CYK Parser Project.

The goal of this project was to design a CYK parser to implement it in code and generate our own CNF language to test the code. I generated my CNF sentences to work with library book search operations. The vocabulary of my language is 48 with 6 parts of speech in the lexicon and 14 non-terminals in the CNF. The parser implementation is written in Python and can be repeated to input new sentences until the user ends the program. The output is a CYK table in CSV form with the correct values in their corresponding rows/columns.

The topic of my sentences is library book search operations. I chose relatively basic sentences to make the generation of my language a little bit simpler. The sentences sound as if they are instructions you may give a child when teaching them about how libraries work. The sentences cover librarian roles, catalogs, search, rules, and advice for library book search. There are 17 valid sentences, and 3 invalid at the end.

Sentences:

* The librarian helps find books.
* You can search for books.
* The system shows the location.
* A card is needed to borrow books.
* Books are arranged by topic.
* Books may not be available.
* Some books are borrowed.
* You can request books.
* The library has a catalog.
* The librarian can assist with books.
* The catalog helps you find authors.
* You may find books online.
* Books are located by number.
* The library updates its catalog.
* You can search by genre.
* The system is easy.
* Ask if you need help finding books.
* The librarian could not find it
* You can look for books on Google.
* Book the flight through Houston.

**Lexicon**

Det [➜](https://www.alt-codes.net/arrow_alt_codes.php) the | some | a | this

Noun [➜](https://www.alt-codes.net/arrow_alt_codes.php) librarian | books | system | location | card | topic | library | catalog | authors | online | number | genre | system | help

Verb [➜](https://www.alt-codes.net/arrow_alt_codes.php) helps | find | search | shows | needed | borrow | arranged | may | available | checked-out | request | has | assist | find | located | updates | search | is | easy | ask | need | finding

Pronoun [➜](https://www.alt-codes.net/arrow_alt_codes.php) you | its

Aux [➜](https://www.alt-codes.net/arrow_alt_codes.php) may | can | is | be | are | not

Preposition [➜ for | by | with | to](https://www.alt-codes.net/arrow_alt_codes.php) | if

**Grammar**

CFG with sentences broken into their parts of speech.

| S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det Noun Verb Det Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det Noun Aux Verb Preposition Verb Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det Noun Verb Det Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det Noun Aux Verb Preposition Verb Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun Aux Verb Preposition Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun Aux Aux Aux Verb  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det Noun Aux Verb  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Pronoun Aux Verb Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det Noun Verb Det Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det Noun Aux Verb Pronoun Preposition Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det Noun Verb Pronoun Verb Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Pronoun Aux Verb Noun Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det Noun Verb Pronoun Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb Preposition Pronoun Verb Noun Verb Noun |
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**CNF Conversion**

| S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det NV  NV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun VV  VV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb VN  VN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Pronoun AV  AV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Aux VP  VP [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb Preposition  PN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Preposition Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det NV  NV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun VD  VD [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb DN  DN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det NA  NA[➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun AV  AV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Aux VP  VP [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb PV  PV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Preposition VN  VN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun AV  AV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Aux VP  VP [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb PN  PN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Preposition Noun | S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun AA  AA [➜](https://www.alt-codes.net/arrow_alt_codes.php) Aux AA  AA [➜](https://www.alt-codes.net/arrow_alt_codes.php) Aux AV  AV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Aux Verb  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det NA  NA [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun AV  AV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Aux Verb  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Pronoun AV  AV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Aux VN  VN [➜](https://www.alt-codes.net/arrow_alt_codes.php)Verb Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det NV  NV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun VD  VD [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb DN  DN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det NA  NA [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun AV  AV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Aux VP  VP [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb PP  PP [➜](https://www.alt-codes.net/arrow_alt_codes.php) Pronoun PN  PN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Preposition Noun | S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det NV  NV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun VP  VP [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb PV  PV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Pronoun VN  VN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Pronoun AV  AV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Aux VN  VN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb NN  NN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det NV  NV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun VP  VP [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb PN  PN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Pronoun Noun  S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb PP  PP [➜](https://www.alt-codes.net/arrow_alt_codes.php) Preposition PV  PV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Pronoun VN  VN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb NV  NV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun VN  VN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb Noun |
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**CNF**

| S [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det NV | Pronoun AV | Det NA | Noun AV | Noun AA | Verb PP  NV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun VV | Noun VD | Noun VP | Noun VN  VN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb Noun | Verb NN | Verb NV  AV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Aux VP | Aux Verb | Aux VN  VP [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb PV | Verb PN | Verb PP  PN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Preposition Noun | Pronoun Noun  PV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Preposition VN | Pronoun VN  AA [➜](https://www.alt-codes.net/arrow_alt_codes.php) Aux AA | Aux AV  PP [➜](https://www.alt-codes.net/arrow_alt_codes.php) Pronoun PN | Preposition PV  VV [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb VN  VD [➜](https://www.alt-codes.net/arrow_alt_codes.php) Verb DN  DN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Det Noun  NA [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun AV  NN [➜](https://www.alt-codes.net/arrow_alt_codes.php) Noun Noun  Det [➜](https://www.alt-codes.net/arrow_alt_codes.php) the | some | a | this  Noun [➜](https://www.alt-codes.net/arrow_alt_codes.php) librarian | books | system | location | card | topic | library | catalog | authors | online | number | genre | system | help  Verb [➜](https://www.alt-codes.net/arrow_alt_codes.php) helps | find | search | shows | needed | borrow | arranged | may | available | checked-out | request | has | assist | find | located | updates | search | is | easy | ask | need | finding  Pronoun [➜](https://www.alt-codes.net/arrow_alt_codes.php) you | its  Aux [➜](https://www.alt-codes.net/arrow_alt_codes.php) may | can | is | be | are | not  Preposition [➜ for | by | with | to](https://www.alt-codes.net/arrow_alt_codes.php) | if |
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