In [16]:
```
from grammar import *
from parser import *
from util2 import *
```

Our Grammar

The current grammar:

In [17]:
```
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 [18]:
```
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
```

A Simple Example

Chart on a simple example.

In [19]:
```
simpleSent = ['time','flies']
chart = cky(timeFliesPCFG2, simpleSent, pruningPercent=None)
printChart(chart, simpleSent, widths=(5,11,7,3,2), 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
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
_____________________________________________________________________________
```

The parse:

In [20]:
```
print parse(timeFliesPCFG2, simpleSent)
```

```
(TOP: (S: (VP: (Verb: 'time') (NP: (Noun: 'flies')))))
```

FYI, 'TOP' is pointing to 'S'

In [21]:
```
N = len(simpleSent)
top = chart.best_in_cell(0,N,'TOP')
printItem(top)
s = top.backPtrLeft
printItem(s)
```

```
_____________________TOP[0:2]_____________________
Left:   S[0:2]
Right:  None
Prob:   -9.02801881518
Tree:   (TOP: (S: (VP: (Verb: 'time') (NP: (Noun: 'flies')))))
_____________________________________________________
_____________________S[0:2]_____________________
Left:   VP[0:2]
Right:  None
Prob:   -5.47267075369
Tree:   (S: (VP: (Verb: 'time') (NP: (Noun: 'flies'))))
```

On the Full Sentence

Desired final output:

In [22]:
```
print desiredTimeFliesParse
```

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

Actual output:

In [23]:
```
myTree = parse(timeFliesPCFG2, timeFliesSent)
print myTree
```

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

Successful evaluation:

In [24]:
```
print evaluate(desiredTimeFliesParse, myTree)
```

```
1.0
```

The chart:

In [25]:
```
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 [25]: