Natural Language Processing

Answers for Old Exam Questions

Multiple Choice Answers

1 a	5 c	9 a	13 c	17 b	21 c	25 d	29 d
2 d	6 c	10 b	14 b	18 a	22 b	26 b	30 d
3 a	7 d	11 c	15 b	19 a	23 b	27 b	
4 c	8 a	12 d	16 c	20 c	24 d	28 a	

Open Question

1. *Tonight's program discusses stress, exercise, nutrition and sex with Celtic forward Scott Wedman, Dr Ruth Westheimer and Dick Cavett.*

   (a) Several variations are possible, but ideally your grammar should look something like the one below. Proper treatment of commas and possessive $'s$ are not so important.

      S → NP VP
      VP → Verb NP (PP)
      PP → Preposition NP
      NP → Noun
      NP → ProperNoun
      NP → Adj Noun
      NP → NP PP
      NP → (NP Comma)* NP Conjunction NP
      NP → NP NP

      Noun → program | stress | exercise | nutrition | sex | forward | Dr
      ProperNoun → Scott Wedman | Ruth Westheimer | Dick Cavett
      Verb → discusses
      Preposition → with
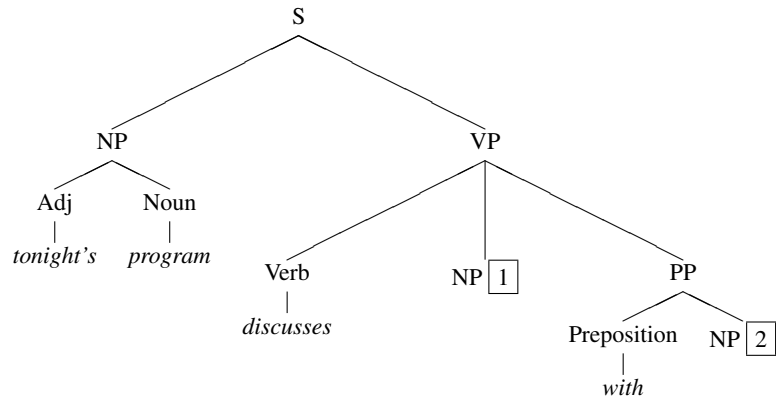   Comma → ,
      Conjunction → and
      Adj → tonight's | Celtic

   (b) Multiple parse trees are produced for this sentence by the grammar. Here we show only the most obvious ones.
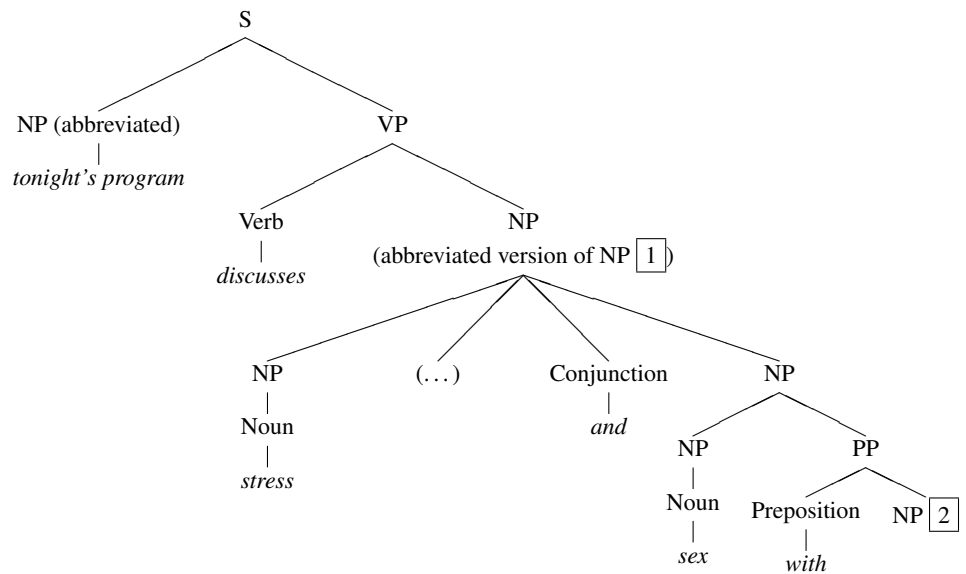
      Parse tree 1
      In this tree, corresponding to what is probably the intended meaning of the sentence, the PP is a modifier in the VP. In this case, the meaning of the

sentence is that in the program, the items *nutrition . . . sex* which form the coordinated NP 1 are discussed with the three persons (*Celtic forward Scott Wedman*, etc.) from the other coordinated NP 2 . (For the trees of NP 1 and 2 , see the next page.)

```
                          S
            ┌─────────────┴──────────────┐
            NP                           VP
        ┌───┴───┐            ┌───────────┼──────────────┐
       Adj     Noun        Verb       NP 1              PP
        │       │            │                     ┌─────┴─────┐
    tonight's program     discusses          Preposition    NP 2
                                                  │
                                                 with
```
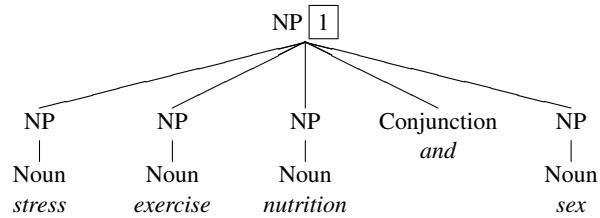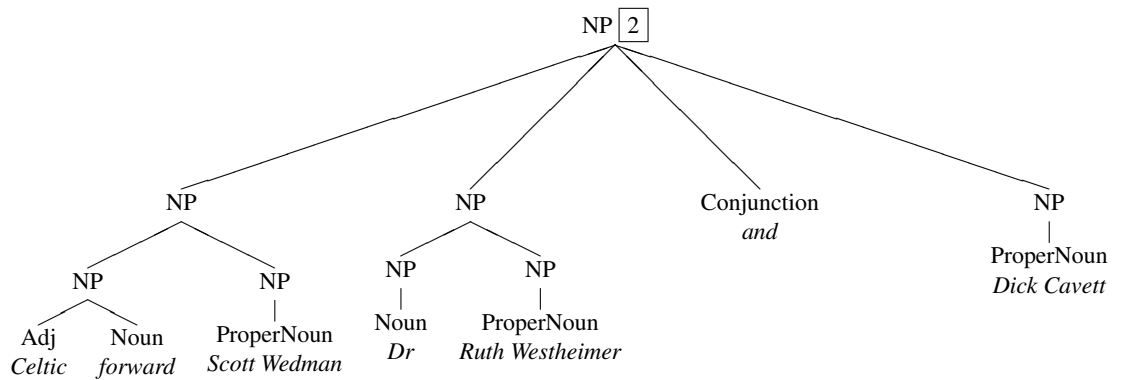
Parse tree 2

In this tree, the PP modifies the NP *sex*: together they form the NP *sex with Celtic forward Scott Wedman, Dr. Ruth Westheimer and Dick Cavett*, which is part of the coordinated NP 1 . In other words, sex with these three people is one of the four items being discussed in the TV show. (The other items are stress, exercise, and nutrition.)

```
                        S
            ┌───────────┴────────────┐
      NP (abbreviated)               VP
            │                ┌───────┴───────────┐
    tonight's program      Verb                 NP
                            │        (abbreviated version of NP 1 )
                         discusses   ┌──────┬──────────┬──────────┐
                                    NP    (...)   Conjunction     NP
                                     │              │        ┌────┴────┐
                                    Noun           and      NP        PP
                                     │              │        │    ┌────┴────┐
                                   stress          Noun  Preposition  NP 2
                                                    │        │
                                                   sex     with
```

NP 1 tree (simplified by leaving out the commas!)

NP 1
- NP — Noun — *stress*
- NP — Noun — *exercise*
- NP — Noun — *nutrition*
- Conjunction — *and*
- NP — Noun — *sex*

NP 2 tree (simplified by leaving out the comma!)

NP 2
- NP
  - NP
    - Adj — *Celtic*
    - Noun — *forward*
  - NP
    - ProperNoun — *Scott Wedman*
- NP
  - NP — Noun — *Dr*
  - NP — ProperNoun — *Ruth Westheimer*
- Conjunction — *and*
- NP — ProperNoun — *Dick Cavett*

Parse tree 3

In this tree, the PP modifies not just *sex* but the entire coordinated NP 1. In other words, the TV show is about the combination of stress, exercise, nutrition and sex (all together) with the three people mentioned. The fact that this combination is not very meaningful is not relevant here.

Parse tree 4 and more

In these trees the NP *Celtic forward Scott Wedman* is part of the PP, but the NPs corresponding to the other two people are not: they are all part of the coordinated NP that is the complement of the verb. In other words, they are being discussed in the show; the discussion is not with them. Discussion items are thus (1) stress, (2) exercise, (3) nutrition, (4) sex with Scott Wedman, (5) Dr. Ruth Westheimer and (6) Dick Cavett. It is not mentioned who these items are discussed with. Alternatively, the show's discussion items could be (1) stress, (2) exercise, (3) nutrition and sex with Scott Wedman, (4) Dr. Ruth Westheimer and (5) Dick Cavett; etc. (Multiple items could be combined with Scott Wedman; see tree 3.)

It's left to the reader to draw all these other trees.