] *
I.....[.>.....| [21:24] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
I.....[.>.....| [21:24] S[] -> PP[] * COMMAs[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
I.....[.>.....| [21:24] S[] -> PP[] * COMMAs[] DATE[] COMMAs[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
I.....[.>.....| [19:24] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
I.....[.>.....| [19:24] NP[NUM=?n] -> Nom[NUM=?n] NP[] *
I.....[.>.....| [18:24] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] PP[] *
I.....[.>.....| [17:24] VP[NUM='pl', TENSE='pres'] -> VP[NUM='pl', TENSE='pres'] PP[] *
I.....[.>.....| [16:24] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
I.....[.>.....| [17:24] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
I.....[.>.....| [17:24] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] {?n2: Variable('?n'), ?t: 'past'}
I.....[.>.....| [17:24] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] {?n3: Variable('?n'), ?t: 'past'}
I.....[.>.....| [17:24] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] {?n2: Variable('?n'), ?t: 'inf'}
I.....[.>.....| [17:24] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] {?n3: Variable('?n'), ?t: 'inf'}
I.....[.>.....| [16:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
I.....[.>.....| [16:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
I.....[.>.....| [15:24] S[] -> NP[NUM=?n] VP[NUM=?n] *
I.....[.>.....| [15:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
I.....[.>.....| [15:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
I.....[.>.....| [12:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I.....[.>.....| [12:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I.....[.>.....| [12:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I.....[.>.....| [11:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I.....[.>.....| [11:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I.....[.>.....| [11:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I.....[.>.....| [13:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
I.....[.>.....| [13:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
I.....[.>.....| [13:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
I.....[.>.....| [13:24] S[] -> NP[NUM=?n] VP[NUM=?n] * IN[] S[] {?n: 'sg'}
I.....[.>.....| [17:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n: 'pl', ?t: 'pres'}
I.....[.>.....| [18:24] S[] -> NP[NUM=?n] VP[NUM=?n] {?n: 'sg'}
I.....[.>.....| [18:24] S[] -> NP[NUM=?n] VP[NUM=?n] DATE[] {?n: 'sg'}
I.....[.>.....| [18:24] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
I.....[.>.....| [18:24] S[] -> NP[NUM=?n] VP[NUM=?n] IN[] S[] {?n: 'sg'}
I.....[.>.....| [17:24] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
I.....[.>.....| [17:24] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *

```

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Figure 146. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ✎
[17:24] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *
[17:24] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
[16:24] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'past'}
[16:24] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] *
[17:24] VP[NUM='p1', TENSE='pres'] -> TV[NUM='p1', TENSE='pres'] NP[] *
[16:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'p1', ?t: 'pres'}
[16:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[16:24] S[] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[15:24] S[] -> NP[NUM=?n] VP[NUM=?n] *
[15:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[15:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[12:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[12:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[12:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[11:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[11:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[11:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[11:24] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[13:24] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[13:24] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[17:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[17:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[17:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[17:24] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[19:24] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[19:24] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[19:24] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[19:24] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[19:24] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[20:24] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[20:24] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[20:24] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[20:24] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[20:24] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[23:24] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[23:24] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[23:24] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[23:24] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}

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```

Figure 147. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ✎
[23:24] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[23:24] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[23:24] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[23:24] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[23:24] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[24:25] NN[] -> 'fridge' *
[24:25] NN['sg'] -> NN[] *
[24:25] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
[24:25] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
[24:25] Nom[NUM=?n] -> N[] *
[24:25] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
[24:25] NP[NUM=?n] -> Nom[NUM=?n] *
[23:25] Nom[NUM=?n] -> N[] Nom[NUM=?n] *
[23:25] NP[NUM=?n] -> Nom[NUM=?n] PP[] {?n2: Variable('?n')}
[23:25] NP[NUM=?n] -> Nom[NUM=?n] *
[22:25] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] *
[22:25] NP[NUM=?n] -> DT[NUM=?n] Nom[NUM=?n] * PP[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[22:25] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[22:25] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[22:25] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[22:25] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[22:25] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[21:25] PP[] -> IN[] NP[] *
[21:25] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[21:25] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[21:25] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[20:25] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
[19:25] NP[NUM=?n] -> Nom[NUM=?n] PP[] *
[18:25] NP[NUM='sg'] -> DT[NUM='sg'] Nom[NUM='sg'] PP[] *
[17:25] VP[NUM='p1', TENSE='pres'] -> VP[NUM='p1', TENSE='pres'] PP[] *
[16:25] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[17:25] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[17:25] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[17:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[17:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[17:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[17:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}

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```

Figure 148. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```
Run: PreProcess (1) <--> [17:25] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *  
[17:25] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *  
[17:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}  
[17:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}  
[17:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}  
[17:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}  
[16:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}  
[16:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}  
[15:25] S[] -> NP[NUM=?n] VP[NUM=?n] *  
[15:25] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}  
[15:25] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}  
[12:25] S[] -> NP[NUM=?sg'] VP[NUM=?sg'] *  
[12:25] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}  
[12:25] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}[11:25] S[] -> NP[NUM=?sg'] VP[NUM=?sg'] *  
[11:25] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}  
[11:25] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}  
[11:25] S[] -> NP[NUM=?sg'] VP[NUM=?sg'] *  
[13:25] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}  
[13:25] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}  
[17:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pl', ?t: 'pres'}  
[18:25] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}  
[18:25] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}  
[18:25] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}  
[18:25] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}  
[17:25] VP[NUM=?n, TENSE='past'] -> TV[NUM=?n, TENSE='past'] NP[] *  
[17:25] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *  
[16:25] VP[NUM=?n, TENSE=?t] -> MD[TENSE=?t] TV[TENSE='inf'] NP[] * RB[] {?t: 'past'}  
[16:25] VP[NUM=?n, TENSE='past'] -> MD[TENSE='past'] TV[TENSE='inf'] NP[] *  
[17:25] VP[NUM=?n, TENSE='pres'] -> TV[NUM='pl', TENSE='pres'] NP[] *  
[17:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n: 'pl', ?t: 'pres'}  
[16:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}  
[16:25] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}  
[15:25] S[] -> NP[NUM=?n] VP[NUM=?n] *  
[15:25] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n2: Variable('?n'), ?n3: Variable('?n')}  
[15:25] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}  
[12:25] S[] -> NP[NUM=?sg'] VP[NUM=?sg'] *
```

Figure 149. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Figure 150. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Run: PreProcess (1) ×

```

[...]
[24:26] NP[NUM=?n] -> N[NUM=?n] CC[] * NP[NUM=?n] {?n: 'sg'}
[15:26] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n'), ?n3: Variable('?n')}
[12:26] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[11:26] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[13:26] S[] -> NP[NUM=?n] VP[NUM=?n] CC[] * TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[26:27] P[] -> 'that' *
[26:27] INTRO[] -> P[] *
[26:27] IN[] -> P[] *
[26:27] PP[] -> IN[] * NP[] {}
[26:27] PP[] -> IN[] * DATE[] {}
[27:28] PropN[NUM='sg'] -> 'O'Malley' *
[27:28] NNP[NUM='sg'] -> PropN[NUM='sg'] *
[27:28] NP[NUM=?n] -> NP[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
[27:28] Nom[NUM='sg'] -> NP[NUM=?n] *
[27:28] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n: 'sg'}
[27:28] NP[NUM='sg'] -> Nom[NUM='sg'] *
[27:28] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n: 'sg'}
[27:28] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n: 'sg'}
[27:28] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[27:28] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n: 'sg'}
[27:28] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n: 'sg'}
[26:28] PP[] -> IN[] NP[] *
[26:28] PP[] -> PP[] * COMMMA[] NP[NUM=?n] VP[NUM=?n] {}
[26:28] S[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[26:28] S[] -> PP[] * COMMMA[] DATE[] COMMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[26:28] S[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[28:29] IV[TENSE='past'] -> 'intended' *
[28:29] VP[NUM=?n, TENSE=?t] -> IV[TENSE=?t] TO[] VP[TENSE='inf'] {?t: 'past'}
[28:29] VP[NUM=?n, TENSE=?t] -> IV[TENSE='past'] *
[28:29] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[28:29] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[27:29] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[27:29] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[27:29] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[29:30] P[] -> 'to' *
[29:30] TO[] -> 'to' *
[28:30] VP[NUM=?n, TENSE=?t] -> IV[TENSE=?t] TO[] * VP[TENSE='inf'] {?t: 'past'}
[29:30] IN[] -> P[] *

```

Commit Git TODO Run Python Console Terminal

Figure 151. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

Run: PreProcess (1) ×

```

[...]
[29:30] IN[] -> P[] *
[29:30] PP[] -> IN[] * NP[] {}
[29:30] PP[] -> IN[] * DATE[] {}
[30:31] TV[TENSE='inf'] -> 'share' *
[30:31] VP[NUM=?n, TENSE=?t] -> TV[NUM=?n, TENSE=?t] * NP[] {?t: 'inf'}
[31:32] PRP[] -> 'it' *
[31:32] NP[NUM=?n] -> PRP[] *
[31:32] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
[31:32] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
[31:32] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[31:32] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[31:32] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[31:32] S[] -> NP[NUM=?n] * VP[NUM=?n] TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[31:32] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[30:32] VP[NUM=?n, TENSE='inf'] -> TV[NUM=?n, TENSE='inf'] NP[] *
[30:32] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[30:32] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[28:32] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] TO[] VP[TENSE='inf'] *
[28:32] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[28:32] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[27:32] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[27:32] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[27:32] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[32:33] P[] -> 'with' *
[32:33] IN[] -> P[] *
[32:33] PP[] -> IN[] * NP[] {}
[32:33] PP[] -> IN[] * DATE[] {}
[33:34] PRP[] -> 'her' *
[33:34] NP[NUM=?n] -> PRP[] *
[33:34] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
[33:34] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
[33:34] S[] -> NP[NUM=?n] VP[NUM=?n] {?n2: Variable('?n')}
[33:34] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[33:34] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[33:34] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[33:34] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[32:34] PP[] -> IN[] NP[] *
[32:34] S[] -> PP[] * COMMMA[] NP[NUM=?n] VP[NUM=?n] {}

```

Commit Git TODO Run Python Console Terminal

Figure 152. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

The screenshot shows a software interface with a title bar "Run: PreProcess (1)". Below the title bar is a tree view of generated parse trees. The root node is a complex phrase structure involving multiple levels of nested nodes like IN[], NP[], PP[], VP[], DATE[], and S[]. The tree has many branches and nodes, indicating a large number of potential grammatical structures. At the bottom of the interface, there are several status icons: Commit, Git, TODO, Run, Python Console, and Terminal.

```

[...]
[. .... | [32:34] PP[] -> IN[] NP[] *
[. .... | [32:34] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[. .... | [32:34] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[. .... | [32:34] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[. .... | [32:34] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[. .... | [28:34] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[. .... | [28:34] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[. .... | [28:34] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] *
[. .... | [27:34] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[. .... | [27:34] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[. .... | [27:34] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[. .... | [30:34] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'inf'}
[. .... | [30:34] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'inf'}
[. .... | [28:34] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] TO[] VP[TENSE='inf'] *
[. .... | [28:34] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
[. .... | [28:34] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
[. .... | [27:34] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[. .... | [27:34] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[. .... | [27:34] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[. .... | [34:35] P[] -> 'on' *
[. .... | [34:35] IN[] -> P[] *
[. .... | [34:35] PP[] -> IN[] * NP[] {}
[. .... | [34:35] PP[] -> IN[] * DATE[] {}
[. .... | [35:36] WEEK[] -> 'Tuesday' *
[. .... | [35:36] DATE[] -> WEEK[] *
[. .... | [35:36] S[] -> DATE[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[. .... | [35:36] S[] -> DATE[] * COMMA[] PP[] COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[. .... | [35:36] S[] -> DATE[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[. .... | [34:36] PP[] -> IN[] DATE[] *
[. .... | [34:36] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[. .... | [34:36] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[. .... | [34:36] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[. .... | [34:36] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[. .... | [28:36] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[. .... | [30:36] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[. .... | [30:36] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'inf'}
[. .... | [30:36] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'inf'}

```

Figure 153. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

The screenshot shows a software interface with a title bar "Run: PreProcess (1)". Below the title bar is a tree view of generated parse trees. The root node is a complex phrase structure involving multiple levels of nested nodes like IN[], NP[], PP[], VP[], DATE[], and S[]. The tree has many branches and nodes, indicating a large number of potential grammatical structures. At the bottom of the interface, there are several status icons: Commit, Git, TODO, Run, Python Console, and Terminal.

```

[...]
[. .... | [30:36] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[. .... | [30:36] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'inf'}
[. .... | [30:36] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'inf'}
[. .... | [28:36] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] TO[] VP[TENSE='inf'] *
[. .... | [28:36] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
[. .... | [28:36] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
[. .... | [27:36] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[. .... | [27:36] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[. .... | [27:36] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[. .... | [28:36] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
[. .... | [28:36] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
[. .... | [27:36] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[. .... | [27:36] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[. .... | [27:36] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[. .... | [36:37] P[] -> 'at' *
[. .... | [36:37] IN[] -> P[] *
[. .... | [36:37] PP[] -> IN[] * NP[] {}
[. .... | [36:37] PP[] -> IN[] * DATE[] {}
[. .... | [37:38] PRP[] -> IN[] * 'his' *
[. .... | [37:38] NP[] -> PRP[] *
[. .... | [37:38] NP[] -> PRP[] * NP[NUM=?n] {}
[. .... | [37:38] NP[] -> PRP[] * DATE[] PP[] {}
[. .... | [37:38] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[. .... | [37:38] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[. .... | [37:38] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[. .... | [37:38] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[. .... | [37:38] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[. .... | [36:38] PP[] -> IN[] NP[] *
[. .... | [36:38] S[] -> PP[] * COMMMA[] NP[NUM=?n] VP[NUM=?n] {}
[. .... | [36:38] S[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[. .... | [36:38] S[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[. .... | [36:38] DATE[] -> PP[] * COMMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[. .... | [30:38] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[. .... | [28:38] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[. .... | [28:38] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
[. .... | [28:38] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
[. .... | [27:38] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[. .... | [27:38] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}

```

Figure 154. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
[...]
[30:36] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[30:36] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[28:36] VP[NUM=?n, TENSE=?t] -> IV[TENSE='past'] TO[] VP[TENSE='inf'] *
[28:36] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[27:36] S[] -> NP[NUM=?n] VP[NUM='sg'] *
[27:36] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[27:36] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[27:36] S[] -> NP[NUM=?n] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}
[27:36] S[] -> NP[NUM=?n] VP[NUM='sg'] *
[27:36] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[27:36] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[36:37] P[] -> 'at' *
[36:37] IN[] -> P[] *
[36:37] PP[] -> IN[] * NP[] {}
[36:37] PP[] -> IN[] * DATE[] {}
[37:38] PRP[] -> 'his' *
[37:38] NP[NUM=?n] -> PRP[] * NP[NUM=?n] {}
[37:38] NP[NUM=?n] -> PRP[] * DATE[] PP[] {}
[37:38] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[37:38] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[37:38] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[37:38] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n3: Variable('?n')}
[36:38] PP[] -> IN[] NP[] *
[36:38] S[] -> PP[] * COMM[] NP[NUM=?n] VP[NUM=?n] {}
[36:38] S[] -> PP[] * COMM[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[36:38] S[] -> PP[] * COMM[] DATE[] COMM[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[36:38] DATE[] -> PP[] * COMM[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[30:38] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[28:38] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[28:38] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[27:38] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[27:38] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}

```

Figure 155. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

```

Run: PreProcess (1) ×
[...]
[27:38] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[27:38] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[27:38] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[27:38] S[] -> NP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'inf'}
[27:38] S[] -> NP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'inf'}
[28:38] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] TO[] VP[TENSE='inf'] *
[28:38] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[27:38] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[27:38] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[27:38] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[38:39] NN[] -> 'desk' *
[38:39] NN[] -> NP[NUM='sg'] VP[NUM='sg'] *
[38:39] NP[NUM=?n] -> N[NUM=?n] * CC[] NP[NUM=?n] {?n: 'sg'}
[38:39] Nom[NUM=?n] -> N[] * Nom[NUM=?n] {}
[38:39] Nom[NUM=?n] -> N[] *
[38:39] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
[38:39] NP[NUM=?n] -> Nom[NUM=?n] *
[38:39] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[38:39] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[38:39] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[38:39] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[38:39] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[37:39] NP[NUM=?n] -> PRP[] NP[NUM=?n] *
[37:39] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[37:39] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[37:39] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[37:39] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[37:39] S[] -> NP[NUM=?n] * VP[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[36:39] PP[] -> IN[] NP[] *
[36:39] S[] -> PP[] * COMM[] NP[NUM=?n] VP[NUM=?n] {}
[36:39] S[] -> PP[] * COMM[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[36:39] S[] -> PP[] * COMM[] DATE[] COMM[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[36:39] DATE[] -> PP[] * COMM[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[30:39] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[28:39] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[28:39] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n2: Variable('?n'), ?t: 'past'}
[28:39] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] * PP[] {?n3: Variable('?n'), ?t: 'past'}

```

Figure 156. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’

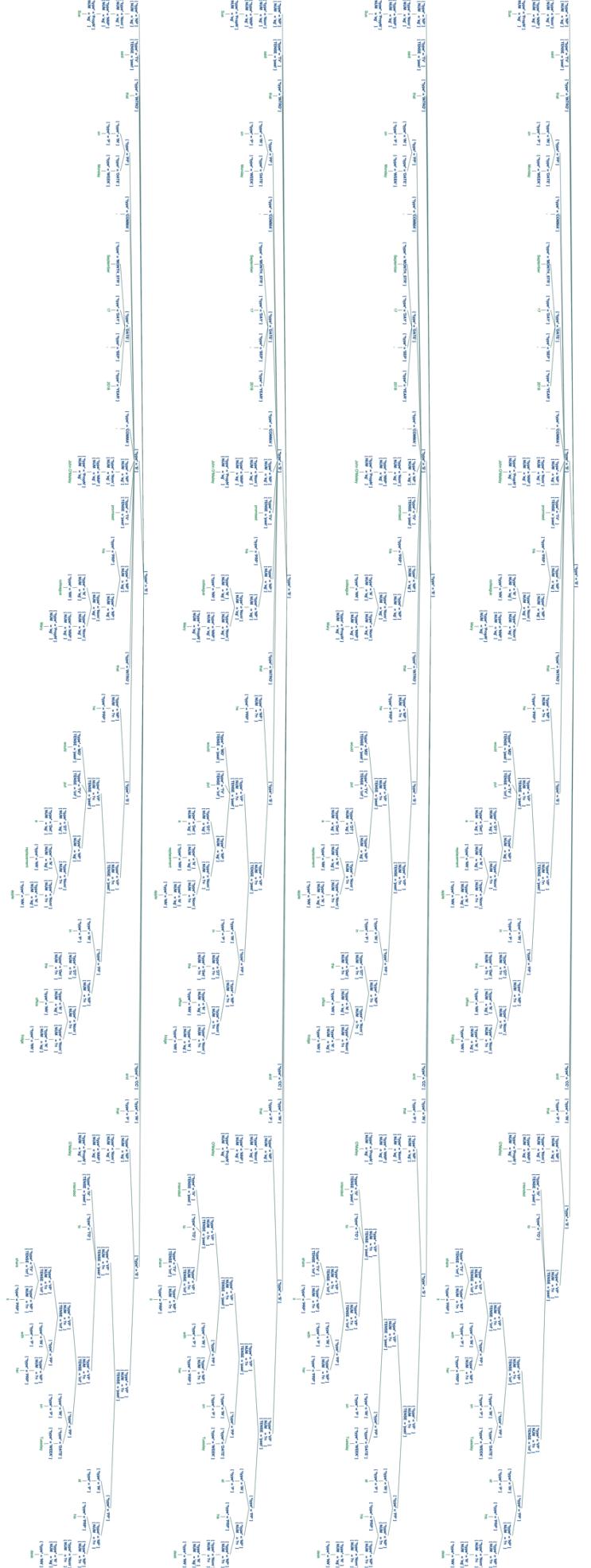
```

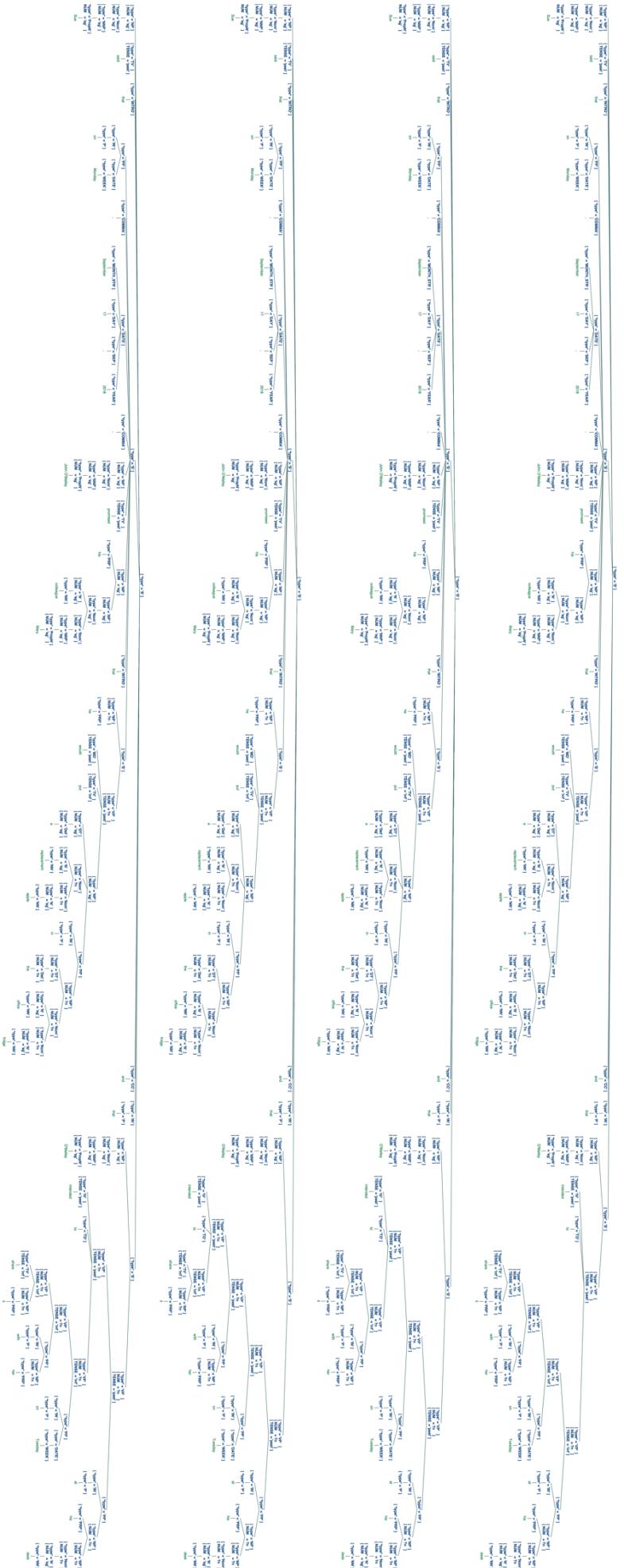
Run: PreProcess (1) ✘
[...]
[.] [38:39] Nom[NUM=?n] -> N[] *
[.>] [38:39] NP[NUM=?n] -> Nom[NUM=?n] * PP[] {?n2: Variable('?n')}
[.] [...]
[.>] [38:39] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[.>] [38:39] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[.>] [38:39] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[.>] [38:39] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[.>] [38:39] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[.] [37:39] NP[NUM=?n] -> PRP[] NP[NUM=?n] *
[.>] [37:39] S[] -> NP[NUM=?n] * VP[NUM=?n] {?n2: Variable('?n')}
[.>] [37:39] S[] -> NP[NUM=?n] * VP[NUM=?n] DATE[] {?n3: Variable('?n')}
[.>] [37:39] S[] -> NP[NUM=?n] * VP[NUM=?n] CC[] TV[NUM=?n] INTRO[] S[] {?n2: Variable('?n')}
[.>] [37:39] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] {?n3: Variable('?n')}
[.>] [37:39] S[] -> NP[NUM=?n] * TV[NUM=?n] INTRO[] S[] CC[] IN[] S[] {?n2: Variable('?n')}
[.] [36:39] PP[] -> IN[] NP[] *
[.>] [36:39] S[] -> PP[] * COMMA[] NP[NUM=?n] VP[NUM=?n] {}
[.>] [36:39] S[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] {}
[.>] [36:39] S[] -> PP[] * COMMA[] DATE[] COMMA[] NP[NUM=?n] TV[NUM=?n] NP[NUM=?n] INTRO[] S[] {}
[.>] [36:39] DATE[] -> PP[] * COMMA[] NP[NUM=?n] TV[NUM=?n] INTRO[] S[] MONTH_STR[] NN_NUM[] YEAR[] {}
[.>] [30:39] VP[NUM=?n, TENSE='inf'] -> VP[NUM=?n, TENSE='inf'] PP[] *
[.] [28:39] VP[NUM=?n, TENSE='past'] -> VP[NUM=?n, TENSE='past'] PP[] *
[.>] [28:39] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
[.>] [28:39] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
[.] [27:39] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[.>] [27:39] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[.>] [27:39] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
[.>] [30:39] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'inf'}
[.>] [30:39] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'inf'}
[.] [28:39] VP[NUM=?n, TENSE='past'] -> IV[TENSE='past'] TO[] VP[TENSE='inf'] *
[.>] [28:39] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n2: Variable('?n'), ?t: 'past'}
[.>] [28:39] VP[NUM=?n, TENSE=?t] -> VP[NUM=?n, TENSE=?t] PP[] {?n3: Variable('?n'), ?t: 'past'}
[.] [27:39] S[] -> NP[NUM='sg'] VP[NUM='sg'] *
[.>] [27:39] S[] -> NP[NUM=?n] VP[NUM=?n] * DATE[] {?n: 'sg', ?n2: 'sg'}
[.>] [27:39] S[] -> NP[NUM=?n] VP[NUM=?n] * CC[] TV[NUM=?n] INTRO[] S[] {?n: 'sg', ?n2: 'sg'}
<generator object FeatureChart.parses at 0x7ffc64cbc6d0>

Process finished with exit code 0

```

Figure 157. Test scenario 9 result: ‘Sue said that on Monday, September 17, 2018, John O’Malley promised his colleague Mary that he would put a replacement apple in the office fridge and that O’Malley intended to share it with her on Tuesday at his desk.’





2. Errors and Limitations

If the text sentence contains a complement, only the process of Earley Parse may be displayed, not the Earley Parse Tree. In cases where sentences are too long, Earley Parse's process table may not display the statement content in the first line.