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

The given PCFG:

```
In [2]: print str(timeFliesPCFG)
         Noun => flies
         Noun => arrow
                         0.4
         Noun => time
                         0.2
         TOP => S
                         1.0
         Det => an
                         1.0
         VP => Verb NP
                         0.6
         VP => Verb PP
                        0.2
                         0.1
         VP => Verb
         VP => Verb NP PP
                                 0.1
         S => VP | 0.2
         S => NP VP
                         0.5
         S => VP PP
                         0.1
         S => NP VP_PP
                         0.2
         VP PP => VP PP
                         1.0
                         1.0
         NP_PP => NP PP
         Prep => like
                         1.0
         PP => Prep NP
                         1.0
         Verb => flies
                         0.5
                         0.2
         Verb => like
         Verb => time
                         0.3
         NP => Det Noun | 0.7
         NP => Noun
                         0.3
The sentence we wish to parse:
In [3]: print timeFliesSent
         ['time', 'flies', 'like', 'an', 'arrow']
Expected output:
(TOP:
    (S:
        (NP: (Noun: 'time'))
        (VP:
            (Verb: 'flies')
            (PP: (Prep: 'like') (NP: (Det: 'an') (Noun: 'arrow'))))))
Actual output:
In [4]: print parse(timeFliesPCFG, timeFliesSent)
         (TOP:
           (S:
             (NP: (Noun: 'time'))
             (VP:
               (Verb: 'flies')
               (PP: (Prep: 'like') (NP: (Det: 'an') (Noun: 'arrow'))))))
The chart produced:
In [8]: chart = cky(timeFliesPCFG, timeFliesSent, pruningPercent=None)
        printChart(chart,timeFliesSent,columnWidth=10, printBackPointers=False)
                   1
                   Noun
                   TOP
                   VΡ
                   S
                   Verb
                   time
                   NP
                             2
                             VP
                             S
                             TOP
                                       3
                                                           5
                                                           VP
```

```
row1__
                               2
                              flies
                              Noun
                              TOP
                              VP
                              S
                              Verb
                              NP
                                         3
                                         S
                                                              5
                                                              VP
                                                              NP_PP
                                                              S
                                                              VP_PP
          row2_
                              2
                                         3
                                         like
                                         TOP
                                         VP
                                         S
                                         Verb
                                         Prep
                                                              5
                                                              VP
                                                              PP
          row3_
                              2
                                         3
                                                    4
                                                    Det
                                                    an
                                                              5
                                                              NP
                              2
                                                    4
                                                              5
                                                              NP
                                                              Noun
                                                              arrow
In [10]: printChart(chart,timeFliesSent,columnWidth=20, printBackPointers=True)
          row0_
                              1
                              Noun
                                     time[0:1]None
                               TOP
                                     S[0:1]None
                              VP
                                     Verb[0:1]None
                                     VP[0:1]None
                                    time[0:1]None
None None
                              Verb
                              time
                              NP
                                     Noun[0:1]None
                                                    VP
                                                          Verb[0:1]NP[1:2]
                                                          VP[0:2]None
                                                    S
                                                    TOP
                                                          S[0:2]None
                                                                                              4
                                                                                                                   5
                                                                                                                   VP
          Verb[0:1]NP_PP[1:5]
                                                                                                                   s
          NP[0:1]VP[1:5]
                                                                                                                  VP_PP
          VP[0:2]PP[2:5]
                                                                                                                         S[0:5]None
                                                                                                                   TOP
          row1_
                              1
```

flies None None Noun flies[1:2]None

VP_PP TOP

		TOP VP S Verb NP	S[1:2]None Verb[1:2]None VP[1:2]None flies[1:2]None Noun[1:2]None					
			3 S		NP[1:2]VP[2:3]		
						4		5
								VP
Verb[1:2]PP[2:5]								NP_PP
NP[1:2]PP[2:5]								S
NP[1:2]VP[2:5]								
VP[1:2]PP[2:5] row2								VP_PP
	1	2						
		2	3					
				ke P	None None S[2:3]None			
			VP S		<pre>Verb[2:3]None VP[2:3]None</pre>			
			Ve	rb	like[2:3]None			
			PI	ер	like[2:3]None	4		
								5 VP
<pre>Verb[2:3]NP[3:5]</pre>								PP
Prep[2:3]NP[3:5] row3								
	1							
		2	3					
			3			4		
						Det an	an[3:4]None None None	
								5 NP
Det[3:4]Noun[4:5] row4_								
	1							
	_	2	2					
			3			4		
								5 NP
Noun[4:5]None								
arrow[4:5]None								Noun
								arrow None 1