CKY example

a 1	pilot 2	likes 3	flying 4	planes 5

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT				

#

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	**pilot** 2	likes 3	flying 4	planes 5
DT				
	NN			

#

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	**pilot** 2	likes 3	flying 4	planes 5
DT	NP			
	NN			

#

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP			
	NN			
		VBZ		

#

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP			
	NN	-		
		VBZ		

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-		
	NN	-		
		VBZ		

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-		
	NN	-		
		VBZ		
			JJ	

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

#

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-		
	NN	-		
		VBZ		
			JJ VBG	

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
\# $VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-		
	NN	-		
		VBZ	-	
			JJ VBG	

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-		
	NN	-	-	
		VBZ	-	
			JJ VBG	

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-	-	
	NN	-	-	
		VBZ	-	
			JJ VBG	

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-	-	
	NN	-	-	
		VBZ	-	
			JJ VBG	
				NNS

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

#

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-	-	
	NN	-	-	
		VBZ	-	
			JJ VBG	NP
				NNS

#

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-	-	
	NN	-	-	
		VBZ	-	
			JJ VBG	NP VP
				NNS

#	
	$S \rightarrow NP\ VP$
	$VP \rightarrow VBG\ NNS$
	$VP \rightarrow VBZ\ VP$
	$VP \rightarrow VBZ\ NP$
	$NP \rightarrow DT\ NN$
	$NP \rightarrow JJ\ NNS$
	$DT \rightarrow a$
	$NN \rightarrow pilot$
	$VBZ \rightarrow likes$
	$VBG \rightarrow flying$
	$JJ \rightarrow flying$
	$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-	-	
	NN	-	-	
		VBZ	-	VP
			JJ VBG	NP VP
				NNS

#

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-	-	
	NN	-	-	
		VBZ	-	VP VP
			JJ VBG	NP VP
				NNS

#

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-	-	
	NN	-	-	-
		VBZ	-	VP VP
			JJ VBG	NP VP
				NNS

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-	-	S
	NN	-	-	-
		VBZ	-	VP VP
			JJ VBG	NP VP
				NNS

\# $S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

CKY example

a 1	pilot 2	likes 3	flying 4	planes 5
DT	NP	-	-	S S
	NN	-	-	-
		VBZ	-	VP VP
			JJ VBG	NP VP
				NNS

$S \rightarrow NP\ VP$
$VP \rightarrow VBG\ NNS$
$VP \rightarrow VBZ\ VP$
$VP \rightarrow VBZ\ NP$
$NP \rightarrow DT\ NN$
$NP \rightarrow JJ\ NNS$
$DT \rightarrow a$
$NN \rightarrow pilot$
$VBZ \rightarrow likes$
$VBG \rightarrow flying$
$JJ \rightarrow flying$
$NNS \rightarrow planes$

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]				

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
#	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	**pilot** 2	likes 3	flying 4	planes 5
DT [0.3]				
	NN [0.1]			

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
#	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	**pilot** 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]			
	NN [0.1]			

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
#	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

$0.3 \times 0.1 \times 0.3 = 0.009$

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]			
	NN [0.1]			
		VBZ [0.4]		

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
#	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]			
	NN [0.1]	-		
		VBZ [0.4]		

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-		
	NN [0.1]	-		
		VBZ [0.4]		

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-		
	NN [0.1]	-		
		VBZ [0.4]		
			JJ [0.1]	

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
#	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-		
	NN [0.1]	-		
		VBZ [0.4]		
			JJ [0.1] VBG [0.5]	

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
#	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-		
	NN [0.1]	-		
		VBZ [0.4]	-	
			JJ [0.1] VBG [0.5]	

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-		
	NN [0.1]	-	-	
		VBZ [0.4]	-	
			JJ [0.1] VBG [0.5]	

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	
			JJ [0.1] VBG [0.5]	

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	
			JJ [0.1] VBG [0.5]	
				NNS [.34]

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
#	$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	
			JJ [0.1] VBG [0.5]	NP [.0136]
				NNS [.34]

#		
	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

$0.1 \times 0.34 \times 0.4 = 0.0136$

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	
			JJ [0.1] VBG [0.5]	NP [.0136] VP [.017]
				NNS [.34]

#		
	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

$0.5 \times 0.34 \times 0.1 = 0.017$

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	VP [.001632]
			JJ [0.1] VBG [0.5]	NP [.0136] VP [.017]
				NNS [.34]

#		
	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

$0.4 \times 0.0136 \times 0.3 = 0.001632$

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	VP [.001632] VP [.00068]
			JJ [0.1] VBG [0.5]	NP [.0136] VP [.017]
				NNS [.34]

#		
	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

$0.4 \times 0.017 \times 0.1 = 0.00068$

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	-
		VBZ [0.4]	-	VP [.001632] VP [.00068]
			JJ [0.1] VBG [0.5]	NP [.0136] VP [.017]
				NNS [.34]

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	S [$1.4688x10^{-5}$]
	NN [0.1]	-	-	-
		VBZ [0.4]	-	VP [.001632] VP [.00068]
			JJ [0.1] VBG [0.5]	NP [.0136] VP [.017]
				NNS [.34]

#		
	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

$0.009 \times 0.001632 \times 1.0 = 1.4688x10^{-5}$

Probabilistic CKY: all parses

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	S [$1.4688x10^{-5}$] S [$6.12x10^{-6}$]
	NN [0.1]	-	-	-
		VBZ [0.4]	-	VP [.001632] VP [.00068]
			JJ [0.1] VBG [0.5]	NP [.0136] VP [.017]
				NNS [.34]

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

$0.009 \times 0.00068 \times 1.0 = 6.12x10^{-6}$

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]				

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
#	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	**pilot** 2	likes 3	flying 4	planes 5
DT [0.3]				
	NN [0.1]			

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
#	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	**pilot** 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]			
	NN [0.1]			

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
#	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

0.3 x 0.1 x 0.3 =
0.009

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]			
	NN [0.1]			
		VBZ [0.4]		

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
#	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]			
	NN [0.1]	-		
		VBZ [0.4]		

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-		
	NN [0.1]	-		
		VBZ [0.4]		

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-		
	NN [0.1]	-		
		VBZ [0.4]		
			JJ [0.1]	

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
#	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-		
	NN [0.1]	-		
		VBZ [0.4]		
			JJ [0.1] VBG [0.5]	

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
#	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-		
	NN [0.1]	-		
		VBZ [0.4]	-	
			JJ [0.1] VBG [0.5]	

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-		
	NN [0.1]	-	-	
		VBZ [0.4]	-	
			JJ [0.1] VBG [0.5]	

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	
			JJ [0.1] VBG [0.5]	

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	
			JJ [0.1] VBG [0.5]	
				NNS [.34]

	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
#	$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	
			JJ [0.1] VBG [0.5]	NP [.0136]
				NNS [.34]

#		
	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

$0.1 \times 0.34 \times 0.4 = 0.0136$

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	
			JJ [0.1] VBG [0.5]	NP [.0136] VP [.017]
				NNS [.34]

#		
	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

$0.5 \times 0.34 \times 0.1 = 0.017$

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	VP [.001632]
			JJ [0.1] VBG [0.5]	NP [.0136] VP [.017]
				NNS [.34]

#		
	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

$0.4 \times 0.0136 \times 0.3 = 0.001632$

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	VP [.001632]
			JJ [0.1] VBG [0.5]	NP [.0136] VP [.017]
				NNS [.34]

#		
	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

Move second VP to chart?
$0.4 \times 0.017 \times 0.1 = 0.00068$

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	
		VBZ [0.4]	-	VP [.001632]
			JJ [0.1] VBG [0.5]	NP [.0136] VP [.017]
				NNS [.34]

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Is 0.001632
less than 0.00068 ?

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	
	NN [0.1]	-	-	-
		VBZ [0.4]	-	VP [.001632]
			JJ [0.1] VBG [0.5]	NP [.0136] VP [.017]
				NNS [.34]

$S \rightarrow NP\ VP$	[1.0]
$VP \rightarrow VBG\ NNS$	[0.1]
$VP \rightarrow VBZ\ VP$	[0.1]
$VP \rightarrow VBZ\ NP$	[0.3]
$NP \rightarrow DT\ NN$	[0.3]
$NP \rightarrow JJ\ NNS$	[0.4]
$DT \rightarrow a$	[0.3]
$NN \rightarrow pilot$	[0.1]
$VBZ \rightarrow likes$	[0.4]
$VBG \rightarrow flying$	[0.5]
$JJ \rightarrow flying$	[0.1]
$NNS \rightarrow planes$	[.34]

Probabilistic CKY: best parse

a 1	pilot 2	likes 3	flying 4	planes 5
DT [0.3]	NP [.009]	-	-	S [$1.4688x10^{-5}$]
	NN [0.1]	-	-	-
		VBZ [0.4]	-	VP [.001632]
			JJ [0.1] VBG [0.5]	NP [.0136] VP [.017]
				NNS [.34]

#		
	$S \rightarrow NP\ VP$	[1.0]
	$VP \rightarrow VBG\ NNS$	[0.1]
	$VP \rightarrow VBZ\ VP$	[0.1]
	$VP \rightarrow VBZ\ NP$	[0.3]
	$NP \rightarrow DT\ NN$	[0.3]
	$NP \rightarrow JJ\ NNS$	[0.4]
	$DT \rightarrow a$	[0.3]
	$NN \rightarrow pilot$	[0.1]
	$VBZ \rightarrow likes$	[0.4]
	$VBG \rightarrow flying$	[0.5]
	$JJ \rightarrow flying$	[0.1]
	$NNS \rightarrow planes$	[.34]

$0.009 \times 0.001632 \times 1.0 = 1.4688x10^{-5}$