NLP Programming Assignment #3 - CKY

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**Steps to compile and run the code with Python 2.7:**

1. Open the terminal
2. Go to the folder CKY.
3. Enter the following commands:

python3 cky.py grammar\_rules.txt sents.txt

**Results and Analysis:**

I ran the program with the given dev test case. The implementation for CKY program outputs the correct results. I also tried different test cases which I have included in my sents.txt file attached with the submission. I tried the following cases:

fish people fish tanks

rods people fish tanks

rods people with tanks

fish rods people

Results for **CKY** (extended) algorithm helps in computing the *best possible* (**most probable**) parse tree for a sentence using the **PCFG grammar**.

Following results are seen on running the program with above test cases –

$ python3 cky.py  grammar\_rules.txt sents.txt

PROCESSING SENTENCE: fish people fish tanks

SPAN:  fish

P(N fish) =  0.2

P(V fish) =  0.6

P(VP) =  0.06 (Backpointer = ( V ))

P(S) =  0.006 (Backpointer = ( VP ))

P(NP) =  0.13999999999999999 (Backpointer = ( N ))

SPAN:  people

P(N people) =  0.5

P(V people) =  0.1

P(VP) =  0.010000000000000002 (Backpointer = ( V ))

P(S) =  0.0010000000000000002 (Backpointer = ( VP ))

P(NP) =  0.35 (Backpointer = ( N ))

SPAN:  fish

P(N fish) =  0.2

P(V fish) =  0.6

P(VP) =  0.06 (Backpointer = ( V ))

P(S) =  0.006 (Backpointer = ( VP ))

P(NP) =  0.13999999999999999 (Backpointer = ( N ))

SPAN:  tanks

P(N tanks) =  0.2

P(V tanks) =  0.3

P(VP) =  0.03 (Backpointer = ( V ))

P(S) =  0.003 (Backpointer = ( VP ))

P(NP) =  0.13999999999999999 (Backpointer = ( N ))

SPAN: fish people

P(VP) =  0.105 (Backpointer = ( 1, V, NP ))

P(S) =  0.0105 (Backpointer = ( VP ))

P(NP) =  0.0049 (Backpointer = ( 1, NP, NP ))

SPAN: people fish

P(VP) =  0.006999999999999999 (Backpointer = ( 2, V, NP ))

P(S) =  0.0189 (Backpointer = ( 2, NP, VP ))

P(NP) =  0.0049 (Backpointer = ( 2, NP, NP ))

SPAN: fish tanks

P(VP) =  0.041999999999999996 (Backpointer = ( 3, V, NP ))

P(S) =  0.0042 (Backpointer = ( VP ))

P(NP) =  0.0019599999999999995 (Backpointer = ( 3, NP, NP ))

SPAN: fish people fish

P(VP) =  0.00147 (Backpointer = ( 1, V, NP ))

P(S) =  0.0008819999999999998 (Backpointer = ( 1, NP, VP ))

P(NP) =  6.859999999999999e-05 (Backpointer = ( 1, NP, NP ))

SPAN: people fish tanks

P(VP) =  9.799999999999998e-05 (Backpointer = ( 2, V, NP ))

P(S) =  0.013229999999999999 (Backpointer = ( 2, NP, VP ))

P(NP) =  6.859999999999999e-05 (Backpointer = ( 3, NP, NP ))

SPAN: fish people fish tanks

P(VP) =  2.0579999999999996e-05 (Backpointer = ( 1, V, NP ))

P(S) =  0.00018521999999999996 (Backpointer = ( 2, NP, VP ))

P(NP) =  9.603999999999997e-07 (Backpointer = ( 1, NP, NP ))

PROCESSING SENTENCE: rods people fish tanks

SPAN:  rods

P(N rods) =  0.1

P(NP) =  0.06999999999999999 (Backpointer = ( N ))

SPAN:  people

P(N people) =  0.5

P(V people) =  0.1

P(VP) =  0.010000000000000002 (Backpointer = ( V ))

P(S) =  0.0010000000000000002 (Backpointer = ( VP ))

P(NP) =  0.35 (Backpointer = ( N ))

SPAN:  fish

P(N fish) =  0.2

P(V fish) =  0.6

P(VP) =  0.06 (Backpointer = ( V ))

P(S) =  0.006 (Backpointer = ( VP ))

P(NP) =  0.13999999999999999 (Backpointer = ( N ))

SPAN:  tanks

P(N tanks) =  0.2

P(V tanks) =  0.3

P(VP) =  0.03 (Backpointer = ( V ))

P(S) =  0.003 (Backpointer = ( VP ))

P(NP) =  0.13999999999999999 (Backpointer = ( N ))

SPAN: rods people

P(S) =  0.0006300000000000001 (Backpointer = ( 1, NP, VP ))

P(NP) =  0.00245 (Backpointer = ( 1, NP, NP ))

SPAN: people fish

P(VP) =  0.006999999999999999 (Backpointer = ( 2, V, NP ))

P(S) =  0.0189 (Backpointer = ( 2, NP, VP ))

P(NP) =  0.0049 (Backpointer = ( 2, NP, NP ))

SPAN: fish tanks

P(VP) =  0.041999999999999996 (Backpointer = ( 3, V, NP ))

P(S) =  0.0042 (Backpointer = ( VP ))

P(NP) =  0.0019599999999999995 (Backpointer = ( 3, NP, NP ))

SPAN: rods people fish

P(S) =  0.0004409999999999999 (Backpointer = ( 1, NP, VP ))

P(NP) =  3.4299999999999993e-05 (Backpointer = ( 1, NP, NP ))

SPAN: people fish tanks

P(VP) =  9.799999999999998e-05 (Backpointer = ( 2, V, NP ))

P(S) =  0.013229999999999999 (Backpointer = ( 2, NP, VP ))

P(NP) =  6.859999999999999e-05 (Backpointer = ( 3, NP, NP ))

SPAN: rods people fish tanks

P(S) =  9.260999999999998e-05 (Backpointer = ( 2, NP, VP ))

P(NP) =  4.801999999999999e-07 (Backpointer = ( 1, NP, NP ))

PROCESSING SENTENCE: rods people with tanks

SPAN:  rods

P(N rods) =  0.1

P(NP) =  0.06999999999999999 (Backpointer = ( N ))

SPAN:  people

P(N people) =  0.5

P(V people) =  0.1

P(VP) =  0.010000000000000002 (Backpointer = ( V ))

P(S) =  0.0010000000000000002 (Backpointer = ( VP ))

P(NP) =  0.35 (Backpointer = ( N ))

SPAN:  with

P(P with) =  1.0

SPAN:  tanks

P(N tanks) =  0.2

P(V tanks) =  0.3

P(VP) =  0.03 (Backpointer = ( V ))

P(S) =  0.003 (Backpointer = ( VP ))

P(NP) =  0.13999999999999999 (Backpointer = ( N ))

SPAN: rods people

P(S) =  0.0006300000000000001 (Backpointer = ( 1, NP, VP ))

P(NP) =  0.00245 (Backpointer = ( 1, NP, NP ))

SPAN: people with

SPAN: with tanks

P(PP) =  0.13999999999999999 (Backpointer = ( 3, P, NP ))

SPAN: rods people with

SPAN: people with tanks

P(@VP\_V) =  0.048999999999999995 (Backpointer = ( 2, NP, PP ))

P(VP) =  0.0014 (Backpointer = ( 2, V, PP ))

P(S) =  0.00014000000000000001 (Backpointer = ( VP ))

P(NP) =  0.0098 (Backpointer = ( 2, NP, PP ))

SPAN: rods people with tanks

P(@VP\_V) =  0.00034299999999999993 (Backpointer = ( 2, NP, PP ))

P(S) =  8.819999999999999e-05 (Backpointer = ( 1, NP, VP ))

P(NP) =  6.859999999999999e-05 (Backpointer = ( 1, NP, NP ))

PROCESSING SENTENCE: fish rods people

SPAN:  fish

P(N fish) =  0.2

P(V fish) =  0.6

P(VP) =  0.06 (Backpointer = ( V ))

P(S) =  0.006 (Backpointer = ( VP ))

P(NP) =  0.13999999999999999 (Backpointer = ( N ))

SPAN:  rods

P(N rods) =  0.1

P(NP) =  0.06999999999999999 (Backpointer = ( N ))

SPAN:  people

P(N people) =  0.5

P(V people) =  0.1

P(VP) =  0.010000000000000002 (Backpointer = ( V ))

P(S) =  0.0010000000000000002 (Backpointer = ( VP ))

P(NP) =  0.35 (Backpointer = ( N ))

SPAN: fish rods

P(VP) =  0.020999999999999998 (Backpointer = ( 1, V, NP ))

P(S) =  0.0021 (Backpointer = ( VP ))

P(NP) =  0.0009799999999999998 (Backpointer = ( 1, NP, NP ))

SPAN: rods people

P(S) =  0.0006300000000000001 (Backpointer = ( 2, NP, VP ))

P(NP) =  0.00245 (Backpointer = ( 2, NP, NP ))

SPAN: fish rods people

P(VP) =  0.000735 (Backpointer = ( 1, V, NP ))

P(S) =  7.35e-05 (Backpointer = ( VP ))

P(NP) =  3.4299999999999993e-05 (Backpointer = ( 1, NP, NP ))

Any known bugs, problems, or limitations of your program

There are no known bugs.