PARSEARG: TURNS ARGPARSE ON ITS HEAD, THE DECLARATIVE WAY

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Contents

1. Overview

The “standard” Python module for writing command-line interfaces (“CLI”) is `argparse`. It is standard in so far as it is one of the batteries that comes included with the Python distribution, so no special installation is required. Probably because `argparse` is a bit clunky to use, many other (non-standard) packages have been developed for creating CLIs. Why “clunky”? Putting together a CLI with `argparse` alone is nothing if not an exercise in imperative programming, and this has three very negative consequences:

(1) It obfuscates the intention of the CLI design;

(2) It is prone to errors;

(3) It discourages CLI design in the first instance; it makes debugging a CLI design very difficult; and it makes refactoring or re-configuring the CLI design overly burdensome.

In spite of this clunkiness, `argparse` has everything we need in terms of functionality. `parsearg`, then, is nothing more than a layer over `argparse` that exposes the `argparse` functionality via a `dict`. The `dict` is the View component of the Model-View-Controller (“MVC”) design pattern. The `dict` embeds callbacks from the Controller component, thereby achieving a clean separation of duties, which is what the MVC pattern calls for. By separating the View component into a `dict`, the CLI design can be expressed in a declarative way: `parsearg` manifests the *intention* of the CLI design without having to specify how that design is implemented in terms of `argparse`’s parsers and subparsers (`parsearg` does that for you).

Other packages—such as `click` and `plac`—effectively decorate functions that are part of the Controller with functionality from the View. Unfortunately, while this may expose the functionality of `argparse` in a more friendly way via the packages’ decorators, it dissipates the elements of the View across the Controller and in so doing it makes the CLI design difficult to grasp.

The `parsearg` philosophy is that `argparse` is already good enough in terms of the functionality that it provides, but that it just needs a little nudge in terms of how it’s used. Arguments to be added to a CLI with `argparse` can be clearly specified as data, as can the callbacks that consume these arguments. `parsearg` takes advantage of this by specifiying everything (in the View component of MVC) as a `dict`, from which `parsearg` then generates a parser (or set of nested parsers) using `argparse`. The Controller is then free to use the generated parser.

The `parsearg` approach is declarative because it manifests the CLI design in a data structure: a `dict`, which is one of Python’s built-in data structures. The keys of this `dict` form a flattened tree of the CLI’s subcommands. Keys like `A|B|C` are easy to specify and neatly summarize the nested hierarchy of subcommands: `A -> B ->`

Date: 2021-06-08 Build: `v-0.1.9 (518ecce6a28f0d179a1a88fdcf89f241c4053271)`.

C. They are also easy to change. The magic, such as it is, of parsearg is that it unflattens this flattened tree into a tree of argparse parsers. parsearg requires nothing special: It works with Python out of the box, and therefore uses what's already available without introducing dependencies.

Simple? The following examples should help.

2. PARSEARG.EXAMPLES.TODOS

Yet another To-Do app? Yes, because:

(1) It illustrates a sufficiently realistic, but not overly complex, problem;

(2) It also illustrates the MVC pattern in the wild;

(3) It shows how parsearg neatly segments the View component into a dict.

Let's start with the outer layer of the onion. How do we interact with todos.py? First, create some users in the User table with the create user subcommand of todos.py. Note that we do not (yet) have a phone number for user bar, nor do we have an email address for user qux:

```
python todos.py create user foo -e foo@foo.com -p 212-555-1234
python todos.py create user bar -e bar@bar.com
python todos.py create user qux -p 212-123-5555
```

```
python: can't open file 'todos.py': [Errno 2] No such file or directory
python: can't open file 'todos.py': [Errno 2] No such file or directory
python: can't open file 'todos.py': [Errno 2] No such file or directory
```

Second, create some to-dos in the Todo table with the create todo subcommand of todos.py.

```
python todos.py create todo foo title1 -c description1 -d 2020-11-30
python todos.py create todo foo title2 -c description2 --due-date=2020-12-31
python todos.py create todo qux todo-1 --description=Christmas-party -d 2020-11-30
python todos.py create todo qux todo-2 --description=New-Year-party
```

```
python: can't open file 'todos.py': [Errno 2] No such file or directory
python: can't open file 'todos.py': [Errno 2] No such file or directory
python: can't open file 'todos.py': [Errno 2] No such file or directory
python: can't open file 'todos.py': [Errno 2] No such file or directory
```

Let's make some changes to the records entered so far. We can add an email address for user qux and a phone number for user bar using the update user email and update user phone subcommands, respectively:

```
python todos.py update user email qux qux@quxbar.com
python todos.py update user phone bar 203-555-1212
```

```
python: can't open file 'todos.py': [Errno 2] No such file or directory
python: can't open file 'todos.py': [Errno 2] No such file or directory
```

Now update two of the to-dos, changing the title and the description in the fourth to-do using the update todo title and update todo description subcommands, respectively:

```
python todos.py update todo title 4 most-important
python todos.py update todo description 4 2021-party
```

```
python: can't open file 'todos.py': [Errno 2] No such file or directory
python: can't open file 'todos.py': [Errno 2] No such file or directory
```

```
python todos.py show users
python todos.py show todos
```

```
python: can't open file 'todos.py': [Errno 2] No such file or directory
python: can't open file 'todos.py': [Errno 2] No such file or directory
```

The result of these commands is that the two tables (`User` and `Todo`) are populated in a SQLite database:

```
sqlite3 todo.db 'select * from User;'
```

```
Error: no such table: User
```

```
sqlite3 todo.db 'select * from Todo;'
```

```
Error: no such table: Todo
```

Let's look at the Python code for `todos.py`.

The View component is entirely contained within a single `dict`, *viz.* `view`, which has been formatted here for clarity using `parsearg.utils.show`:

```python
from parsearg.examples.todos import view
from parsearg.utils import show

show(view)
```

```
'purge|users':
    'callback':
    <function purge_users at 0x7f11d6ff6700>
'purge|todos':
    'callback':
    <function purge_todos at 0x7f11d6fcfaf0>
'show|users':
    'callback':
    <function show_users at 0x7f11d6fcfb80>
'show|todos':
    'callback':
    <function show_todos at 0x7f11d6fcfc10>
'create|user':
    'callback':
    <function create_user at 0x7f11d6fcfca0>
    'name':
    {'help': 'create user name', 'action': 'store'}
    '-e|--email':
    {'help': "create user's email address", 'action': 'store', 'default': ''}
    '-p|--phone':
    {'help': "create user's phone number", 'action': 'store', 'default': ''}
'create|todo':
    'callback':
    <function create_todo at 0x7f11d6fcfd30>
    'user':
    {'help': 'user name', 'action': 'store'}
    'title':
    {'help': 'title of to-do', 'action': 'store'}
    '-c|--description':
    {'help': 'description of to-do', 'action': 'store', 'default': ''}
    '-d|--due-date':
    {'help': 'due date for the to-do', 'action': 'store', 'default': None}
'update|user|email':
    'callback':
    <function update_user_email at 0x7f11d6fcfdc0>
    'name':
    {'help': 'user name', 'action': 'store'}
```

```
        'email':
        {'help': 'user email', 'action': 'store'}
    'update|user|phone':
        'callback':
        <function update_user_phone at 0x7f11d6fcfe50>
        'name':
        {'help': 'user name', 'action': 'store'}
        'phone':
        {'help': 'user phone', 'action': 'store'}
    'update|todo|title':
        'callback':
        <function update_todo_title at 0x7f11d6fcfee0>
        'id':
        {'help': 'ID of to-do', 'action': 'store'}
        'title':
        {'help': 'title of to-do', 'action': 'store'}
    'update|todo|description':
        'callback':
        <function update_todo_description at 0x7f11d6fcff70>
        'id':
        {'help': 'ID of to-do', 'action': 'store'}
        'description':
        {'help': 'description of to-do', 'action': 'store'}
```

We can generate a tree view of the CLI design specified by the above `dict`, namely `view`, as follows:

```python
from parsearg.parser import ParseArg

print(
    ParseArg(d=view, root_name='TODO').tree.show(quiet=True)
)
```

```
TODO
    purge
        todos
        users
    update
        user
            phone
            email
        todo
            description
            title
    show
        todos
        users
    create
        user
        todo
```

3. How parsearg works

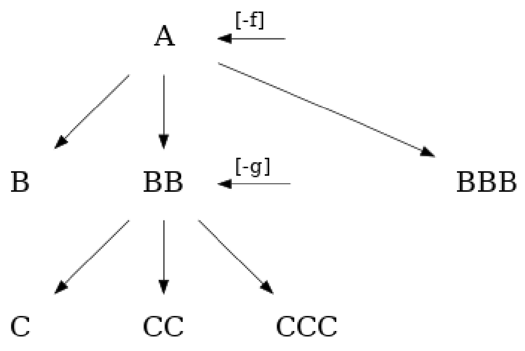
It is easier to explain how `parsearg` works with a simpler abstraction than the above example `parsearg.examples.todos.py`. Here, we will consider nested parsers as trees. We introduce two trees for this purpose:

(1) The “A tree”, and

(2) The “A-AA tree”.

3.1. The A-tree.

The “A tree” has three levels. As each node of the tree must necessarily occupy a positional argument of the command line, `[-f]` and `[-g]` are correspondingly *optional arguments* that attach to the nodes (`A` and `BB`, respectively, in the below diagram).



Let’s look at the Python code for `a.py`.

Consider the `dict` that represents the View component:

```
from parsearg.examples.a import view

show(view)
```

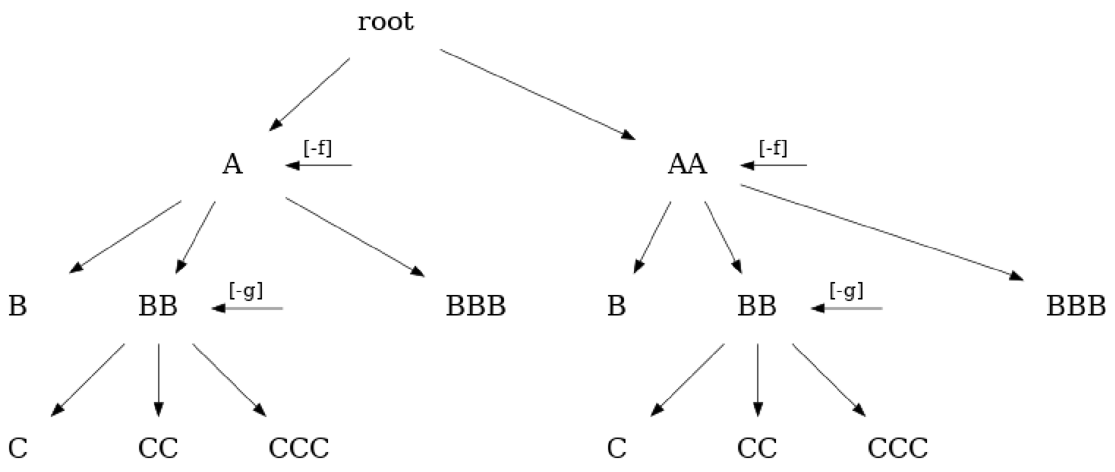
```
 'A':
     'callback':
     <function make_callback.<locals>.func at 0x7f11d7d10c10>
     '-c':
     {'help': 'A [optional pi]', 'action': 'store_const', 'const': 3.141593}
     '-v|--verbose':
     {'help': 'A verbosity', 'action': 'store_true'}
 'A|B':
     'callback':
     <function make_callback.<locals>.func at 0x7f11d70409d0>
     '-c':
     {'help': 'A B [optional pi]', 'action': 'store_const', 'const': 3.141593}
     '-v|--verbose':
     {'help': 'A B verbosity', 'action': 'store_true'}
 'A|BB':
     'callback':
     <function make_callback.<locals>.func at 0x7f11d7040a60>
     '-c':
     {'help': 'A BB [optional pi]', 'action': 'store_const', 'const': 3.141593}
     '-v|--verbose':
     {'help': 'A BB erbosity', 'action': 'store_true'}
 'A|BB|C':
     'callback':
     <function make_callback.<locals>.func at 0x7f11d7040af0>
     '-c':
     {'help': 'A BB C [optional pi]', 'action': 'store_const', 'const': 3.141593}
     '-v|--verbose':
     {'help': 'A BB C verbosity', 'action': 'store_true'}
 'A|BB|CC':
     'callback':
     <function make_callback.<locals>.func at 0x7f11d7040b80>
     '-c':
     {'help': 'A BB CC [optional pi]', 'action': 'store_const', 'const': 3.141593}
     '-v|--verbose':
     {'help': 'A BB CC verbosity', 'action': 'store_true'}
 'A|BB|CCC':
     'callback':
     <function make_callback.<locals>.func at 0x7f11d7040c10>
     '-c':
     {'help': 'A BB CCC [optional pi]', 'action': 'store_const', 'const': 3.141593}
     '-v|--verbose':
     {'help': 'A BB CCC verbosity', 'action': 'store_true'}
 'A|BBB':
     'callback':
     <function make_callback.<locals>.func at 0x7f11d7040ca0>
     '-c':
     {'help': 'A BBB [optional pi]', 'action': 'store_const', 'const': 3.141593}
     '-v|--verbose':
     {'help': 'A BBB verbosity', 'action': 'store_true'}
```

and then the tree that the parsed `dict` is represented by:

```
print(
    ParseArg(d=view, root_name='TODO').tree.show(quiet=True)
)
```

```
TODO
    A
        B
        BBB
        BB
            C
            CC
            CCC
```

3.2. **The A-A tree.** The A-AA tree simply extends the A tree one level:



Let's look at the Python code for `a_aa.py`.

Consider the `dict` that represents the View component:

```
from parsearg.examples.a_aa import view

show(view)
```

```
'A':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d7044670>
    '-c':
    {'help': 'A [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'A verbosity', 'action': 'store_true'}
'A|B':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d70445e0>
    '-c':
    {'help': 'A B [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'A B verbosity', 'action': 'store_true'}
'A|BB':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d7044550>
    '-c':
    {'help': 'A BB [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'A BB erbosity', 'action': 'store_true'}
```

```
'A|BB|C':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d70444c0>
    '-c':
    {'help': 'A BB C [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'A BB C verbosity', 'action': 'store_true'}
'A|BB|CC':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d7044430>
    '-c':
    {'help': 'A BB CC [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'A BB CC verbosity', 'action': 'store_true'}
'A|BB|CCC':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d70443a0>
    '-c':
    {'help': 'A BB CCC [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'A BB CCC verbosity', 'action': 'store_true'}
'A|BBB':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d70440d0>
    '-c':
    {'help': 'A BBB [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'A BBB verbosity', 'action': 'store_true'}
'AA':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d7044310>
    '-c':
    {'help': 'AA [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'AA verbosity', 'action': 'store_true'}
'AA|B':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d7044280>
    '-c':
    {'help': 'AA B [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'AA B verbosity', 'action': 'store_true'}
'AA|BB':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d70441f0>
    '-c':
    {'help': 'AA BB [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'AA BB verbosity', 'action': 'store_true'}
'AA|BB|C':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d7044160>
    '-c':
    {'help': 'AA BB C [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'AA BB C verbosity', 'action': 'store_true'}
'AA|BB|CC':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d7044040>
    '-c':
    {'help': 'AA BB CC [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'AA BB CC verbosity', 'action': 'store_true'}
'AA|BB|CCC':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d7044c10>
    '-c':
    {'help': 'AA BB CCC [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'AA BB CCC verbosity', 'action': 'store_true'}
'AA|BBB':
    'callback':
    <function make_callback.<locals>.func at 0x7f11d7044ca0>
    '-c':
    {'help': 'AA BBB [optional pi]', 'action': 'store_const', 'const': 3.141593}
    '-v|--verbose':
    {'help': 'AA BBB verbosity', 'action': 'store_true'}
```

and then the tree that the parsed `dict` is represented by:

```
print(
    ParseArg(d=view, root_name='TODO').tree.show(quiet=True)
)
```

```
TODO
    AA
        B
        BBB
        BB
            C
            CC
            CCC
    A
        B
        BBB
        BB
            C
            CC
            CCC
```

We can now run the A-tree and the A-AA-tree examples, respectively:

```
from parsearg.examples.a import main
main()
```

```
NODE :: 'A':
--------------
usage:  A [-h] [-c] [-v] {B,BBB,BB} ...

positional arguments:
  {B,BBB,BB}

optional arguments:
  -h, --help     show this help message and exit
  -c             A [optional pi]
  -v, --verbose  A verbosity


'A':
----
        args: {'c': None, 'verbose': False}
        <Mock name='mock.A' id='139714611964512'>
'A -v':
-------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.A' id='139714611964512'>
'A -c':
-------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.A' id='139714611964512'>
'A -v -c':
----------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.A' id='139714611964512'>


NODE :: 'A B':
----------------
usage: A B [-h] [-c] [-v]

optional arguments:
  -h, --help     show this help message and exit
  -c             A B [optional pi]
  -v, --verbose  A B verbosity


'A B':
------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.A_B' id='139714598437792'>
```

```
'A B -v':
---------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.A_B' id='139714598437792'>
'A B -c':
---------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.A_B' id='139714598437792'>
'A B -v -c':
------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.A_B' id='139714598437792'>


NODE :: 'A BB':
-----------------
usage: A BB [-h] [-c] [-v] {C,CC,CCC} ...

positional arguments:
  {C,CC,CCC}

optional arguments:
  -h, --help     show this help message and exit
  -c             A BB [optional pi]
  -v, --verbose  A BB erbosity


'A BB':
-------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.A_BB' id='139714598483088'>
'A BB -v':
----------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.A_BB' id='139714598483088'>
'A BB -c':
----------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.A_BB' id='139714598483088'>
'A BB -v -c':
-------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.A_BB' id='139714598483088'>


NODE :: 'A BB C':
-------------------
usage: A BB C [-h] [-c] [-v]

optional arguments:
  -h, --help     show this help message and exit
  -c             A BB C [optional pi]
  -v, --verbose  A BB C verbosity


'A BB C':
---------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.A_BB_C' id='139714598483280'>
'A BB C -v':
------------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.A_BB_C' id='139714598483280'>
'A BB C -c':
------------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.A_BB_C' id='139714598483280'>
'A BB C -v -c':
---------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.A_BB_C' id='139714598483280'>


NODE :: 'A BB CC':
--------------------
usage: A BB CC [-h] [-c] [-v]
```

```
optional arguments:
  -h, --help     show this help message and exit
  -c             A BB CC [optional pi]
  -v, --verbose  A BB CC verbosity


'A BB CC':
----------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.A_BB_CC' id='139714598483472'>
'A BB CC -v':
-------------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.A_BB_CC' id='139714598483472'>
'A BB CC -c':
-------------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.A_BB_CC' id='139714598483472'>
'A BB CC -v -c':
----------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.A_BB_CC' id='139714598483472'>


NODE :: 'A BB CCC':
---------------------
usage: A BB CCC [-h] [-c] [-v]

optional arguments:
  -h, --help     show this help message and exit
  -c             A BB CCC [optional pi]
  -v, --verbose  A BB CCC verbosity


'A BB CCC':
-----------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.A_BB_CCC' id='139714598483664'>
'A BB CCC -v':
--------------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.A_BB_CCC' id='139714598483664'>
'A BB CCC -c':
--------------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.A_BB_CCC' id='139714598483664'>
'A BB CCC -v -c':
-----------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.A_BB_CCC' id='139714598483664'>
```

```python
from parsearg.examples.a_aa import main
main()
```

```
NODE :: 'A':
--------------
usage:  A [-h] [-c] [-v] {B,BBB,BB} ...

positional arguments:
  {B,BBB,BB}

optional arguments:
  -h, --help     show this help message and exit
  -c             A [optional pi]
  -v, --verbose  A verbosity


'A':
----
        args: {'c': None, 'verbose': False}
        <Mock name='mock.A' id='139714598483904'>
'A -v':
-------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.A' id='139714598483904'>
```

```
'A -c':
-------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.A' id='139714598483904'>
'A -v -c':
----------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.A' id='139714598483904'>


NODE :: 'A B':
----------------
usage: A B [-h] [-c] [-v]

optional arguments:
  -h, --help     show this help message and exit
  -c             A B [optional pi]
  -v, --verbose  A B verbosity


'A B':
------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.A_B' id='139714598562448'>
'A B -v':
---------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.A_B' id='139714598562448'>
'A B -c':
---------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.A_B' id='139714598562448'>
'A B -v -c':
------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.A_B' id='139714598562448'>


NODE :: 'A BB':
-----------------
usage: A BB [-h] [-c] [-v] {C,CC,CCC} ...

positional arguments:
  {C,CC,CCC}

optional arguments:
  -h, --help     show this help message and exit
  -c             A BB [optional pi]
  -v, --verbose  A BB erbosity


'A BB':
-------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.A_BB' id='139714598562592'>
'A BB -v':
----------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.A_BB' id='139714598562592'>
'A BB -c':
----------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.A_BB' id='139714598562592'>
'A BB -v -c':
-------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.A_BB' id='139714598562592'>


NODE :: 'A BB C':
-------------------
usage: A BB C [-h] [-c] [-v]

optional arguments:
  -h, --help     show this help message and exit
  -c             A BB C [optional pi]
  -v, --verbose  A BB C verbosity
```

```
'A BB C':
---------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.A_BB_C' id='139714598562256'>
'A BB C -v':
------------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.A_BB_C' id='139714598562256'>
'A BB C -c':
------------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.A_BB_C' id='139714598562256'>
'A BB C -v -c':
---------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.A_BB_C' id='139714598562256'>


NODE :: 'A BB CC':
--------------------
usage: A BB CC [-h] [-c] [-v]

optional arguments:
  -h, --help     show this help message and exit
  -c             A BB CC [optional pi]
  -v, --verbose  A BB CC verbosity


'A BB CC':
----------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.A_BB_CC' id='139714598562496'>
'A BB CC -v':
-------------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.A_BB_CC' id='139714598562496'>
'A BB CC -c':
-------------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.A_BB_CC' id='139714598562496'>
'A BB CC -v -c':
----------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.A_BB_CC' id='139714598562496'>


NODE :: 'A BB CCC':
---------------------
usage: A BB CCC [-h] [-c] [-v]

optional arguments:
  -h, --help     show this help message and exit
  -c             A BB CCC [optional pi]
  -v, --verbose  A BB CCC verbosity


'A BB CCC':
-----------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.A_BB_CCC' id='139714598562016'>
'A BB CCC -v':
--------------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.A_BB_CCC' id='139714598562016'>
'A BB CCC -c':
--------------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.A_BB_CCC' id='139714598562016'>
'A BB CCC -v -c':
-----------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.A_BB_CCC' id='139714598562016'>


NODE :: 'AA':
```

```
---------------
usage:  AA [-h] [-c] [-v] {B,BBB,BB} ...

positional arguments:
  {B,BBB,BB}

optional arguments:
  -h, --help     show this help message and exit
  -c             AA [optional pi]
  -v, --verbose  AA verbosity


'AA':
-----
        args: {'c': None, 'verbose': False}
        <Mock name='mock.AA' id='139714598576960'>
'AA -v':
--------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.AA' id='139714598576960'>
'AA -c':
--------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.AA' id='139714598576960'>
'AA -v -c':
-----------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.AA' id='139714598576960'>


NODE :: 'AA B':
-----------------
usage: AA B [-h] [-c] [-v]

optional arguments:
  -h, --help     show this help message and exit
  -c             AA B [optional pi]
  -v, --verbose  AA B verbosity


'AA B':
-------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.AA_B' id='139714598576912'>
'AA B -v':
----------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.AA_B' id='139714598576912'>
'AA B -c':
----------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.AA_B' id='139714598576912'>
'AA B -v -c':
-------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.AA_B' id='139714598576912'>


NODE :: 'AA BB':
------------------
usage: AA BB [-h] [-c] [-v] {C,CC,CCC} ...

positional arguments:
  {C,CC,CCC}

optional arguments:
  -h, --help     show this help message and exit
  -c             AA BB [optional pi]
  -v, --verbose  AA BB verbosity


'AA BB':
--------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.AA_BB' id='139714598576864'>
'AA BB -v':
-----------
```

```
        args: {'c': None, 'verbose': True}
        <Mock name='mock.AA_BB' id='139714598576864'>
'AA BB -c':
-----------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.AA_BB' id='139714598576864'>
'AA BB -v -c':
--------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.AA_BB' id='139714598576864'>


NODE :: 'AA BB C':
--------------------
usage: AA BB C [-h] [-c] [-v]

optional arguments:
  -h, --help     show this help message and exit
  -c             AA BB C [optional pi]
  -v, --verbose  AA BB C verbosity


'AA BB C':
----------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.AA_BB_C' id='139714598577824'>
'AA BB C -v':
-------------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.AA_BB_C' id='139714598577824'>
'AA BB C -c':
-------------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.AA_BB_C' id='139714598577824'>
'AA BB C -v -c':
----------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.AA_BB_C' id='139714598577824'>


NODE :: 'AA BB CC':
---------------------
usage: AA BB CC [-h] [-c] [-v]

optional arguments:
  -h, --help     show this help message and exit
  -c             AA BB CC [optional pi]
  -v, --verbose  AA BB CC verbosity


'AA BB CC':
-----------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.AA_BB_CC' id='139714598577536'>
'AA BB CC -v':
--------------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.AA_BB_CC' id='139714598577536'>
'AA BB CC -c':
--------------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.AA_BB_CC' id='139714598577536'>
'AA BB CC -v -c':
-----------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.AA_BB_CC' id='139714598577536'>


NODE :: 'AA BB CCC':
----------------------
usage: AA BB CCC [-h] [-c] [-v]

optional arguments:
  -h, --help     show this help message and exit
  -c             AA BB CCC [optional pi]
  -v, --verbose  AA BB CCC verbosity
```

```
'AA BB CCC':
------------
        args: {'c': None, 'verbose': False}
        <Mock name='mock.AA_BB_CCC' id='139714598576384'>
'AA BB CCC -v':
---------------
        args: {'c': None, 'verbose': True}
        <Mock name='mock.AA_BB_CCC' id='139714598576384'>
'AA BB CCC -c':
---------------
        args: {'c': 3.141593, 'verbose': False}
        <Mock name='mock.AA_BB_CCC' id='139714598576384'>
'AA BB CCC -v -c':
------------------
        args: {'c': 3.141593, 'verbose': True}
        <Mock name='mock.AA_BB_CCC' id='139714598576384'>
```