Inside Chisel

- design goals
  - in the style of Unix
  - command line only
  - one command to achieve one task well

- `chisel` is a package with at least three command line programs
  - `txt2pen` convert a `txt` file into a `pen` file
  - `pen2map` convert a `pen` file into a `map` file (doom3)
  - `rndpen` generate a random pen file

- for your coursework you should consider extending:
  - `pen2map` or `txt2pen` or introducing a third which could manipulate a `pen` or `txt` file

rndpen

- generate a random `pen` map
- highly alpha code, but it will generate a corridor based random pen file
- the program does always find a map
- so some experimentation is required for the pseudo random numbers to mesh with the algorithm to generate a map

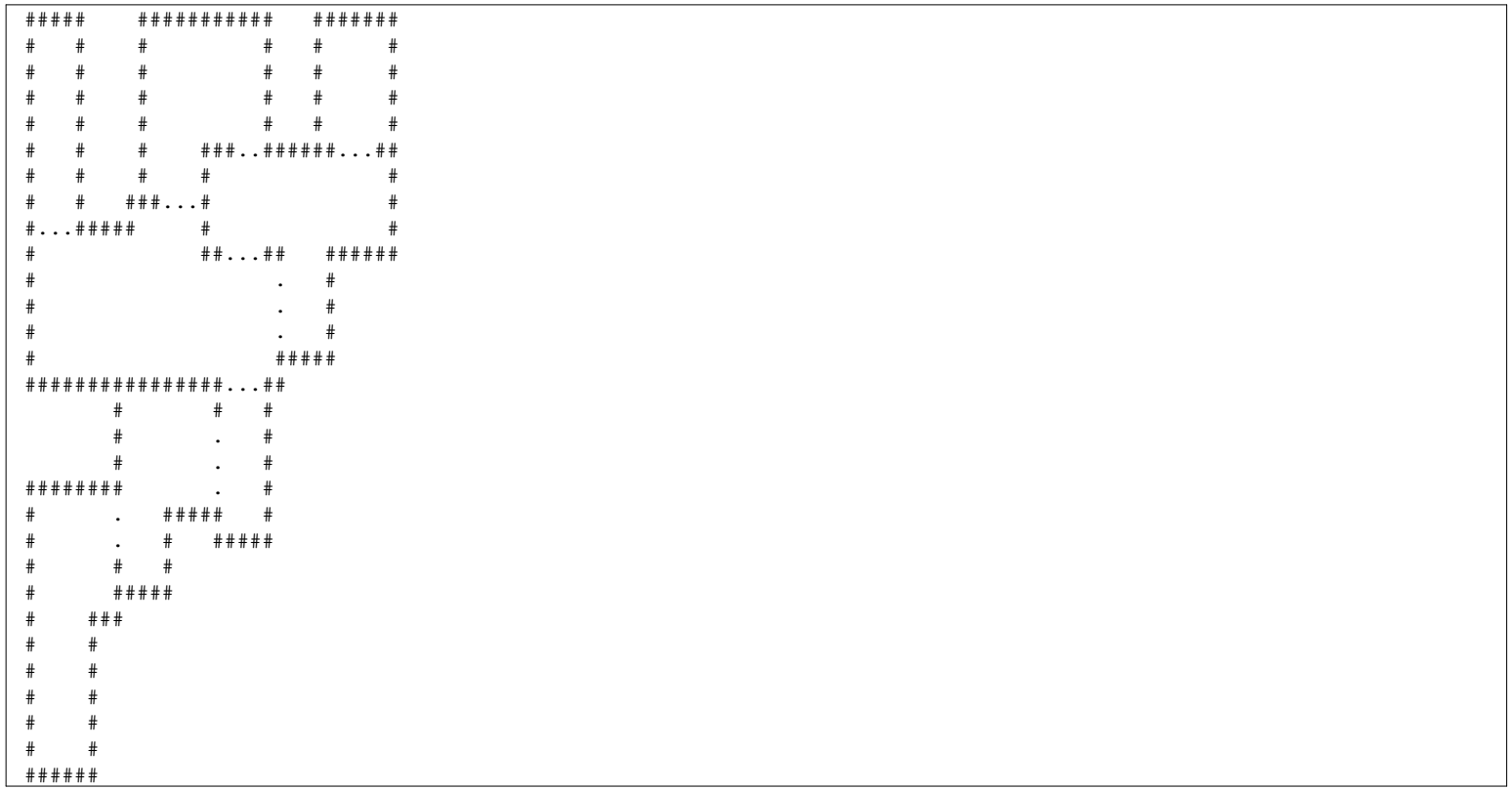
rndpen

```
$ rndmap -h
Usage rndpen [-a minroomsize] [-b maxroomsize] \
  [-c mincorridorlength] [-d maxcorridorlength] \
  [-e totalcorridorlength] [-h] [-o outputfile] \
  [-s seed] [-x maxx] [-y maxy]
  -a minroomsize              (default is 6)
  -b maxroomsize              (default is 13)
  -c mincorridorsize          (default is 15)
  -d maxcorridorsize          (default is 70)
  -e totalcorridorlength      (default is 300)
  -o outputfile               (default is stdout)
  -s seed                     (default is 3)
  -x minx for whole map       (default is 120)
  -y maxy for whole map       (default is 80)
```

rndpen

- ```
  $ rndmap -s 3 -a 5 -b 10 -c 5 -d 10 -e 20 -x 30 -y 30 | pen2map -t -
  ```
- notice how the command line tools can be combined using the pipe
  ```

rndpen



rndpen

- `rndpen` prioritises placing random corridors on the map
- it then tries to fill in the remaining gaps with boxes and will combine boxes to give rooms of desired min/max dimensions
- it also restricts the number of walls to 8
- it might be useful if you wanted to generate a map quickly
  - however it might generate concave rooms (pen2map can only encode convex rooms currently)

Inside: txt2pen

- source is in one file:
  `$HOME/Sandpit/chisel/python/txt2pen.py`
  - 690 lines of Python

- uses the following command line options

- ```
  $ cd $HOME/Sandpit/chisel/python
  $ python txt2pen.py -h
    -d debugging
    -h help
    -V verbose
    -v version
    -o outputfile name
  ```
  ```

Inside: txt2pen

- notice the `-o` option which takes an additional argument (filename)
- it uses the `getopt` module to handle the options
  - see function `handleOptions`

Inside: txt2pen

```
def handleOptions ():
    global debugging, verbose, outputName

    outputName = None
    try:
       optlist, l = getopt.getopt(sys.argv[1:], ':dho:vV')
       for opt in optlist:
           if opt[0] == '-d':
               debugging = True
           elif opt[0] == '-h':
               usage (0)
           elif opt[0] == '-o':
               outputName = opt[1]
           elif opt[0] == '-v':
               printf ("txtpen version " + str (versionNumber) + "\n")
               sys.exit (0)
           elif opt[0] == '-V':
               verbose = True
       if l != []:
           return (l[0], outputName)

    except getopt.GetoptError:
       usage (1)
    return (None, outputName)
```

Inside: txt2pen

- it uses a dictionary to maintain the defines
- stores the map in a 2D list (array)
  - `mapGrid`

Inside: txt2pen

- it determines the walls of a room
  - it finds the room number (location)
  - moves to the top left inside the room (`generateRoom`)
  - it then attempts to turn left as it moves around the room (the wall is always on the left)
  - examine `scanRoom` for the implementation
  - it looks the square forward and square forward left comparing the two characters: `##` or `--` or `#-`
    - `#` wall and `-` for space

- a space should be thought of as not a wall

Inside: txt2pen

- `scanRoom` will start at the top right corner of a room and walk around the edge with the wall always on the left
  - it builds a list of walls, a wall stops/starts at each turn
- if it sees `##` then it must turn right
  - the old wall is stored and a new start position is remembered
- if it sees `--` then it must turn left
  - the old wall is stored and a new start position is remembered
- if it sees `#-` then it continues moving a square forward

Extending chisel (txt2pen)

- one of the obvious improvements is for chisel to automatically introduce lights
  - add another option to enable automatic lighting
  - `-l`
- copy `scanRoom` into a new function `introduceLights`
- adapt this new function to add lights
  - but only if the rooms has no user defined lights

Inside: pen2map

- `chisel/python/pen2map.py` is 2086 lines of Python

-
```
$ cd $HOME/Sandpit/chisel/python
$ python pen2map.py -h
Usage: pen2map [-c filename.ss] [-dhmtvV] [-o outputfile] inputfile
  -c filename.ss    use filename.ss as the defaults for the map file
  -d                debugging
  -e                provide comments in the map file
  -g type           game type.  The type must be 'single' or 'deathmatch'
  -h                help
  -m                create a doom3 map file from the pen file
  -s                generate statistics about the map file
  -t                create a txt file from the pen file
  -V                generate verbose information
  -v                print the version
  -o outputfile     place output into outputfile
```

Example style sheet for the map

- how are textures defined - could use the defaults - and ignore this slide!
  - or examine `chisel/python/tiny.ss`

```
# style sheet for simple doom3 maps

define floor textures/hell/qfloor
define portal textures/editor/visportal
define open textures/editor/visportal
define closed textures/hell/wood1
define secret textures/hell/bricks1a_d
define wall textures/hell/cbrick2b
define ceiling textures/hell/wood1
```

pen2map

- reads in a `pen` file and converts it into a doom3 `map` file

- the `pen` map is parsed by a top down recursive descent parser
  - the pen syntax is described by an ebnf grammar
  - (extended backus naur form)
  - hand translated into a top down recursive descent parser

- recursive descent parsers are fast and straightforward to implement once the grammar is defined
  - they also allow for strict syntax checking of input
  - they are used extensively in the construction of compilers

ebnf

- consists of terminal symbols and non-terminal production rules which define the legal sequence of symbols
- in C++ for example, a terminal symbol might be `while`, `for`, `do`, `=` `;` `0` etc
- a rule might be:
- ```
  assignment := lhs "=" rhs =:
  ```
- meaning the `assignment` rule is satisfied if there is a legal `lhs` followed by = followed by `rhs`
  ```

pen example

```
ROOM 1
   WALL
     1 21  18 21
     18 21  18 14
     18 14  1 14
     1 14  1 21
   DOOR 18 18 18 17 STATUS OPEN LEADS TO 2
   MONSTER python_doommarine_mp AT 13 18
   LIGHT AT 12 20
   LIGHT AT 4 15
   LIGHT AT 15 15
   SPAWN PLAYER AT 3 18
END
```

pen grammar in ebnf

```
FileUnit := RoomDesc { RoomDesc } [ RandomTreasure ] "END." =:

RoomDesc := 'ROOM' Integer
            { WallDesc | DoorDesc | TreasureDesc } 'END' =:

WallDesc := 'WALL' WallCoords { WallCoords } =:

WallCoords := Integer Integer Integer Integer =:

DoorDesc := 'DOOR' DoorCoords { DoorCoords } =:
```

pen grammar in ebnf

```
DoorCoords := Integer Integer Integer Integer Status
              'LEADS' 'TO' Integer  =:

Status := 'STATUS' ( 'OPEN'
                   | 'CLOSED'
                   | 'SECRET'
                  ) =:

TreasureDesc := 'TREASURE' 'AT' Integer Integer
                'IS' Integer =:

RandomTreasure := 'RANDOMIZE' 'TREASURE' Integer
                  { Integer } =:
```

ebnf meta symbols

- `{ foo }`
  - means it is legal to have 0 or more occurrences of `foo`
- `[ foo ]`
  - means it is legal to have 0 or 1 occurrence of `foo`
- `( foo | bar )`
  - here the `(` and `)` group together the extent of the `|`
- `"foo"` represents the terminal symbol `f o o`
- as opposed to the rule `foo`

Translating ebnf grammar into a top down parser

- once the grammar is defined it is straightforward to implement a top down parser

- if the grammar is said to be well formed if we only need to look at the next token to determine the flow of control in the parser

Translating ebnf grammar into a top down parser

- we define a few helper functions
  - `expect ("foo")` insists that the next token is "foo" and generates an error if it is not "foo"
  - if "foo" is seen the consume this symbol and move onto the next

- `expecting (list)`
  - returns `True` if any symbol in `list` matches the current symbol

- `integer` return `True` if the current symbol is an integer
  - if True store the value of the integer in `curinteger`