```
S NP #NP V #V NP #NP #S (500)
NP D #D N #N #NP (1000)
D 0 t h i s #D (600)
D 1 t h a t #D (400)
N 0 g i r l #N (300)
N 1 b o y #N (700)
V 0 l o v e s #V (650)
V 1 h a t e s #V (350)
```

(a)


```
0           t h i s         b o y         l o v e s           t h a t       g i r l           0
            | | | |         | | |         | | | | |           | | | |       | | |
1           | | | |         | | |         | | | | |           | | | |     N 0 g i r l #N       1
            | | | |         | | |         | | | | |           | | | |     |           |
2           | | | |         | | |         | | | | |   NP D     | | | | #D N         #N #NP     2
            | | | |         | | |         | | | | |   | |  | | | | | |               |
3           | | | |         | | |         | | | | |   | D 1 t h a t #D               |         3
            | | | |         | | |         | | | | |   |                               |
4           | | | |         | | |     V 0 l o v e s #V |                               |         4
            | | | |         | | |     |           | |                               |
5 S NP      | | | |         | | |   #NP V         #V NP                         #NP #S 5
  |         | | | |         | | |     |
6 | D 0 t h i s #D         | | |     |                                                         6
  | |               |       | | |     |
7 NP D             #D N     | | | #N #NP                                                       7
                    |       | | | |
8                 N 1 b o y #N                                                                 8
```

(b)


```
0 S       0             1             0             1             0             #S 0
  |       |             |             |             |             |             |
1 S NP    |             |         #NP V |         #V NP |             |         #NP #S 1
  |       |             |         | |  | |         | | |             |             |
2 |       |             |         | V 0 l o v e s #V | |             |             |         2
  |       |             |         |             | |             |             |
3 |       |             |         |             | |             N 0 g i r l #N |         3
  |       |             |         |             | |             |           | |
4 |       |             |         |             NP D |         #D N         #N #NP 4
  |       |             |         |             | |             |
5 |       |             |         |             D 1 t h a t #D               5
  |       |             |         |
6 | D 0 t h i s #D      |         |                                                         6
  | |             |     |         |
7 NP D           #D N | #N #NP                                                             7
                  | |
8               N 1 b o y #N                                                               8
```

(c)

```
0              fruit          flies              like              a         banana        0
               |              |                  |                 |         |
1              |              |                  |                 |    < N 1 banana >      1
               |              |                  |                 |    | |                |
2              |              |                  |        < NP 1 < D    | > < N          > > 2
               |              |                  |        | |    | |   | |                |
3              |              |                  |        | |    < D 1 a >                |   3
               |              |                  |        | |                             |
4              |              |          < ADV 0 like > | |                              |   4
               |              |                  |      | | |                             |
5              |              |    < ADP < ADV        > < NP                        > > 5
               |              |    | |  |                                               |
6     < N 2 fruit >           |    | |  |                                               | 6
      | |                     |    | |  |                                               |
7 S 0 < N         > < V   |   > < ADP                                               > 7
          | |             |  |  |
8              < V 0 flies >                                                             8

(a)

0                  fruit          flies              like              a         banana        0
                   |              |                  |                 |         |
1                  |              |                  |                 |    < N 1 banana >      1
                   |              |                  |                 |    | |                |
2                  |              |                  |        < NP 1 < D    | > < N          > > 2
                   |              |                  |        | |    | |   | |                |
3                  |              |                  |        | |    < D 1 a >                |   3
                   |              |                  |        | |                             |
4                  |              |          < V 1 like > | |                              |   4
                   |              |                  |      | | |                             |
5 S 1 < NP         |              |        > < V        > < NP                        > 5
      | |          |              |        |
6     | |    < A 0 fruit >        |        |                                               6
      | |    | |                  |        |
7     < NP 0 < A         > < N    |   > >                                               7
             | |             |    |   |
8                  < N 0 flies >                                                          8

(b)
```

```
0                              t w o              k i t t e n   s              p l a y       0
                               | | |              | | | | | |   |              | | | |
1                              | | |          < Nr 5 k i t t e n > |           | | | |       1
                               | | |              | |                 | |      | | | |
2                              | | |     < N Np < Nr               > s >        | | | |       2
                               | | |       | | |                     |         | | | |
3                   < D Dp 4 t w o > | | |                           |         | | | |       3
                      | |        | | | |                             |         | | | |
4                 < NP < D        > < N |                       > >   |         | | | |       4
                    | |              |                               |         | | | |
5                   | |              |                               |       < Vr 1 p l a y >   5
                    | |              |                               |           | |       |
6                   | |              |                               | < V Vp < Vr         > >   6
                    | |              |                               | | | |               |
7 < S Num    ; < NP                 |                               > < V |               > > 7
        |        |                   |                               |
8       Num PL ;                      Np                             Vp                   8
```

(a)

```
0                              t   o              k i t t e     m s              p l a x y     0
                               |   |              | | | | |     |                | | |   |
1                              |   |          < Nr 5 k i t t e n >   |           | | |   |     1
                               |   |              | |                   |        | | |   |
2                              |   |     < N Np < Nr               >   s >        | | |   |     2
                               |   |       | | |                       |         | | |   |
3                   < D Dp 4 t w o > | | |                             |         | | |   |     3
                      | |        | | | |                               |         | | |   |
4                 < NP < D        > < N |                         > >   |         | | |   |     4
                    | |              |                                 |         | | |   |
5                   | |              |                                 |       < Vr 1 p l a   y >   5
                    | |              |                                 |           | |         |
6                   | |              |                                 | < V Vp < Vr           > >   6
                    | |              |                                 | | | |                 |
7 < S Num    ; < NP                 |                                 > < V |                 > > 7
        |        |                   |                                 |
8       Num PL ;                      Np                               Vp                     8
```
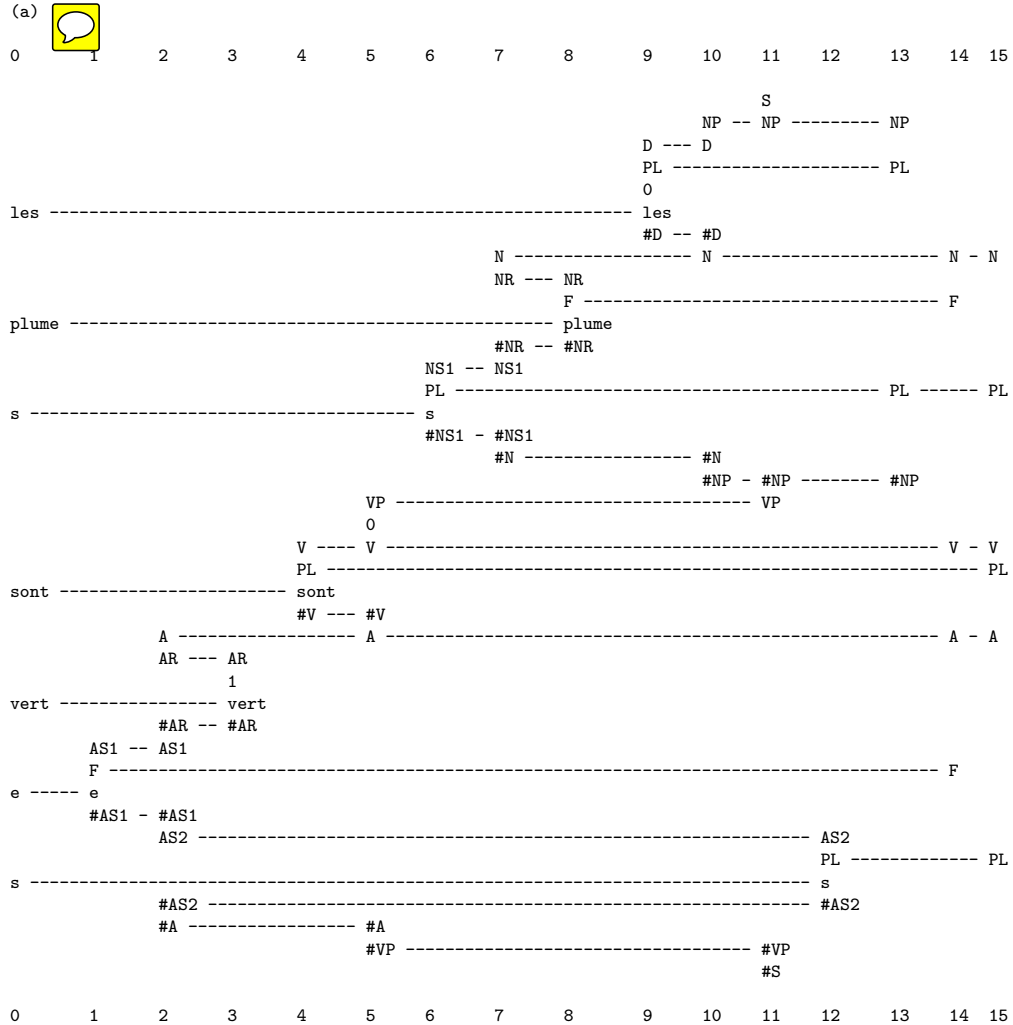
(b)
```

```
 P       P P         P       Number dependencies
Les plume s sont vert e s
     F               F       Gender dependencies

(a) [speech bubble icon]

0       1       2       3       4       5       6       7       8       9      10      11      12      13      14  15

                                                                                        S
                                                                            NP -- NP --------- NP
                                                                        D --- D
                                                                        PL -------------------- PL
                                                                        O
les ------------------------------------------------------------ les
                                                                        #D -- #D
                                                            N ----------------- N --------------------- N - N
                                                            NR --- NR
                                                              F --------------------------------- F
plume ------------------------------------------------- plume
                                                        #NR -- #NR
                                        NS1 -- NS1
                                        PL --------------------------------------------- PL ------ PL
s ------------------------------------- s
                                        #NS1 - #NS1
                                            #N ---------------- #N
                                                              #NP - #NP -------- #NP
                                VP ---------------------------------- VP
                                O
                        V ---- V ------------------------------------------------------ V - V
                        PL ---------------------------------------------------------------- PL
sont --------------------- sont
                        #V --- #V
                A ----------------- A ------------------------------------------------- A - A
                AR --- AR
                        1
vert --------------- vert
                #AR -- #AR
        AS1 -- AS1
        F ------------------------------------------------------------------------------- F
e ----- e
        #AS1 - #AS1
            AS2 ------------------------------------------------------------- AS2
                                                                        PL ------------ PL
s ------------------------------------------------------------------------------- s
            #AS2 ------------------------------------------------------------- #AS2
            #A ---------------- #A
                        #VP --------------------------------- #VP
                                                        #S

0       1       2       3       4       5       6       7       8       9      10      11      12      13      14  15

(b) [speech bubble icon]
```

```
            H------en  B2---------en
            ----      --  --           --
It   will  have  been  being  washed
     ----  ----  --        ---  ----
      M----inf    B1------ing    V


            B1------ing
            --         ---
Will   he   be   talking?
----        --   ----
 M-------inf    V


                V
              ------
They   have   finished
       ----           --
        H----------en
        fin


Are   they   gone?
---          ----
B2----------en
fin          V


            B1--------ing
            --         ---
Has   he   been   working?
---        --   ----
 H---------en    V
fin
```

```
0     1     2     3     4     5     6     7     8     9     10

                                                        S
                                                        ST
                                              NP -- NP
                                              SNG ------- SNG
it --------------------------------------------- it
                                              #NP - #NP
                                        X1 --------- X1
                                        2
                              XB1 -- XB1
                        V --- V
                  B -- B --- B
                        SNG -------------------------- SNG
                        FIN -------- FIN
                        O
is ------------------------- is
                        #V -- #V
                              #XB1 - #XB1
                                        #X1 -------- #X1
                                        XR --------- #XR
                                        XB
                  XV - XV -------------- XV
      V ---------- V
      EN -------------- EN
      5
wash - wash
      ED --- ED
ed ---------- ed
      #ED -- #ED
      #V --------- #V
            #S ------------------- #S --------- #S

0     1     2     3     4     5     6     7     8     9     10
```

```
0     1     2     3     4     5     6     7     8     9     10    11    12    13    14    15    16

                                                            S
                                                            Q
                                                X1 -------- X1
                                                O
                                          V ---- V
                                          M ---- M -------------------------------- M
                                          O
will ------------------------------------ will
                                          #V --- #V
                                                #X1 ------- #X1
                                                      NP -- NP
                                                      SNG
it ------------------------------------------------- it
                                                      #NP - #NP -
                                                XR -------- XR
                                                XH --------------------- XH
                                                            V ---- V
                                                            H -----H---------------- H
                                                            INF -------------- INF
have ----------------------------------------------------------------- have
                                                            #V --- #V
                                                                  #XH
                                                XB --------------------- XB
                                    XB ---------- XB
                      XB1 -------------- XB1
              V ---- V
              B ---- B --------------------------------------------------------------------- B
              EN --------------------------------------------------------------------------- EN
be ---------- be
        EN1 -- EN1
en --- en
        #EN1 - #EN1
              #V --- #V
                      #XB1 ------------- #XB1
                            XV - XV ---------- XV ------------------------------------------- XV
                      V ---- V
                      EN ----------------------------------------------------------------- EN
                      1
brok --------------------- brok
                      EN1 ------------------------------------------------- EN1
en -------------------------------------------------------------------------------- en
                      #EN1 ----------------------------------------------------------#EN1
                      #V --- #V
                            #S - #S ---------- #S -------- #S --------- #S

0     1     2     3     4     5     6     7     8     9     10    11    12    13    14    15    16
```

```
0     1     2     3     4     5     6     7     8     9     10

                                    S
                                    Q
                                    X1 -- X1
                                          2
                                          XB1 -------- XB1
                                                  V --- V
                                                  B --- B --------- B
                                                  PL --------- PL
                                          FIN -- FIN
                                                  O
are ---------------------------------------- are
                                                  #V -- #V
                                          #XB1 ------- #XB1
                                    #X1 - #X1
                              NP --- NP
                              PL ---------------------------- PL
they --------------------- they
                              #NP -- #NP
                                    XR -- XR
                                          XB --------------------- XB
                        XV ---------------XV
        V -------------V
        ING ----------------------------------------------------- ING
        1
walk - walk
        ING1 -- ING1
ing ---------- ing
        #ING1 - #ING1
        #V ------------ #V
                    #S -------- #S -- #S

0     1     2     3     4     5     6     7     8     9     10
```

```
0         1         2         3         4         5         6         7         8         9         10        11        12        13

                                                        SM
                        S ------------------------ S
                        AR ---------------------------------------------------------------------------------- AR
                        NP --- NP
                                1 ------------------------------------------------------------------------------ 1
john ---------------- john
                        #NP -- #NP
                        #AR ---------------------------------------------------------------------------------- #AR
                        AN ---------------------------------------------------------------------------- AN
                        V1 ------------------ V1
                                V ------ V
                                0 ---------------------------------------------------- 0
kissed --------------------- kissed
                                #V ----- #V
                        #V1 ------------------ #V1
                        #AN ---------------------------------------------------------------------- #AN
                        OBJ ------------------------------------------ OBJ
                NP --- NP
                2 -------------------------------------------------- 2
mary --- mary
                #NP -- #NP
                        #OBJ ------------------------------------------ #OBJ
                        #S ------------------------ #S
                                                        A --- A
                                                        X -------------------------------- X
                                                        an ---------------- an
                                                                0 ------------ 0
                                                                KISSED
                                                        #an ---------------- #an
                                                        #X -------------------------------- #X
                                                        Y ---------- Y
                                                        obj -- obj
                                                                1 ---- 1
                                                                MARY
                                                        #obj - #obj
                                                        #Y ---------- #Y
                                                        Z ---------------------------------------- Z
                                                        ar ------------------------ ar
                                                                0 --------- 0
                                                                JOHN
                                                        #ar ------------------------ #ar
                                                        #Z ---------------------------------------- #Z
                                        #A -- #A
                                        #SM

0         1         2         3         4         5         6         7         8         9         10        11        12        13
```

```
0       1       2       3       4       5       6       7       8       9       10          11      12      13

                                                SM
                                                S --- S
                                                        AR ---------------- AR
                                                        NP --- NP
                                                                1 --------- 1
                                                                john
                                                        #NP -- #NP
                                                        #AR -------------- #AR
                                                        AN ----------------------------- AN
                                                        V1 --------- V1
                                                                        V --------- V
                                                                                0 ------ 0
                                                                                kissed
                                                                #V ------- #V
                                                        #V1 -------- #V1
                                                        #AN ---------------------------- #AN
                                                        OBJ ------------------------------------------- OBJ
                                                        NP ------------------------------------- NP
                                                                                                2 ---- 2
                                                                                                mary
                                                        #NP ------------------------------------ #NP
                                                        #OBJ ------------------------------------ #OBJ
                                        #S -- #S
                        A ----------------- A
                        X ------------------------------------------------------ X
        an ----- an
        0 ------------------------------------------------------------ 0
KISSED - KISSED
        #an ---- #an
                        #X ------------------------------------------------------ #X
                        Y ------------------------------------------------------------ Y
                        obj --------- obj
                                        1 ------------------------------------------------------ 1
MARY ------------------------ MARY
                        #obj -------- #obj
                        #Y ------------------------------------------------------------ #Y
                        Z ----------------------------------------- Z
                        ar --- ar
                                        0 ----------------------------------- 0
JOHN ------------------- JOHN
                        #ar -- #ar
                        #Z ----------------------------------------- #Z
                        #A ---------------- #A
                                        #SM

0       1       2       3       4       5       6       7       8       9       10          11      12      13
```

```
0               1                 2                 3               4             5

                <disease> --------- <disease> ---------- <disease> ---- <disease>
                                    flu
                : ----------------- :
<patient> ------ <patient>
John_Smith
</patient> ----- </patient>
                <dname> ----------- <dname>
                                    Influenza
                </dname> ---------- </dname>
                <R1> -------------- <R1>
                                    flu_symptoms ------- flu_symptoms
                </R1> ------------- </R1>
                <R2> ----------------------------------- <R2>
                                                         fever -------- fever
                </R2> ---------------------------------- </R2>
<appetite> ----- <appetite> -------- <appetite>
poor                                normal
</appetite> ---- </appetite> ------- </appetite>
<breathing> ---- <breathing> --------------------------------------------------- <breathing>
rapid ------------------------------------------------------------------------- rapid
</breathing> --- </breathing> -------------------------------------------------- </breathing>
                <chest> ----------- <chest>
                                    normal
                </chest> ---------- </chest>
<chills> ------- <chills> ------------------------------- <chills>
yes -------------------------------------------------- yes
</chills> ------ </chills> ------------------------------ </chills>
                <cough> ------------------------------- <cough>
                                                        yes
                </cough> ------------------------------ </cough>
                <diarrhoea> ------- <diarrhoea>
                                    no
                </diarrhoea> ------ </diarrhoea>
<face> --------- <face> ------------------------------------------------- <face>
flushed -------------------------------------------------------------- flushed
</face> -------- </face> ------------------------------------------------ </face>
<fatigue> ------ <fatigue> ---------- <fatigue>
yes                                 no
</fatigue> ----- </fatigue> --------- </fatigue>
                <headache> --------------------------- <headache>
                                                       yes
                </headache> -------------------------- </headache>
<lymph_nodes> -- <lymph_nodes> ------ <lymph_nodes>
normal --------------------------- normal
</lymph_nodes> - </lymph_nodes> ----- </lymph_nodes>
<malaise> ------ <malaise> ---------- <malaise>
no -------------------------------- no
</malaise> ----- </malaise> --------- </malaise>
<muscles> ------ <muscles> ----------------------------- <muscles>
aching ------------------------------------------------ aching
</muscles> ----- </muscles> ---------------------------- </muscles>
<nose> --------- <nose> -------------------------------- <nose>
runny ------------------------------------------------- runny
</nose> -------- </nose> ------------------------------- </nose>
                <skin> ------------- <skin>
                                    normal
                </skin> ----------- </skin>
<temperature> -- <temperature> ------------------------------------------------- <temperature>
                                                                                 <t1> ----------- <t1>
38-39 ------------------------------------------------------------------------------------------ 38-39
                                                                                 </t1> --------- </t1>
</temperature> - </temperature> ------------------------------------------------ </temperature>
<throat> ------- <throat> ----------------------------- <throat>
sore -------------------------------------------------- sore
</throat> ------ </throat> ----------------------------- </throat>
                <weight_change> ---- <weight_change>
                                    no
                </weight_change> --- </weight_change>
                <causative_agent> -- <causative_agent>
                                    flu_virus
                </causative_agent> - </causative_agent>
                <treatment> -------- <treatment>
                                    flu_treatment
                </treatment> ------- </treatment>
                </disease> --------- </disease> --------- </disease> --- </disease>

0               1                 2                 3               4             5
```

```
0            1            2            3            4

                                                     T
                                                     Tibs
                                        C ---------------- C
                                        cat
                          M ----------- M
                          mammal
            A ---------- A
            animal
            head --------------------- head
                                        carnassial-teeth
            #head -------------------- #head
            body ------------------------------------------ body
white-bib ----------------------------------------------------- white-bib
            #body ------------------------------------------ #body
            legs --------------------- legs
                                        retractile-claws
            #legs -------------------- #legs
eats ------ eats
            breathes
            has-senses
            ...
            #A --------- #A
furry ------------------ furry
                          warm-blooded
                          ...
                          #M ----------- #M
purrs -------------------------------- purrs
                                        ...
                                        #C -------------- #C
                                        tabby
                                        ...
                                        #T

0            1            2            3            4
```

```
0              1         2         3         4         5         6         7         8         9

               john1
               person -- person
               name ---- name
John -------- John ------------------------------------------------------------------------------ John
               Smith
               #name --- #name
                         gender --------------------------------------------------------- gender
                                                                                           male ---- male
                                                                                           ...
                         #gender --------------------------------------------------------- #gender
                         profession -- profession
                                       doctor
stethoscope ----------------------- stethoscope
black-bag                                 ...
                         #profession - #profession
                         head --------------------------------------------------- head
                                                     hair ------------- hair
                                           hcolour --- hcolour
fair-hair ------------------------------------- fair-hair
                                           #hcolour -- #hcolour
                                                     length
                                                     #length
                                                     #hair ------------ #hair
                                                                 eyes --- eyes
                                                                 pupil
iris ----------------------------------------------------------- iris
                                                                 whites
                                                                 #eyes -- #eyes
                                                                          nose
                                                                          #nose
                                                                          mouth
                                                                          #mouth
                                                                          chin --- chin
                                                                                   beard
                                                                          #chin -- #chin
                                                                          ...
                         #head --------------------------------------------- #head
                         body
                         #body
                         legs
                         #legs
                         voice ------------------------------------------------- voice
                                                                                 deep
                         #voice ----------------------------------------------- #voice
               town ---- town
Dorking ----- Dorking
               #town --- #town
                         ...
               #person - #person
               #john1

0              1         2         3         4         5         6         7         8         9
```

```
0               1               2               3               4               5

                <vehicle> ----------------------- <vehicle> ------- <vehicle>
                <car> ----------------------------------------- <car>
                <v4
                <v> ----------------------------- <v> ------------ <v>
                <registration> ------------------- <registration>
                LMN
                888
                </registration> ------------------ </registration>
                <engine> --------- <engine> ------- <engine> ----------------------- <engine>
                <gasoline_type> ------------------------------------------------- <gasoline_type>
spark_plugs ------------------------------------------------------------------------ spark_plugs
                                                                                     carburettor
                <e> ------------- <e> ------------------------------------------- <e>
                                <fuel> ---------------------------------------- <fuel>
                                                                                 gasoline
                                </fuel> --------------------------------------- </fuel>
<capacity> -- <capacity> ------- <capacity>
2000cc ------ 2000cc
</capacity> - </capacity> ------ </capacity>
                                <compression> --------------------------------- <compression>
                                                                                 low
                                </compression> -------------------------------- </compression>
                                cylinder_block
                                crank_shaft
                                pistons
                                valves
                </e> ------------- </e> ---------------------------------------- </e>
                </gasoline_type> --------------------------------------------- </gasoline_type>
                </engine> -------- </engine> ------ </engine> --------------------- </engine>
                                                    steering_wheel
<seats> ---------------------------------------- <seats> --------- <seats>
4 ---------------------------------------------------------------- 4
</seats> --------------------------------------- </seats> ------- </seats>
                                                    <doors> --------- <doors>
                                                                        4
                                                    </doors> ------- </doors>
                                                    <load_space> ---- <load_space>
                                                                        small
                                                    </load_space> --- </load_space>
                                                    <wheels> -------- <wheels>
                                                                        4
                                                    </wheels> ------- </wheels>
                </v> ---------------------------- </v> ------------ </v>
                </v4>
                </car> --------------------------------------- </car>
                </vehicle> ---------------------- </vehicle> ------ </vehicle>

0               1               2               3               4               5
```

```
Start 43 Does the starter turn the engine?
    43 yes 44 Does starter turn the engine briskly?
        44 yes 19 Slowly press throttle to floor, return
                choke and try again. Does engine start?
                19 yes 58 Problem is solved.
                19 no 1 Is there a spark at the plug leads?
                    1 yes 2 Remove and examine plugs.
                            Are they black, oily or wet?
                        2 yes 4 Thoroughly clean and
                                dry [plugs], or renew, check
                                gap and refit. Try again.
                                Does engine start?
                            4 yes 58 Problem is solved.
                            4 no 23 Check for water in fuel.
                                    Drain off to clear.
                        2 no 5 Clean, check gap and replace plugs.
                                Does engine start?
(etc)
```

(a)


```
0 Start     yes     yes    no    no    no    yes    no    0
    |        |       |      |     |     |      |     |
1 Start 43  |       |      |     |     |      |     |     1
    |  |     |      |     |     |      |     |
2      43 yes 44    |      |     |     |      |     |     2
        |  |        |     |     |      |     |
3          44 yes 19 |     |     |      |     |     3
            |  |       |     |      |     |
4              19 no 1 |     |      |     |     4
                |  |     |      |     |
5              1 no 3 |      |     |     5
                    |  |      |     |
6                  3 no 7  |      |     6
                        |  |      |
7                      7 yes 8 |     7
                            | |
8                          8 no 9 8
```

(b)


```
0 Sta... ...yes 44                7 yes 8 no  0
    |   |   |  |                   |  |  | |
1   |   |   |  |                   7 yes 8 |  1
    |   |   |  |                      | |
2   |   |   |  |               3 no 7    | |  2
    |   |   |  |                  |      | |
3   |   |   |  |            1 no 3       | |  3
    |   |   |  |               |         | |
4 Start 43  |  |               |         | |  4
    |   |  |  |               |         | |
5      43 yes 44              |         | |  5
            |                |         | |
6          44 yes 19         |         | |  6
            |        |       |         | |
7                  19 no 1            | |  7
                                      | |
8                                  8 no 9 8
```

(c)

```
0           1           2           3           4           5

                        1 ---------- 1
suspect ------------------------- suspect
                        2 ---------- 2
                        3
            4 -------- 4 ----------------------------- 4
            destroy ------------------------------------ destroy
            5 -------- 5 -- 5 --------------- 5 ------- 5
                            fire ------------ fire ---- fire
                        6 -- 6 --------------- 6 ------- 6
matches ----------------------------------- matches
                        7 ---------- 7 ------- 7
                                    petrol -- petrol
                        8 ---------- 8 ------- 8
                        9 -- 9
smoke -------------------- smoke
                        10 - 10
            11 ------- 11
the_barn - the_barn
            12 ------- 12

0           1           2           3           4           5
```

```
0           1           2                   3

                                            Default
                        Bd ----------- Bd
bird ------------ bird
          name --- name
Tweety - Tweety
          #name -- #name
                        f ------------ f
                                            canfly
                        #f ----------- #f
                        warm-blooded
                        wings
                        feathers
                        ...
                        #Bd ---------- #Bd
                                            #Default
0           1           2                   3

(a, p = 0.66)
```

```
0          1          2              3

                                     0
                                     ostrich
                      Bd ----------- Bd
bird ------------ bird
         name --- name
Tweety - Tweety
         #name -- #name
                      f ------------ f
                                     cannotfly
                      #f ---------- #f
                      warm-blooded
                      wings
                      feathers
                      ...
                      #Bd ---------- #Bd
                                     ...
                                     #0

0          1          2              3

(b, p = 0.22)
```

```
0          1          2                  3

                                         P
                                         penguin
                      Bd ----------- Bd
bird ------------ bird
          name --- name
Tweety - Tweety
          #name -- #name
                      f ------------ f
                                         cannotfly
                      #f ---------- #f
                      warm-blooded
                      wings
                      feathers
                      ...
                      #Bd ---------- #Bd
                                         ...
                                         #P

0          1          2                  3

(c, p = 0.12)
```

```
0            1          2                      3

                                              P
penguin ------------------------- penguin
                       Bd ----------- Bd
                       bird
           name --- name
Tweety -- Tweety
           #name -- #name
                       f ------------ f
                                              cannotfly
                       #f ----------- #f
                       warm-blooded
                       wings
                       feathers
                       ...
                       #Bd ---------- #Bd
                                              ...
                                              #P

0            1          2                      3

(d, p = 1.0)
```

```
0            1           2             3

Beijing -- Beijing
             0
             Delhi --- Delhi
                       15a
                       Cape_Town - Cape_Town
                                   13
New_York ---------------------- New_York

0            1           2             3

(a)

0            1         2         3

Beijing -- Beijing
             0
             Delhi --- Delhi
                       17
                       Paris - Paris
                               27
New_York ------------------ New_York

0            1         2         3

(b)

0            1             2             3

Beijing -- Beijing
             1
             Melbourne - Melbourne
                         22
                         Zurich ---- Zurich
                                     23a
New_York ------------------------ New_York

0            1             2             3
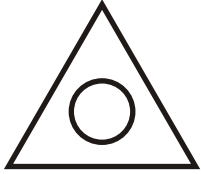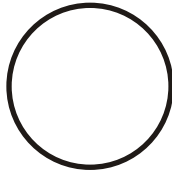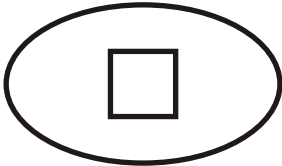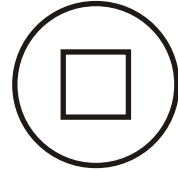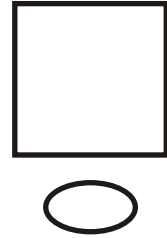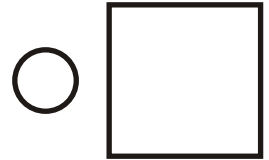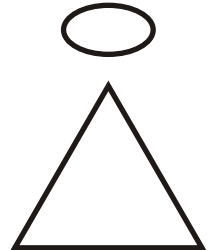
(c)
```

```
C1 small square inside large ellipse ;
    D small square inside large circle #C1
C2 small square inside large ellipse ;
    E large square above small ellipse #C2
C3 small square inside large ellipse ;
    F small circle left-of large square #C3
C4 small square inside large ellipse ;
    G small ellipse above large rectangle #C4
```

(a)

```
small circle inside large triangle ;
    large circle above small triangle
```

(b)

```
0           1

            C2
small ---- small
circle     square
inside --- inside
large ---- large
triangle   ellipse
; -------- ;
            E
large ---- large
circle     square
above ---- above
small ---- small
triangle   ellipse
            #C2
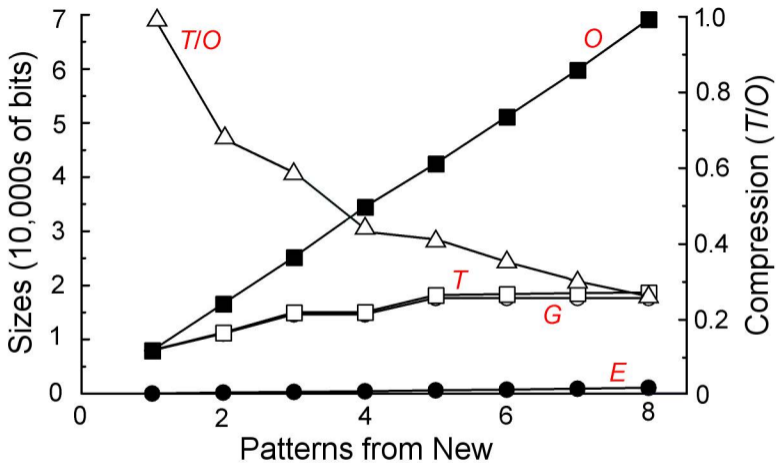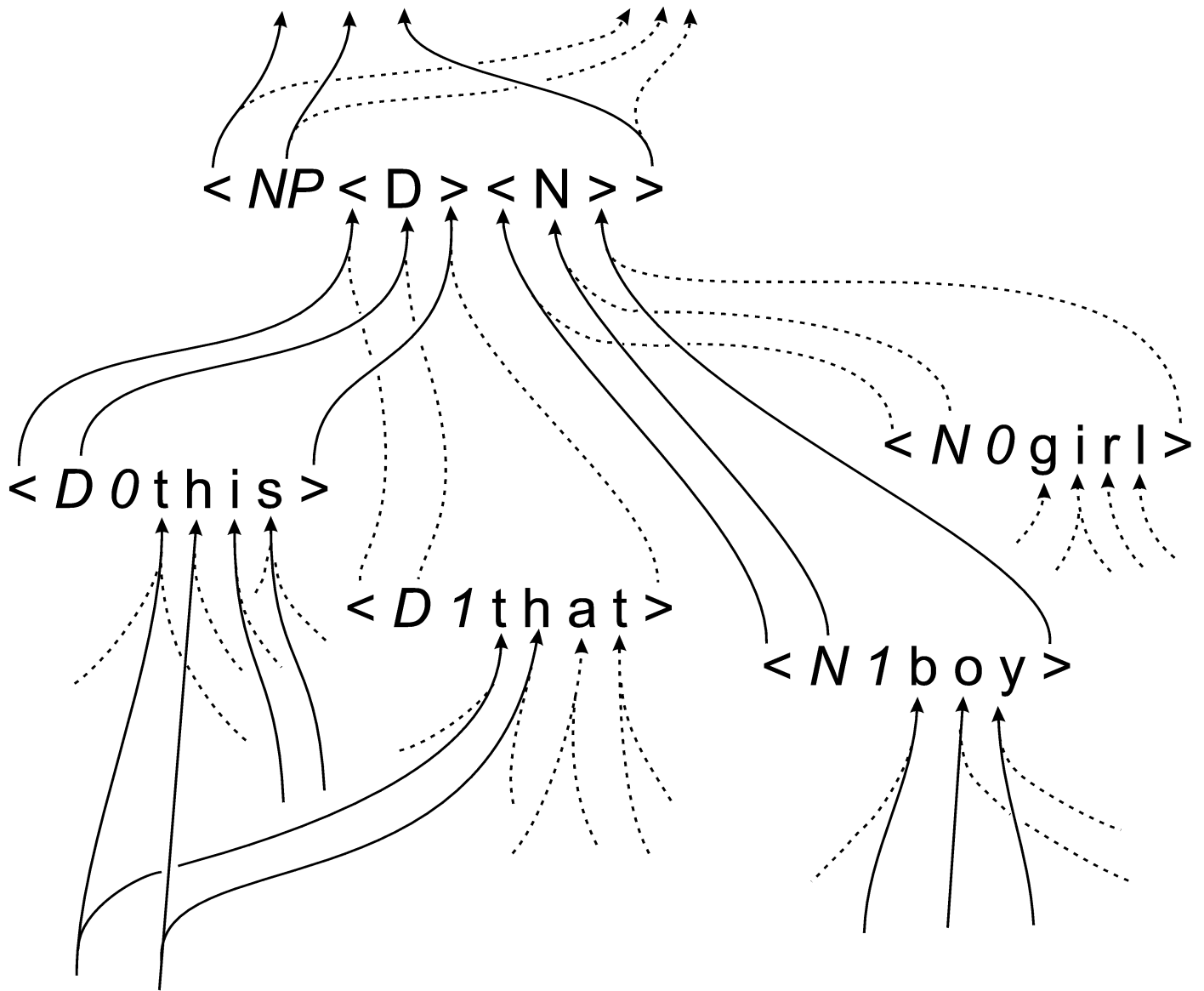

0           1
```

(c)

t h a t b o y r u n s
t h a t g i r l r u n s
t h a t b o y w a l k s
t h a t g i r l w a l k s
s o m e b o y r u n s
s o m e g i r l r u n s
s o m e b o y w a l k s
s o m e g i r l w a l k s

(a)

< %2 2 s o m e >
< %2 3 t h a t >
< %1 5 b o y >
< %1 6 g i r l >
< %3 4 r u n s >
< %3 7 w a l k s >
< 1 < %2 > < %1 > < %3 > >

(b)

O = original (New) data (cumulative) E = encoded data (cumulative)

G = grammar (cumulative) $T = G + E$

To higher-level pattern assemblies

$< NP < D > < N > >$

$< D\ 0\ t\ h\ i\ s >$

$< D\ 1\ t\ h\ a\ t >$

$< N\ 0\ g\ i\ r\ l >$

$< N\ 1\ b\ o\ y >$

From lower-level pattern assemblies
and/or receptor arrays