IST664 HW 3

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Monty Python and the Context-Free Grammars

Using the given files, the goal was to find the correct CFGs within the Camelot sentences by iterating further on the CFG file provided.

Format:

* Sentence #
* Grammar Rules (with additions highlighted)
* Parse Tree
* Added Vocab rule
* Description

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| Sentence 1 | Arthur is the king. |
| Grammar Rules | #Sentence  S1 -> NP VP Eos  #Verb phrases  VP -> VerbT NP | VerbT NP PP  #Noun Phrases  NP -> Det NP | Proper | Noun PP | Noun  #Prepositional phrase  PP -> Prep NP |
| Tree | (START  (S  (NP (Proper Arthur))  (VP (VerbT is) (NP (Det the) (NP (Noun king))))  (Eos .)))  ['Arthur', 'rides', 'the', 'horse', 'near', 'the', 'castle', '.']  (START  (S  (NP (Proper Arthur))  (VP  (VerbT rides)  (NP  (Det the)  (NP  (Noun horse)  (PP (Prep near) (NP (Det the) (NP (Noun castle)))))))  (Eos .))) |
| Added Rule | N/A This was given with the assignment. |
| Description | Uses the given structure of sentence one. |

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| Sentence 2 | Arthur rides the horse near the castle. |
| Rules | S1 -> NP VP Eos  VP -> VerbT NP | VerbT NP PP  NP -> Det NP | Proper | Noun PP | Noun  PP -> Prep NP |
| Tree | (START  (S  (NP (Proper Arthur))  (VP  (VerbT rides)  (NP  (Det the)  (NP  (Noun horse)  (PP (Prep near) (NP (Det the) (NP (Noun castle)))))))  (Eos .)))  (START  (S  (NP (Proper Arthur))  (VP  (VerbT rides)  (NP (Det the) (NP (Noun horse)))  (PP (Prep near) (NP (Det the) (NP (Noun castle)))))  (Eos .))) |
| Added Rule | N/A |
| Description | Uses the given structure of sentence 2 |

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| Sentence 3 | Arthur rides the plodding horse near the castle |
| Rules | S1 -> NP VP Eos  VP -> VerbT NP | VerbT NP PP  NP -> Det NP | Proper | Noun PP | Det JJ Noun  PP -> Prep NP |
| Tree | (START  (S  (NP (Proper Arthur))  (VP  (VerbT rides)  (NP (Det the) (Adj plodding) (Noun horse))  (PP (Prep near) (NP (Det the) (NP (Noun castle)))))  (Eos .))) |
| Added Rule | # Adjectives  Adj -> 'plodding' | 'bloody' | 'weary' | 'unable' | 'trusty' | 'further' | 'sacred' | 'hot' | 'lucky' | 'simple' | 'tiny' | 'hard' | 'sensational' | 'comparable' | 'yellow' |
| Description | I needed to add a tag for adjectives to account for ‘plodding.’  NP -> Proper: “Arthur”  VerbT -> NP PP: “rides”  NP -> Det Adj Noun: “the plodding horse”  NP -> Det NP: “the castle” |

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| Sentence 4 | the Holy\_Grail is a chalice. |
| Rules | # Sentences  S -> NP VP Eos  # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbT NP PP  # Noun phrases  NP -> Det NP | Proper | Noun PP | Noun | Det Adj Noun | Det NPN  # Prepositional phrase  PP -> Prep NP |
| Tree | (START  (S  (NP (Det the) (NPN Holy\_Grail))  (VP (VerbT is) (NP (Det a) (NP (Noun chalice))))  (Eos .))) |
| Added | # More proper nouns, not people.  NPN -> 'Camelot' | 'England' | 'Holy\_Grail' | 'Round\_Table' |
| Description | All the previous tags work, but I needed to add NPN in order to find “Holy\_Grail”. |

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| Sentence 5 | the sensational Holy\_Grail is a sacred chalice. |
| Rules | # Verb phrases  VP -> VerbT NP | VerbT NP PP  # Noun phrases  NP -> Det NP | Proper | Noun PP | Noun | Det Adj Noun | Det NPN | Det Adj NPN |
| Tree | (START  (S  (NP (Det the) (Adj sensational) (NPN Holy\_Grail))  (VP (VerbT is) (NP (Det a) (Adj sacred) (Noun chalice)))  (Eos .))) |
| Added | N/A |
| Description | Det Adj NPN finds “the sensational Holy\_Grail.” Previously added rules find the rest. |

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| Sentence 6 | Every coconut was carried to the hottest mountains. |
| Rules | # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP  # Noun phrases  NP -> Det NP | Proper | Noun PP | Noun | Det Adj Noun | Det NPN | Det Adj NPN | Det Noun | Det AdjS Plur  # Prepositional phrase  PP -> Prep NP | TO NP |
| Tree | (START  (S  (NP (Det every) (Noun coconut))  (VP  (VerbP was)  (VP  (VerbP carried)  (PP (TO to) (NP (Det the) (AdjS hottest) (Plur mountains)))))  (Eos .))) |
| Added | # Verbs (past tense).  VerbP -> 'had' | 'spoke' | 'covered' | 'was' | 'were' | 'rode' | 'drank' | 'grew' | 'carried' | 'suggested' | 'migrated' | 'knew'  # Plural nouns.  Plur -> 'coconuts' | 'halves' | 'snows' | 'mountains' | 'areas' | 'strangers' | 'inches' | 'ants' | 'nights'  # Superlative adjectives.  AdjS -> 'bloodiest' | 'weariest' | 'trustiest' | 'hottest' | 'simplest' | 'tiniest' | 'hardest' |
| Description | I had to remove Det NP because it was causing duplicates when I added Det Noun. Det Noun finds “every coconut”. VerbP VP finds “was”. VerbP PP finds “carried to”. TO PP was added for the addition of “to”. Det AdjS Plur finds “the hottest mountains”. |

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| Sentence 7 | Sixty strangers are at the Round\_Table. |
| Rules | # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP | VerbAll Prep NP  # Noun phrases  NP -> Proper | Noun PP | Noun | Det Adj Noun | Det NPN | Det Adj NPN | Det Noun | Det AdjS Plur | Num Plur |
| Tree | (START  (S  (NP (Num sixty) (Plur strangers))  (VP (VerbAll are) (Prep at) (NP (Det the) (NPN Round\_Table)))  (Eos .))) |
| Added | # Verbs (present, plural, third person).  VerbAll -> 'have' | 'speak' | 'cover' | 'are' | 'ride' | 'drink' | 'grow' | 'carry' | 'suggest' | 'migrate' | 'know' |
| Description | Num Plur finds “sixty strangers”. VerbAll Prep NP finds “are at the Round\_Table”. |

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| Sentence 8 | Sir\_Lancelot might have spoken. |
| Rules | # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP | VerbAll Prep NP | Mod VP | VerbB VerbPast  # Noun phrases  NP -> Proper | Noun PP | Noun | Det Adj Noun | Det NPN | Det Adj NPN | Det Noun | Det AdjS Plur | Num Plur | NPN |
| Tree | (START  (S  (NP (Proper Sir\_Lancelot))  (VP (Mod might) (VP (VerbB have) (VerbPast spoken)))  (Eos .))) |
| Added | # Modals.  Mod -> 'can' | 'could' | 'may' | 'might' | 'must' | 'ought' | 'shall' | 'should' | 'will' | 'would'  # Verbs (base form).  VerbB -> 'have' | 'speak' | 'cover' | 'be' | 'ride' | 'drink' | 'grow' | 'carry' | 'suggest' | 'migrate' | 'know'  # Verbs (past participle).  VerbPast -> 'had' | 'spoken' | 'covered' | 'been' | 'ridden' | 'drunk' | 'grown' | 'carried' | 'suggested' | 'migrated' | 'known' |
| Description | NNP finds “Sir\_Lancelot”. Mod VP finds “might”. VerbB VerbPast finds “have spoken”. |

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| Sentence 9 | Guinevere had been riding with Patsy for five weary nights. |
| Rules | # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP | VerbAll Prep NP | Mod VP | VerbB VerbPast | VerbPast VerbPres PP  # Noun phrases  NP -> Proper | Noun PP | Noun | Det Adj Noun | Det NPN | Det Adj NPN | Det Noun | Det AdjS Plur | Num Plur | NPN | NPN PP | Proper PP | Num Adj Plur |
| Tree | ['Guinevere', 'had', 'been', 'riding', 'with', 'Patsy', 'for', 'five', 'weary', 'nights', '.']  (START  (S  (NP (Proper Guinevere))  (VP  (VerbP had)  (VP  (VerbPast been)  (VerbPres riding)  (PP  (Prep with)  (NP  (Proper Patsy)  (PP (Prep for) (NP (Num five) (Adj weary) (Plur nights)))))))  (Eos .))) |
| Added | # Verbs (present participles).  VerbPres -> 'having' | 'speaking' | 'covering' | 'being' | 'riding' | 'drinking' | 'growing' | 'carrying' | 'suggesting' | 'migrating' | 'knowing' |
| Description | Proper finds “Guinevere”. VerbP PP finds “had”. VerbPast VerbPres PP finds “been riding”. Prep NP finds “with”. Proper PP finds “Patsy”. Prep NP finds “for”. Num Adj Plur finds “five weary nights”. |

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| Sentence 10 | Sir\_Bedevere might have been suggesting this quest. |
| Rules | # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP | VerbAll Prep NP | Mod VP | VerbB VerbPast | VerbPast VerbPres PP | VerbB VerbPast VP | VerbPres Det NP  # Noun phrases  NP -> Proper | Noun PP | Noun | Det Adj Noun | Det NPN | Det Adj NPN | Det Noun | Det AdjS Plur | Num Plur | NPN | NPN PP | Proper PP | Num Adj Plur |
| Tree | (START  (S  (NP (Proper Sir\_Bedevere))  (VP  (Mod might)  (VP  (VerbB have)  (VerbPast been)  (VP (VerbPres suggesting) (Det this) (NP (Noun quest)))))  (Eos .))) |
| Added | N/A |
| Description | Proper finds “Sir\_Bedevere”. Mod VP finds “might”. VerbB VerbPast VP finds “have been”. VerbPres Det NP finds “suggesting the quest.” |

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| Sentence 11 | The Britons migrate south frequently. |
| Rules | # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP | VerbAll Prep NP | Mod VP | VerbB VerbPast | VerbPast VerbPres PP | VerbB VerbPast VP | VerbPres Det NP | VerbB Adv Adv  # Noun phrases  NP -> Proper | Noun PP | Noun | Det Adj Noun | Det NPN | Det Adj NPN | Det Noun | Det AdjS Plur | Num Plur | NPN | NPN PP | Proper PP | Num Adj Plur | Det PlurPN |
| Tree | (START  (S  (NP (Det the) (PlurPN Britons))  (VP (VerbB migrate) (Adv south) (Adv frequently))  (Eos .))) |
| Added | # Adverbs.  Adv -> 'again' | 'already' | 'currently' | 'frequently' | 'precisely' | 'south' | 'successfully' | 'unfortunately'  # Plural proper nouns.  PlurPN -> 'Britons' | 'Saxons' |
| Description | Det PlurPN finds “the Britons”. VerbB Adv Adv finds “migrate south frequently”. |

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| Sentence 12 | Arthur and Guinevere ride frequently near the castle. |
| Rules | # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP | VerbAll Prep NP | Mod VP | VerbB VerbPast | VerbPast VerbPres PP | VerbB VerbPast VP | VerbPres Det NP | VerbB Adv Adv | VerbB Adv PP  # Noun phrases  NP -> Proper | Noun PP | Noun | Det Adj Noun | Det NPN | Det Adj NPN | Det Noun | Det AdjS Plur | Num Plur | NPN | NPN PP | Proper PP | Num Adj Plur | Det PlurPN | Proper Conj Proper |
| Tree | (START  (S  (NP (Proper Arthur) (Conj and) (Proper Guinevere))  (VP  (VerbB ride)  (Adv frequently)  (PP (Prep near) (NP (Det the) (Noun castle))))  (Eos .))) |
| Added | # Coordinating conjunctions.  Conj -> 'and' | 'but' | 'or' | 'either' | 'nor' | 'neither' | 'so' |
| Description | Added Conj for “and”. Proper Conj Proper finds “Arthur and Guinevere”. VerbB Adv PP finds “ride frequently”. Prep NP finds “near the castle”. |

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| Sentence 13 | He suggests to grow fruit at home. |
| Rules | # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP | VerbAll Prep NP | Mod VP | VerbB VerbPast | VerbPast VerbPres PP | VerbB VerbPast VP | VerbPres Det NP | VerbB Adv Adv | VerbB Adv PP | VerbPlus PP | VerbB NP  # Noun phrases  NP -> Proper | Noun PP | Noun | Det Adj Noun | Det NPN | Det Adj NPN | Det Noun | Det AdjS Plur | Num Plur | NPN | NPN PP | Proper PP | Num Adj Plur | Det PlurPN | Proper Conj Proper | Pro |
| Tree | (START  (S  (NP (Proper Arthur) (Conj and) (Proper Guinevere))  (VP  (VerbB ride)  (Adv frequently)  (PP (Prep near) (NP (Det the) (Noun castle))))  (Eos .))) |
| Added | # Personal pronouns.  Pro -> 'he' | 'her' | 'him' | 'it' | 'one' | 'she' | 'them' | 'they'  # More third person singular verbs.  VerbPlus -> 'speaks' | 'grows' | 'goes' | 'migrates' | 'suggests' | 'knows' |
| Description | Added Pro for “he”. Added VerbPlus for “suggests”. |

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| Sentence 14 | Riding to Camelot is not hard. |
| Rules | # Sentences  S -> NP VP Eos | VP VP Eos  # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP | VerbAll Prep NP | Mod VP | VerbB VerbPast | VerbPast VerbPres PP | VerbB VerbPast VP | VerbPres Det NP | VerbB Adv Adv | VerbB Adv PP | VerbPlus PP | VerbB NP | VerbT NOT Adj | VerbPres PP  # Noun phrases  NP -> Proper | Noun PP | Noun | Det Adj Noun | Det NPN | Det Adj NPN | Det Noun | Det AdjS Plur | Num Plur | NPN | NPN PP | Proper PP | Num Adj Plur | Det PlurPN | Proper Conj Proper | Pro |
| Tree | (START  (S  (VP (VerbPres riding) (PP (TO to) (NP (NPN Camelot))))  (VP (VerbT is) (NOT not) (Adj hard))  (Eos .))) |
| Added | N/A |
| Description | VP VP Eos is needed for having two verb phrases. VerbPres PP finds “riding”. TO NP finds “to”. NPN finds “Camelot”. VerbT NOT Adj finds “is not hard”. |

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| Sentence 15 | Do coconuts speak? |
| Rule | START -> S | SQ  # Sentences  S -> NP VP Eos | VP VP Eos | SQ Eos  SQ -> DO Plur VerbB |
| Tree | START (S (SQ (DO do) (Plur coconuts) (VerbB speak)) (Eos ?))) |
| Added | N/A |
| Description | Since this is a question, SQ needed to be added to sentences, as well as the SQ under #sentences. DO Plur VerbB finds “do coconuts speak”. |

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| Sentence 16 | Why does England have a King? |
| Rules | START -> S | SQ | SW  # Sentences  S -> NP VP Eos | VP VP Eos | SQ Eos | SW Eos  SQ -> DO Plur VerbB | DO NP VP  SW -> Whad SQ  # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP | VerbAll Prep NP | Mod VP | VerbB VerbPast | VerbPast VerbPres PP | VerbB VerbPast VP | VerbPres Det NP | VerbB Adv Adv | VerbB Adv PP | VerbPlus PP | VerbB NP | VerbT NOT Adj | VerbPres PP |
| Tree | (START  (S  (SW  (Whad why)  (SQ  (DO does)  (NP (NPN England))  (VP (VerbB have) (NP (Det a) (Noun king)))))  (Eos ?))) |
| Added | # Wh-adverbs  Whad -> 'how' | 'when' | 'where' | 'why' |
| Description | Since this is another question and it starts with a “wh-adverb,” I made the SW identifier. This included adding a new rule as well, SW -> Whad SQ. This finds “why” and the SQ tag DO VP VP finds “does”. NPN finds “England” and Det Noun finds “a king”. |

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| Challenge Sentence 1 | What horse does Arthur ride? |
| Rules | # Sentences  S -> NP VP Eos | VP VP Eos | SQ Eos | SW Eos  SQ -> DO Plur VerbB | DO NP VP | DO NP VerbB  WHNP -> WDT NP SQ  SW -> Whad SQ | WHNP |
| Tree | ['what', 'horse', 'does', 'Arthur', 'ride', '?']  (START  (S  (SW  (WHNP  (WDT what)  (NP (Noun horse))  (SQ (DO does) (NP (Proper Arthur)) (VerbB ride))))  (Eos ?))) |
| Added | # Wh-determiners.  WDT -> 'that' | 'what' | 'which' |
| Description | This needed a new rule for Wh-noun phrases, so I made WHNP. “what” is a determiner, so WDT NP SQ was used to find “what horse”. DO NP VerbB finds “does Arthur ride.” |

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| Challenge Sentence 2 | Who does Arthur suggest she carry? |
| Rules | # Sentences  S -> NP VP Eos | VP VP Eos | SQ Eos | SW Eos  SQ -> DO Plur VerbB | DO NP VP | DO NP VerbB  WHNP -> WDT NP SQ | WHP SQ  SW -> Whad SQ | WHNP  # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP | VerbAll Prep NP | Mod VP | VerbB VerbPast | VerbPast VerbPres PP | VerbB VerbPast VP | VerbPres Det NP | VerbB Adv Adv | VerbB Adv PP | VerbPlus PP | VerbB NP | VerbT NOT Adj | VerbPres PP | VerbB Pro VerbB |
| Tree | ['who', 'does', 'Arthur', 'suggest', 'she', 'carry', '?']  (START  (S  (SW  (WHNP  (WHP who)  (SQ  (DO does)  (NP (Proper Arthur))  (VP (VerbB suggest) (Pro she) (VerbB carry)))))  (Eos ?))) |
| Added | # Wh-pronouns.  WHP -> 'what' | 'who' |
| Description | I added WHP to find “who”. WHP SQ finds “who”. DO finds “does”. VerbB Pro VerbB finds “suggest she carry”. |

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| Exemplar Sentence 1 | Sir\_Lancelot carries his coconuts. |
| Rules | # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP | VerbAll Prep NP | Mod VP | VerbB VerbPast | VerbPast VerbPres PP | VerbB VerbPast VP | VerbPres Det NP | VerbB Adv Adv | VerbB Adv PP | VerbPlus PP | VerbB NP | VerbT NOT Adj | VerbPres PP | VerbB Pro VerbB | Proper VerbT  # Noun phrases  NP -> Proper | Noun PP | Noun | Det Adj Noun | Det NPN | Det Adj NPN | Det Noun | Det AdjS Plur | Num Plur | NPN | NPN PP | Proper PP | Num Adj Plur | Det PlurPN | Proper Conj Proper | Pro | Pos Plur |
| Tree | (START  (S  (NP (Proper Sir\_Lancelot))  (VP (VerbT carries) (NP (Pos his) (Plur coconuts)))  (Eos .))) |
| Added | N/A |
| Description | For this, I just needed to add Proper VerbT for “Sir\_Lancelot carries” and Pos Plur for “his coconuts”. |

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| Exemplar Sentence 2 | Arthur covers mountains across 5,000 . |
| Rules | # Verb phrases  VP -> VerbT NP | VerbT NP PP | VerbP VP | VerbP PP | VerbAll Prep NP | Mod VP | VerbB VerbPast | VerbPast VerbPres PP | VerbB VerbPast VP | VerbPres Det NP | VerbB Adv Adv | VerbB Adv PP | VerbPlus PP | VerbB NP | VerbT NOT Adj | VerbPres PP | VerbB Pro VerbB | Proper VerbT  # Noun phrases  NP -> Proper | Noun PP | Noun | Det Adj Noun | Det NPN | Det Adj NPN | Det Noun | Det AdjS Plur | Num Plur | NPN | NPN PP | Proper PP | Num Adj Plur | Det PlurPN | Proper Conj Proper | Pro | Pos Plur | Plur Prep Num |
| Tree | (START  (S  (NP (Proper Arthur))  (VP  (VerbT covers)  (NP (Plur mountains) (Prep across) (Num 5,000)))  (Eos .))) |
| Added | N/A |
| Description | The rules from the previous sentence apply here, except I added Plur Prep Num for “mountains across 5,000”. You can’t carry mountains, let alone across 5,000m that doesn’t make a lick of sense. The parser, however, doesn’t know what makes sense or not, it only knows the rules we give it, and this sentence falls in line with those rules. So, overgeneralizing could pose a problem for real-world NLP tasks. |