Homework 2

Natural Language Processing | asj170430 | April 15, 2019

**Question 1:**

**1)**

**Generated Grammar**

*S1: Sales of the company to return to normalcy.*

S -> NP VP

NP -> NNS PP

NP -> Det NN

NP -> NN

PP -> IN NP

PP -> TO NP

VP -> TO VP

VP -> VB PP

IN -> 'of'

Det -> 'the'

TO -> 'to'

NNS -> 'Sales'

NN -> 'company'

NN -> 'normalcy'

VB -> 'return'

*S2: The new products and services contributed to increase revenue.*

S -> NP VP

S -> VP

NP -> Det JJ NNS

NP -> NN

NNS -> NNS CC NNS

CC -> 'and'

NNS -> 'products'

NNS -> 'services'

VP -> VBD S

VP -> TO VP

VP -> VB NP

Det -> 'The'

VBD -> 'contributed'

TO -> 'to'

VB -> 'increase'

JJ -> 'new'

NN -> 'revenue'

*S3: Dow falls as recession indicator flashed red and economical worries continue through the month.*

S -> NP VP

NP -> NNP

NNP -> 'Dow'

VP -> VBZ SBAR

VBZ -> 'falls'

SBAR -> SBAR CC S

SBAR -> IN S

IN -> 'as'

NP -> NN NN

NN -> 'recession'

NN -> 'indicator'

VP -> VBD ADJP

ADJP -> JJ

VBD -> 'flashed'

JJ -> 'red'

CC -> 'and'

NP -> JJ NNS

JJ -> 'economical'

NNS -> 'worries'

VP -> VB PP

VB -> 'continue'

PP -> IN NP

IN -> 'through'

NP -> Det NN

Det -> 'the'

NN -> 'month'

*S4: Figure skater lands historic quadruple jump in senior international competition at the 2019 World Figure Skating Championships on Day 3 but could only clinch a silver medal.*

S -> NP VP

NP -> NN NN

NN -> 'Figure'

NN -> 'skater'

VP -> VP CC VP

VP -> NNS

NNS -> 'lands'

NP -> NP PP PP PP

NP -> JJ JJ NN

JJ -> 'historic'

JJ -> 'quadruple'

NN -> 'jump'

PP -> IN NP

IN -> 'in'

JJ -> 'senior'

JJ -> 'international'

NN -> 'competition'

IN -> 'at'

NP -> DT CD NNP NNP NNP NNPS

DT -> 'the'

CD -> '2019'

NNP -> 'World'

NNP -> 'Figure'

NNP -> 'Skating'

NNPS -> 'Championships'

IN -> 'on'

NP -> NN CD

NN -> 'Day'

CD -> '3'

CC -> 'but'

VP -> MD ADVP VP

MD -> 'could'

ADVP -> RB

RB -> 'only'

VP -> VB NP

VB -> 'clinch'

NP -> DT NN NN

DT -> 'a'

NN -> 'silver'

NN -> 'medal'

**CNF Converted:**

CC -> and

CC -> but

CD -> 2019

CD -> 3

DT -> a

DT -> the

IN -> as

IN -> at

IN -> in

IN -> of

IN -> on

IN -> through

JJ -> JJ JJ

JJ -> economical

JJ -> historic

JJ -> international

JJ -> new

JJ -> quadruple

JJ -> red

JJ -> senior

MD -> could

NP -> CD NP

NP -> DT NP

NP -> JJ NP

NP -> NP CD

NP -> NP NP

NP -> NP PP

NP -> XNP NP

NP -> championships

NP -> company

NP -> competition

NP -> day

NP -> dow

NP -> figure

NP -> indicator

NP -> jump

NP -> medal

NP -> month

NP -> normalcy

NP -> products

NP -> recession

NP -> revenue

NP -> sales

NP -> services

NP -> silver

NP -> skater

NP -> skating

NP -> world

NP -> worries

PP -> IN NP

PP -> PP PP

PP -> TO NP

RB -> only

S -> IN S

S -> NP VP

S -> VP VP

S -> S XS

TO -> to

VP -> TO VP

VP -> VP JJ

VP -> VP NP

VP -> VP NP

VP -> VP PP

VP -> VP S

VP -> XMR VP

VP -> XVP VP

S -> TO VP

S -> VP JJ

S -> VP NP

S -> VP NP

S -> VP PP

S -> VP S

S -> XMR VP

S -> XVP VP

VP -> clinch

VP -> continue

VP -> contributed

VP -> falls

VP -> flashed

VP -> increase

VP -> lands

VP -> return

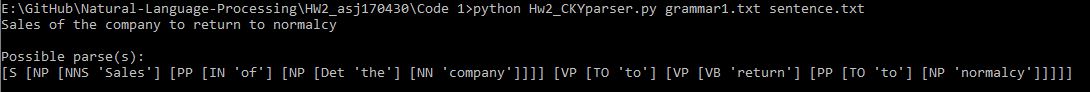
XMR -> MD RB

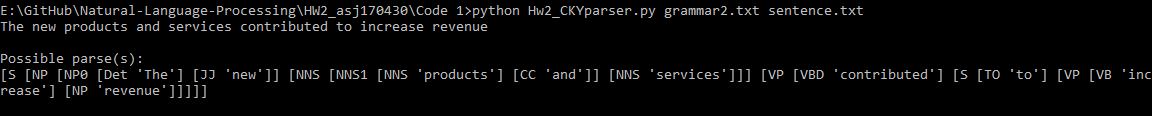
XNP -> NP CC

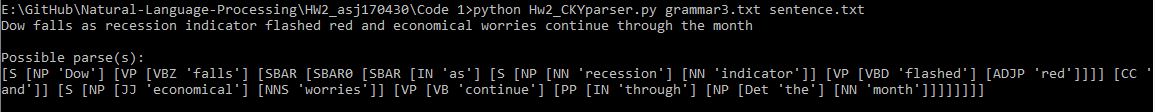
XS -> CC S

XVP -> VP CC

**Screenshots:**







S1:

[ [ [sales]NP [ [of]IN [ [the]DT [company]NP ]NP ]PP ]NP [ [to]TO [ [return]VP [ [to]TO [normalcy]NP ]PP ]VP ]VP ]S

[ [ [sales]NP [ [of]IN [ [the]DT [company]NP ]NP ]PP ]NP [ [ [to]TO [return]VP ]VP [ [to]TO [normalcy]NP ]PP ]VP ]S

S2:

[ [ [the]DT [ [new]JJ [ [ [products]NP [and]CC ]XNP [services]NP ]NP ]NP ]NP [ [contributed]VP [ [ [to]TO [increase]VP ]VP [revenue]NP ]S ]VP ]S

[ [ [the]DT [ [ [ [new]JJ [products]NP ]NP [and]CC ]XNP [services]NP ]NP ]NP [ [contributed]VP [ [ [to]TO [increase]VP ]VP [revenue]NP ]S ]VP ]S

[ [ [ [ [the]DT [ [new]JJ [products]NP ]NP ]NP [and]CC ]XNP [services]NP ]NP [ [contributed]VP [ [ [to]TO [increase]VP ]VP [revenue]NP ]S ]VP ]S

[ [ [ [ [the]DT [ [new]JJ [products]NP ]NP ]NP [and]CC ]XNP [services]NP ]NP [ [contributed]VP [ [to]TO [ [increase]VP [revenue]NP ]VP ]S ]VP ]S

[ [ [ [ [the]DT [ [new]JJ [products]NP ]NP ]NP [and]CC ]XNP [services]NP ]NP [ [ [contributed]VP [ [to]TO [increase]VP ]S ]VP [revenue]NP ]VP ]S

[ [ [the]DT [ [new]JJ [ [ [products]NP [and]CC ]XNP [services]NP ]NP ]NP ]NP [ [contributed]VP [ [to]TO [ [increase]VP [revenue]NP ]VP ]S ]VP ]S

[ [ [the]DT [ [ [ [new]JJ [products]NP ]NP [and]CC ]XNP [services]NP ]NP ]NP [ [contributed]VP [ [to]TO [ [increase]VP [revenue]NP ]VP ]S ]VP ]S

[ [ [the]DT [ [ [ [new]JJ [products]NP ]NP [and]CC ]XNP [services]NP ]NP ]NP [ [ [contributed]VP [ [to]TO [increase]VP ]S ]VP [revenue]NP ]VP ]S

[ [ [the]DT [ [new]JJ [ [ [products]NP [and]CC ]XNP [services]NP ]NP ]NP ]NP [ [ [contributed]VP [ [to]TO [increase]VP ]S ]VP [revenue]NP ]VP ]S

S3:

Dow falls as recession indicator flashed red and economical worries continue through the month . [ [dow]NP [ [ [falls]VP [ [as]IN [ [recession]NP [indicator]NP ]NP ]PP ]VP [ [ [flashed]VP [red]JJ ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [ [continue]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S ]XS ]S ]VP ]S

[ [ [dow]NP [ [ [ [falls]VP [ [as]IN [recession]NP ]PP ]VP [ [indicator]NP [flashed]VP ]S ]VP [red]JJ ]VP ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [ [continue]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S ]XS ]S

[ [dow]NP [ [ [falls]VP [ [ [as]IN [ [ [recession]NP [indicator]NP ]NP [ [flashed]VP [red]JJ ]VP ]S ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [continue]VP ]S ]XS ]S ]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S

[ [dow]NP [ [falls]VP [ [as]IN [ [ [ [recession]NP [indicator]NP ]NP [ [flashed]VP [red]JJ ]VP ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [ [continue]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S ]XS ]S ]S ]VP ]S

[ [dow]NP [ [ [ [falls]VP [ [as]IN [recession]NP ]PP ]VP [ [ [indicator]NP [ [flashed]VP [red]JJ ]VP ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [continue]VP ]S ]XS ]S ]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S

[ [ [dow]NP [ [ [falls]VP [ [as]IN [recession]NP ]PP ]VP [ [indicator]NP [ [flashed]VP [red]JJ ]VP ]S ]VP ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [ [continue]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S ]XS ]S

[ [dow]NP [ [falls]VP [ [ [as]IN [ [ [recession]NP [indicator]NP ]NP [ [flashed]VP [red]JJ ]VP ]S ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [ [continue]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S ]XS ]S ]VP ]S

[ [ [dow]NP [ [ [falls]VP [ [as]IN [ [ [recession]NP [indicator]NP ]NP [flashed]VP ]S ]S ]VP [red]JJ ]VP ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [ [continue]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S ]XS ]S

[ [ [dow]NP [ [ [ [falls]VP [ [as]IN [recession]NP ]PP ]VP [indicator]NP ]VP [ [flashed]VP [red]JJ ]S ]VP ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [ [continue]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S ]XS ]S

[ [ [dow]NP [ [falls]VP [ [as]IN [ [ [recession]NP [indicator]NP ]NP [ [flashed]VP [red]JJ ]VP ]S ]S ]VP ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [ [continue]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S ]XS ]S

[ [dow]NP [ [ [ [falls]VP [ [as]IN [recession]NP ]PP ]VP [indicator]NP ]VP [ [ [flashed]VP [red]JJ ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [ [continue]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S ]XS ]S ]VP ]S

[ [dow]NP [ [ [ [ [falls]VP [ [as]IN [recession]NP ]PP ]VP [indicator]NP ]VP [ [ [flashed]VP [red]JJ ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [continue]VP ]S ]XS ]S ]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S

[ [ [dow]NP [ [ [falls]VP [ [as]IN [ [recession]NP [indicator]NP ]NP ]PP ]VP [ [flashed]VP [red]JJ ]S ]VP ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [ [continue]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S ]XS ]S

[ [dow]NP [ [ [ [falls]VP [ [as]IN [ [recession]NP [indicator]NP ]NP ]PP ]VP [ [ [flashed]VP [red]JJ ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [continue]VP ]S ]XS ]S ]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S

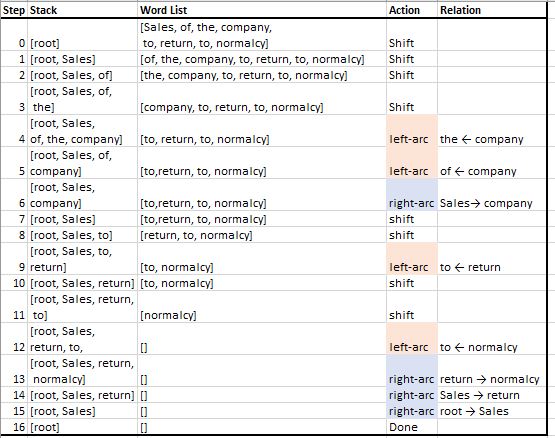
[ [dow]NP [ [ [falls]VP [ [as]IN [recession]NP ]PP ]VP [ [ [indicator]NP [ [flashed]VP [red]JJ ]VP ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [ [continue]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S ]XS ]S ]VP ]S

[ [dow]NP [ [ [falls]VP [ [as]IN [ [ [ [recession]NP [indicator]NP ]NP [ [flashed]VP [red]JJ ]VP ]S [ [and]CC [ [ [economical]JJ [worries]NP ]NP [continue]VP ]S ]XS ]S ]S ]VP [ [through]IN [ [the]DT [month]NP ]NP ]PP ]VP ]S

**Question 2:**

**1)**

*S1: Sales of the company to return to normalcy.*



*S2: The new products and services contributed to increase revenue.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Stack | Word List | Action | Relation Added |
| 0 | [root] | [The, new, products, and, services, contributed, to, increase, revenue] | shift |  |
| 1 | [root, The] | [new, products, and, services, contributed, to, increase, revenue] | shift |  |
| 2 | [root, The, new] | [products, and, services, contributed, to, increase, revenue] | shift |  |
| 3 | [root, The, new, products] | [and, services, contributed, to, increase, revenue] | left-arc | new ← product |
| 4 | [root, The, products] | [and, services, contributed, to, increase, revenue] | left-arc | The ← product |
| 5 | [root, products] | [and, services, contributed, to, increase, revenue] | shift |  |
| 6 | [root, products, and] | [services, contributed, to, increase, revenue] | right-arc | products → and |
| 7 | [root, products] | [services, contributed, to, increase, revenue] | shift |  |
| 8 | [root, products, services] | [contributed, to, increase, revenue] | right-arc | products → services |
| 9 | [root, products] | [contributed, to, increase, revenue] | shift |  |
| 10 | [root, products, contributed] | [to, increase, revenue] | left-arc | products← contributed |
| 11 | [root, contributed] | [to, increase, revenue] | shift |  |
| 12 | [root, contributed, to] | [increase, revenue] | right-arc | contributed→ to |
| 13 | [root, contributed] | [increase, revenue] | shift |  |
| 14 | [root, contributed, increase] | [revenue] | right-arc | contributed→ increase |
| 15 | [root, contributed] | [revenue] | shift |  |
| 16 | [root, contributed, revenue] | [] | right-arc | contributed→ revenue |
| 17 | [root, contributed] | [] | right-arc | root→ contributes |
| 18 | [root] | [] | Done |  |

*S3: Dow falls as recession indicator flashed red and economical worries continue through the month*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Stack | Word List | Action | Relation Added |
| 0 | [root] | [Dow, falls, as, recession, indicator, flashed, red, and, economical, worries, continue, through, the, month] | shift |  |
| 1 | [root, Dow] | [falls, as, recession, indicator, flashed, red, and, economical, worries, continue, through, the, month] | shift |  |
| 2 | [root, Dow, falls] | [as, recession, indicator, flashed, red, and, economical, worries, continue, through, the, month] | left-arc | Dow ← falls |
| 3 | [root, falls] | [as, recession, indicator, flashed, red, and, economical, worries, continue, through, the, month] | shift |  |
| 4 | [root, falls, as] | [recession, indicator, flashed, red, and, economical, worries, continue, through, the, month] | right-arc | falls → as |
| 5 | [root, falls] | [recession, indicator, flashed, red, and, economical, worries, continue, through, the, month] | shift |  |
| 6 | [root, falls, recession] | [indicator, flashed, red, and, economical, worries, continue, through, the, month] | shift |  |
| 7 | [root, falls, recession, indicator] | [flashed, red, and, economical, worries, continue, through, the, month] | left-arc | recession ← indicator |
| 8 | [root, falls, indicator] | [flashed, red, and, economical, worries, continue, through, the, month] | shift |  |
| 9 | [root, falls, indicator, flashed] | [red, and, economical, worries, continue, through, the, month] | left-arc | indicator ← flashed |
| 10 | [root, falls, flashed] | [red, and, economical, worries, continue, through, the, month] | shift |  |
| 11 | [root, falls, flashed, red] | [and, economical, worries, continue, through, the, month] | right-arc | flashed → red |
| 12 | [root, falls, flashed] | [and, economical, worries, continue, through, the, month] | shift |  |
| 13 | [root, falls, flashed, and] | [economical, worries, continue, through, the, month] | right-arc | flashed → and |
| 14 | [root, falls, flashed] | [economical, worries, continue, through, the, month] | shift |  |
| 15 | [root, falls, flashed, economical] | [worries, continue, through, the, month] | shift |  |
| 16 | [root, falls, flashed, economical, worries] | [continue, through, the, month] | left-arc | economical ← worries |
| 17 | [root, falls, flashed, worries] | [continue, through, the, month] | shift |  |
| 18 | [root, falls, flashed, worries, continue] | [through, the, month] | left-arc | worries ← continue |
| 19 | [root, falls, flashed, continue] | [through, the, month] | left-arc | flashed ← continue |
| 20 | [root, falls, continue] | [through, the, month] | shift |  |
| 21 | [root, falls, continue, through] | [the, month] | shift |  |
| 22 | [root, falls, continue, through, the] | [month] | shift |  |
| 23 | [root, falls, continue, through, the, month] | [] | left-arc | the ← month |
| 24 | [root, falls, continue, through, month] | [] | left-arc | through ← month |
| 25 | [root, falls, continue, month] | [] | right-arc | continue → month |
| 26 | [root, falls, continue] | [] | right-arc | falls → continue |
| 27 | [root, falls] | [] | right-arc | root → falls |
| 28 | [root] | [] | Done |  |

*S4: Figure skater lands historic quadruple jump in senior international competition at the 2019 World Figure Skating Championships on Day 3 but could only clinch a silver medal.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Stack | Word List | Action | Relation Added |
| 0 | [root] | [Figure, skater, lands, historic, quadruple, jump, in, senior, international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 1 | [root, Figure] | [skater, lands, historic, quadruple, jump, in, senior, international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 2 | [root, Figure, skater] | [lands, historic, quadruple, jump, in, senior, international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 3 | [root, Figure, skater, lands] | [historic, quadruple, jump, in, senior, international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | skater← lands |
| 4 | [root, Figure, lands] | [historic, quadruple, jump, in, senior, international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | Figure← lands |
| 5 | [root, lands] | [historic, quadruple, jump, in, senior, international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 6 | [root, lands, historic] | [quadruple, jump, in, senior, international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 7 | [root, lands, historic, quadruple] | [jump, in, senior, international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 8 | [root, lands, historic, quadruple, jump] | [in, senior, international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | quadruple← jump |
| 9 | [root, lands, historic, jump] | [in, senior, international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | history← jump |
| 10 | [root, lands, jump] | [in, senior, international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 11 | [root, lands, jump, in] | [senior, international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 12 | [root, lands, jump, in, senior] | [international, competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 13 | [root, lands, jump, in, senior, international] | [competition, at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 14 | [root, lands, jump, in, senior, international, competition] | [at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | international← competition |
| 15 | [root, lands, jump, in, senior, competition] | [at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | senior← competition |
| 16 | [root, lands, jump, in, competition] | [at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | in← competition |
| 17 | [root, lands, jump, competition] | [at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | right-arc | jump→ competition |
| 18 | [root, lands, jump] | [at, the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 19 | [root, lands, jump, at] | [the, 2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 20 | [root, lands, jump, at, the] | [2019, World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 21 | [root, lands, jump, at, the, 2019] | [World, Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 22 | [root, lands, jump, at, the, 2019, World] | [Figure, Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 23 | [root, lands, jump, at, the, 2019, World, Figure] | [Skating, Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 24 | [root, lands, jump, at, the, 2019, World, Figure, Skating] | [Championships, on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 25 | [root, lands, jump, at, the, 2019, World, Figure, Skating, Championships] | [on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 26 | [root, lands, jump, at, the, 2019, World, Figure, Skating, Championships] | [on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | Skating← Championships |
| 27 | [root, lands, jump, at, the, 2019, World, Figure, Championships] | [on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | Figure← Championships |
| 28 | [root, lands, jump, at, the, 2019, World, Championships] | [on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | World← Championships |
| 29 | [root, lands, jump, at, the, 2019, Championships] | [on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | 2019← Championships |
| 30 | [root, lands, jump, at, the, Championships] | [on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | the← Championships |
| 31 | [root, lands, jump, at, Championships] | [on, Day, 3, but, could, only, clinch, a, silver, medal] | left-arc | at← Championships |
| 32 | [root, lands, jump, Championships] | [on, Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 33 | [root, lands, jump, Championships, on] | [Day, 3, but, could, only, clinch, a, silver, medal] | shift |  |
| 34 | [root, lands, jump, Championships, on, Day] | [3, but, could, only, clinch, a, silver, medal] | left-arc | on← Day |
| 35 | [root, lands, jump, Championships, Day] | [3, but, could, only, clinch, a, silver, medal] | shift |  |
| 36 | [root, lands, jump, Championships, Day, 3] | [but, could, only, clinch, a, silver, medal] | right-arc | Day→ 3 |
| 37 | [root, lands, jump, Championships, Day] | [but, could, only, clinch, a, silver, medal] | right-arc | Championships→ Day |
| 38 | [root, lands, jump, Championships] | [but, could, only, clinch, a, silver, medal] | right-arc | jump→ Championships |
| 39 | [root, lands, jump] | [but, could, only, clinch, a, silver, medal] | shift |  |
| 40 | [root, lands, jump, but] | [could, only, clinch, a, silver, medal] | right-arc | jump→ but |
| 41 | [root, lands, jump] | [could, only, clinch, a, silver, medal] | shift |  |
| 42 | [root, lands, jump, could] | [only, clinch, a, silver, medal] | shift |  |
| 43 | [root, lands, jump, could, only] | [clinch, a, silver, medal] | shift |  |
| 44 | [root, lands, jump, could, only, clinch] | [a, silver, medal] | left-arc | only← clinch |
| 45 | [root, lands, jump, could clinch] | [a, silver, medal] | left-arc | could← clinch |
| 46 | [root, lands, jump, clinch] | [a, silver, medal] | shift |  |
| 47 | [root, lands, jump, clinch, a] | [silver, medal] | shift |  |
| 48 | [root, lands, jump, clinch, a, silver] | [medal] | shift |  |
| 49 | [root, lands, jump, clinch, a, silver, medal] | [] | left-arc | silver← medal |
| 50 | [root, lands, jump, clinch, a, medal] | [] | left-arc | a← medal |
| 51 | [root, lands, jump, clinch, medal] | [] | right-arc | clinch→ medal |
| 52 | [root, lands, jump, clinch] | [] | right-arc | jump→ clinch |
| 53 | [root, lands, jump] | [] | right-arc | lands→jump |
| 54 | [root, lands] | [] | right-arc | root→lands |
| 55 | [root] | [] | Done |  |

**2)**

*You will execute both Stanford dependency parsers on all four sentences and discuss which of them performed best on each of the sentences, and why. You will show the results of the parses on each of the sentences.*

S1

Lexical Parser

[Tree('ROOT', [Tree('NP', [Tree('NP', [Tree('NNS', ['Sales'])]), Tree('PP', [Tree('IN', ['of']), Tree('NP', [Tree('DT', ['the']), Tree('NN', ['company']), Tree('S', [Tree('VP', [Tree('TO', ['to']), Tree('VP', [Tree('VB', ['return']), Tree('PP', [Tree('TO', ['to']), Tree('NP', [Tree('NN', ['normalcy'])])])])])])])]), Tree('.', ['.'])])])]

Neural Parser

root(ROOT-0, Sales-1)

case(company-4, of-2)

det(company-4, the-3)

nmod(Sales-1, company-4)

mark(return-6, to-5)

acl(company-4, return-6)

case(normalcy-8, to-7)

nmod(return-6, normalcy-8)

Both appears perfectly well working

S2

Lexical Parser

[Tree('ROOT', [Tree('S', [Tree('NP', [Tree('NP', [Tree('DT', ['The']), Tree('JJ', ['new']), Tree('NNS', ['products'])]), Tree('CC', ['and']), Tree('NP', [Tree('NNS', ['services'])])]), Tree('VP', [Tree('VBD', ['contributed']), Tree('S', [Tree('VP', [Tree('TO', ['to']), Tree('VP', [Tree('VB', ['increase']), Tree('NP', [Tree('NN', ['revenue'])])])])])]), Tree('.', ['.'])])])]

Neural Parser

S2

det(products-3, The-1)

amod(products-3, new-2)

nsubj(contributed-6, products-3)

cc(products-3, and-4)

conj(products-3, services-5)

root(ROOT-0, contributed-6)

mark(increase-8, to-7)

xcomp(contributed-6, increase-8)

dobj(increase-8, revenue-9)

Both appears working well

S3

Lexical Parser

[Tree('ROOT', [Tree('S', [Tree('NP', [Tree('NNP', ['Dow'])]), Tree('VP', [Tree('VBZ', ['falls']), Tree('SBAR', [Tree('IN', ['as']), Tree('S', [Tree('NP', [Tree('NN', ['recession']), Tree('NN', ['indicator'])]), Tree('VP', [Tree('VBD', ['flashed']), Tree('SBAR', [Tree('S', [Tree('NP', [Tree('JJ', ['red']), Tree('CC', ['and']), Tree('JJ', ['economical']), Tree('NNS', ['worries'])]), Tree('VP', [Tree('VBP', ['continue']), Tree('PP', [Tree('IN', ['through']), Tree('NP', [Tree('DT', ['the']), Tree('NN', ['month'])])])])])])])])])]), Tree('.', ['.'])])])]

Neural Parser

nsubj(falls-2, Dow-1)

root(ROOT-0, falls-2)

mark(flashed-6, as-3)

compound(indicator-5, recession-4)

nsubj(flashed-6, indicator-5)

advcl(falls-2, flashed-6)

amod(worries-10, red-7)

cc(red-7, and-8)

conj(red-7, economical-9)

nsubj(continue-11, worries-10)

ccomp(flashed-6, continue-11)

case(month-14, through-12)

det(month-14, the-13)

nmod(continue-11, month-14)

Error: ‘And’ is matched incorrectly

S4

Lexical Parser

[Tree('ROOT', [Tree('S', [Tree('NP', [Tree('NNP', ['Figure']), Tree('NN', ['skater']), Tree('NNS', ['lands'])]), Tree('VP', [Tree('VP', [Tree('NP', [Tree('NP', [Tree('JJ', ['historic']), Tree('JJ', ['quadruple']), Tree('NN', ['jump'])]), Tree('PP', [Tree('IN', ['in']), Tree('NP', [Tree('NP', [Tree('JJ', ['senior']), Tree('JJ', ['international']), Tree('NN', ['competition'])]), Tree('PP', [Tree('IN', ['at']), Tree('NP', [Tree('DT', ['the']), Tree('CD', ['2019']), Tree('NNP', ['World']), Tree('NNP', ['Figure']), Tree('NNP', ['Skating']), Tree('NNP', ['Championships'])])])])])]), Tree('PP', [Tree('IN', ['on']), Tree('NP', [Tree('NNP', ['Day']), Tree('CD', ['3'])])])]), Tree('CC', ['but']), Tree('VP', [Tree('MD', ['could']), Tree('ADVP', [Tree('RB', ['only'])]), Tree('VP', [Tree('VB', ['clinch']), Tree('NP', [Tree('DT', ['a']), Tree('NN', ['silver']), Tree('NN', ['medal'])])])])]), Tree('.', ['.'])])])]

Neural Parser

S4

compound(skater-2, Figure-1)

nsubj(lands-3, skater-2)

root(ROOT-0, lands-3)

amod(jump-6, historic-4)

compound(jump-6, quadruple-5)

dobj(lands-3, jump-6)

case(competition-10, in-7)

amod(competition-10, senior-8)

amod(competition-10, international-9)

nmod(lands-3, competition-10)

case(Championships-17, at-11)

det(Championships-17, the-12)

nummod(Championships-17, 2019-13)

compound(Championships-17, World-14)

compound(Championships-17, Figure-15)

compound(Championships-17, Skating-16)

nmod(competition-10, Championships-17)

case(Day-19, on-18)

nmod(lands-3, Day-19)

nummod(Day-19, 3-20)

cc(lands-3, but-21)

aux(clinch-24, could-22)

advmod(clinch-24, only-23)

conj(lands-3, clinch-24)

det(medal-27, a-25)

amod(medal-27, silver-26)

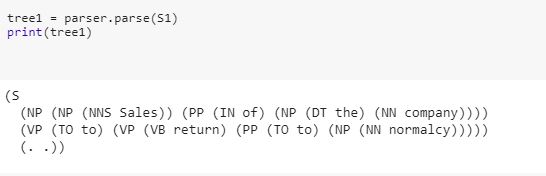
dobj(clinch-24, medal-27)

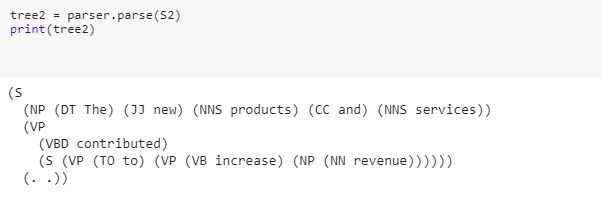
Both appear to work well.

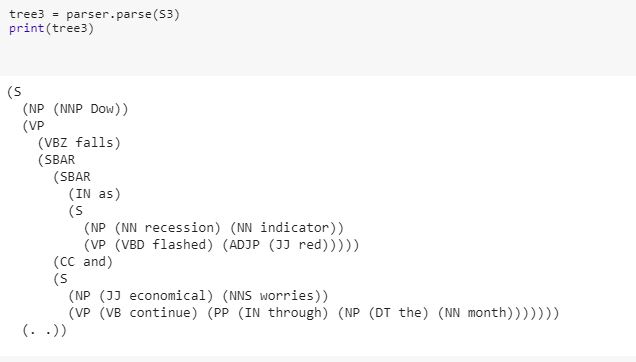
**3)**

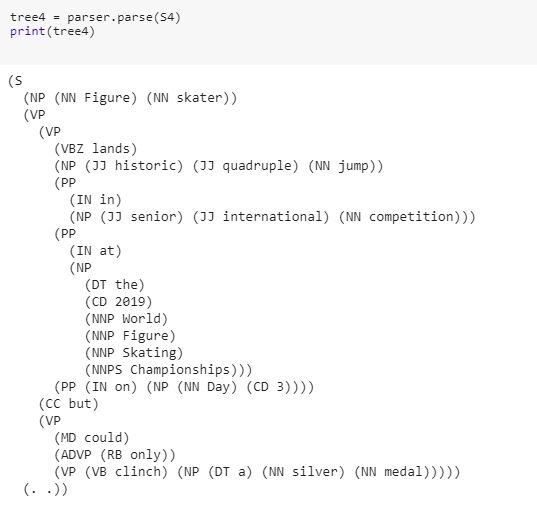
*You will execute the two constituency parsers (BLIPP and Kitaev & Klein, 2018) to enable you to discuss what errors you observe that the BLIPP parser of the Constituency parser with self-attentive encoding made on any of the four sentences. You will show the results of the parses on each of the sentences.*

Screenshots:









*S1: Sales of the company to return to normalcy.*

(S (NP (NP (NNS Sales)) (PP (IN of) (NP (DT the) (NN company)))) (VP (TO to) (VP (VB return) (PP (TO to) (NP (NN normalcy))))) (. .))

Seems Appropriate.

*S2: The new products and services contributed to increase revenue.*

(S (NP (DT The) (JJ new) (NNS products) (CC and) (NNS services)) (VP (VBD contributed) (S (VP (TO to) (VP (VB increase) (NP (NN revenue)))))) (. .))

Seems Appropriate.

*S3: Dow falls as recession indicator flashed red and economical worries continue through the month.*

(S (NP (NNP Dow)) (VP (VBZ falls) (SBAR (SBAR (IN as) (S (NP (NN recession) (NN indicator)) (VP (VBD flashed) (ADJP (JJ red))))) (CC and) (S (NP (JJ economical) (NNS worries)) (VP (VB continue) (PP (IN through) (NP (DT the) (NN month))))))) (. .))

Coordinating conjunction (CC ) placed wrong.

*S4: Figure skater lands historic quadruple jump in senior international competition at the 2019 World Figure Skating Championships on Day 3 but could only clinch a silver medal.*

(S (NP (NN Figure) (NN skater)) (VP (VP (VBZ lands) (NP (JJ historic) (JJ quadruple) (NN jump)) (PP (IN in) (NP (JJ senior) (JJ international) (NN competition))) (PP (IN at) (NP (DT the) (CD 2019) (NNP World) (NNP Figure) (NNP Skating) (NNPS Championships))) (PP (IN on) (NP (NN Day) (CD 3)))) (CC but) (VP (MD could) (ADVP (RB only)) (VP (VB clinch) (NP (DT a) (NN silver) (NN medal))))) (. .))

Seems Appropriate.

**Question 3:**

**1)**

*S1: Sales of the company to return to normalcy.*

Return

[ Sales of the company ] Arg1 to return to normalcy.

*S2: The new products and services contributed to increase revenue.*

Contributed

[ The new products and services ] Arg0 contributed to [ increase revenue ] Arg1 .

*S3: Dow falls as recession indicator flashed red and economical worries continue through the month.*

[ Dow ] Arg1 falls as recession indicator flashed red and economical worries continue through the month.

Flashed

Dow falls as [ recession indicator ] Arg1 flashed [ red ] Arg2 and economical worries continue through the month.

Continues

Dow falls as recession indicator flashed red and [ economical worries ] Arg0 continue through the month.

*S4: Figure skater lands historic quadruple jump in senior international competition at the 2019 World Figure Skating Championships on Day 3 but could only clinch a silver medal.*

Lands

[ Figure skater ] Arg0 lands [ historic quadruple jump ] Arg1 in senior international competition at the 2019 World Figure Skating Championships on Day 3 but could only clinch a silver medal.

Clinch

[ Figure skater ] Arg0 lands historic quadruple jump in senior international competition at the 2019 World Figure Skating Championships on Day 3 but could only clinch a [ silver medal ] Arg1.

**2)**

*S1: Sales of the company to return to normalcy.*

{"doc\_key": "S0", "sent\_offset": 0, "predicted\_srl": [[0, 1, 3, "ARG1"], [0, 4, 7, "ARGM-PRP"], [5, 0, 3, "ARG1"], [5, 6, 7, "ARG4"]], "srl": [[]], "sentences": [["Sales", "of", "the", "company", "to", "return", "to", "normalcy", "."]]}

*S2: The new products and services contributed to increase revenue.*

{"doc\_key": "S0", "sent\_offset": 0, "predicted\_srl": [[4, 1, 1, "ARGM-TMP"], [5, 0, 4, "ARG0"], [5, 6, 8, "ARG2"], [7, 0, 4, "ARG0"], [7, 8, 8, "ARG1"]], "srl": [[]], "sentences": [["The", "new", "products", "and", "services", "contributed", "to", "increase", "revenue", "."]]}

*S3: Dow falls as recession indicator flashed red and economical worries continue through the month.*

{"doc\_key": "S0", "sent\_offset": 0, "predicted\_srl": [[1, 0, 0, "ARG1"], [1, 2, 13, "ARGM-TMP"], [10, 8, 9, "ARG1"], [10, 11, 13, "ARGM-TMP"], [5, 3, 4, "ARG0"], [5, 6, 6, "ARG1"]], "srl": [[]], "sentences": [["Dow", "falls", "as", "recession", "indicator", "flashed", "red", "and", "economical", "worries", "continue", "through", "the", "month", "."]]}

*S4: Figure skater lands historic quadruple jump in senior international competition at the 2019 World Figure Skating Championships on Day 3 but could only clinch a silver medal.*

{"doc\_key": "S0", "sent\_offset": 0, "predicted\_srl": [[2, 0, 1, "ARG0"], [2, 3, 5, "ARG1"], [2, 6, 9, "ARGM-LOC"], [2, 10, 16, "ARGM-LOC"], [2, 17, 19, "ARGM-TMP"], [5, 3, 3, "ARGM-ADJ"], [5, 4, 4, "ARGM-MNR"], [23, 0, 1, "ARG0"], [23, 21, 21, "ARGM-MOD"], [23, 22, 22, "ARGM-ADV"], [23, 24, 26, "ARG1"]], "srl": [[]], "sentences": [["Figure", "skate", "lands", "historic", "quadruple", "jump", "in", "senior", "international", "competition", "at", "the", "2019", "World", "Figure", "Skating", "Championships", "on", "Day", "3", "but", "could", "only", "clinch", "a", "silver", "medal", "."]]}

Comparison:

Observed Differences:

‘And’ appears to be misplaced when did manually.

I think Stanford neural SRL appears more appropriate than other.

**EXTRA-CREDIT PROBLEM 1 (30 points):**

Please find attached Screenshots

