In [1]:
```
from grammar import *
from parser import *
from util2 import *
```

The current grammar:

In [2]:
```
print str(timeFliesPCFG2)
```

```
Noun => flies    | 0.5
Noun => arrow    | 0.4
Noun => time     | 0.1
TOP => S         | 1.0
Det => an        | 1.0
VP => Verb NP    | 0.1
VP => Verb PP    | 0.1
VP => Verb       | 0.1
VP => Verb NP_PP         | 0.7
S => VP | 0.7
S => NP VP       | 0.1
S => VP PP       | 0.1
S => NP VP_PP    | 0.1
VP_PP => VP PP   | 1.0
NP_PP => NP PP   | 1.0
Prep => like     | 1.0
PP => Prep NP    | 1.0
Verb => flies    | 0.4
Verb => like     | 0.2
Verb => time     | 0.4
NP => Det Noun   | 0.7
NP => Noun       | 0.3
```

Just the unary rules:

In [3]:
```
for lhs in timeFliesPCFG2.pcfgC.iterkeys():
    for rhs,count in timeFliesPCFG2.pcfgC[lhs].iteritems():
        rule = Rule(lhs,rhs)
        if rule.isUnary:
            print rule
```

```
Noun => flies
Noun => arrow
Noun => time
TOP => S
Det => an
VP => Verb
S => VP
Prep => like
Verb => flies
Verb => like
Verb => time
NP => Noun
```

Chart on a simple example:

In [4]:
```
simpleSent = ['time','flies']
chart = cky(timeFliesPCFG2, simpleSent, pruningPercent=None)
printChart(chart, simpleSent, widths=(5,11,7,3,2), printBackPointers=True, printProbs=True)
print parse(timeFliesPCFG2, simpleSent)
```

```
row0
```

```
    ____________________________________________________________________________________
1
 Noun  time[0:1]  None    -2.30
 TOP   S[0:1]     None    -3.58
 VP    Verb[0:1]  None    -3.22
 S     VP[0:1]    None    -3.58
 Verb  time[0:1]  None    -0.92
 time  None       None    0.00
 NP    Noun[0:1]  None    -3.51
                          2
                           VP    Verb[0:1]  NP[1:2] -5.12
                           S     VP[0:2]    None    -5.47
                           TOP   S[0:2]     None    -9.03
row1____________________________________________________________________________________
1
                          2
                           flies None       None    0.00
                           Noun  flies[1:2] None    -0.69
                           TOP   S[1:2]     None    -3.58
                           VP    Verb[1:2]  None    -3.22
                           S     VP[1:2]    None    -3.58
                           Verb  flies[1:2] None    -0.92
                           NP    Noun[1:2]  None    -1.90
(TOP: (S: (NP: (Noun: 'time')) (VP: (Verb: 'flies'))))
```

Desired final output:

In [5]:
```
print desiredTimeFliesParse
```

```
(TOP:
  (S:
    (VP:
      (Verb: 'time')
      (NP: (Noun: 'flies'))
      (PP: (Prep: 'like') (NP: (Det: 'an') (Noun: 'arrow'))))))
```

Actual output:

In [6]:
```
myTree = parse(timeFliesPCFG2, timeFliesSent)
print myTree
print evaluate(desiredTimeFliesParse, myTree)
```

```
(TOP:
  (S:
    (VP: (Verb: 'time') (NP: (Noun: 'flies')))
    (PP: (Prep: 'like') (NP: (Det: 'an') (Noun: 'arrow')))))
0.9375
```

The chart:

In [7]:
```
chart = cky(timeFliesPCFG2, timeFliesSent, pruningPercent=None)
printChart(chart, timeFliesSent, widths=(5,11,7,1,2), printBackPointers=True, printProbs=True)
```

```
row0____________________________________________________________________________________

1
 Noun  time[0:1]  None    -2.30
 TOP   S[0:1]     None    -3.58
 VP    Verb[0:1]  None    -3.22
 S     VP[0:1]    None    -3.58
 Verb  time[0:1]  None    -0.92
 time  None       None    0.00
 NP    Noun[0:1]  None    -3.51
```

2

| | | | |
|---|---|---|---|
| VP | Verb[0:1] | NP[1:2] | -5.12 |
| S | VP[0:2] | None | -5.47 |
| TOP | S[0:2] | None | -9.03 |

3

4

5

| | | | |
|---|---|---|---|
| VP | Verb[0:1] | NP_PP[1:5] | -4.44 |
| S | VP[0:5] | None | -4.80 |
| VP_PP | VP[0:2] | PP[2:5] | -6.39 |
| TOP | S[0:5] | None | -8.69 |

row1

1

2

| | | | |
|---|---|---|---|
| flies | None | None | 0.00 |
| Noun | flies[1:2] | None | -0.69 |
| TOP | S[1:2] | None | -3.58 |
| VP | Verb[1:2] | None | -3.22 |
| S | VP[1:2] | None | -3.58 |
| Verb | flies[1:2] | None | -0.92 |
| NP | Noun[1:2] | None | -1.90 |

3

| | | | |
|---|---|---|---|
| S | NP[1:2] | VP[2:3] | -8.11 |
| TOP | S[1:3] | None | -8.11 |

4

5

| | | | |
|---|---|---|---|
| VP | Verb[1:2] | PP[2:5] | -4.49 |
| NP_PP | NP[1:2] | PP[2:5] | -3.17 |
| S | VP[1:5] | None | -4.85 |
| VP_PP | VP[1:2] | PP[2:5] | -4.49 |
| TOP | S[1:5] | None | -6.79 |

row2

1

2

3

| | | | |
|---|---|---|---|
| like | None | None | 0.00 |
| TOP | S[2:3] | None | -4.27 |
| VP | Verb[2:3] | None | -3.91 |
| S | VP[2:3] | None | -4.27 |
| Verb | like[2:3] | None | -1.61 |
| Prep | like[2:3] | None | 0.00 |

4

5

| | | | |
|---|---|---|---|
| VP | Verb[2:3] | NP[3:5] | -5.18 |
| PP | Prep[2:3] | NP[3:5] | -1.27 |
| S | VP[2:5] | None | -5.54 |

row3

1

2

3

4

| | | | |
|---|---|---|---|
| Det | an[3:4] | None | 0.00 |
| an | None | None | 0.00 |

5

| | | | |
|---|---|---|---|
| NP | Det[3:4] | Noun[4:5] | -1.27 |

row4

1

2

3

4

5

```
 NP    Noun[4:5]  None    -2.12
 Noun  arrow[4:5] None    -0.92
 arrow None       None    0.00
```

In [7]: