

CS 246

Object-Oriented Software Development

Final Project

Constructor

Demo

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The demo will guide you through all the possible features that you will play with this game without any bonus features. To start the game, you have four ways: using a default board, using a random board, using a board with a seed, loading a board (and also the information of board and player) to the current game.

In this demo, *red words* means the command you need to enter to follow the demo. *green words* are describing the features or edges case that the program is performing. When enter the command, please enter them WORD-BY-WORD separated by new line.

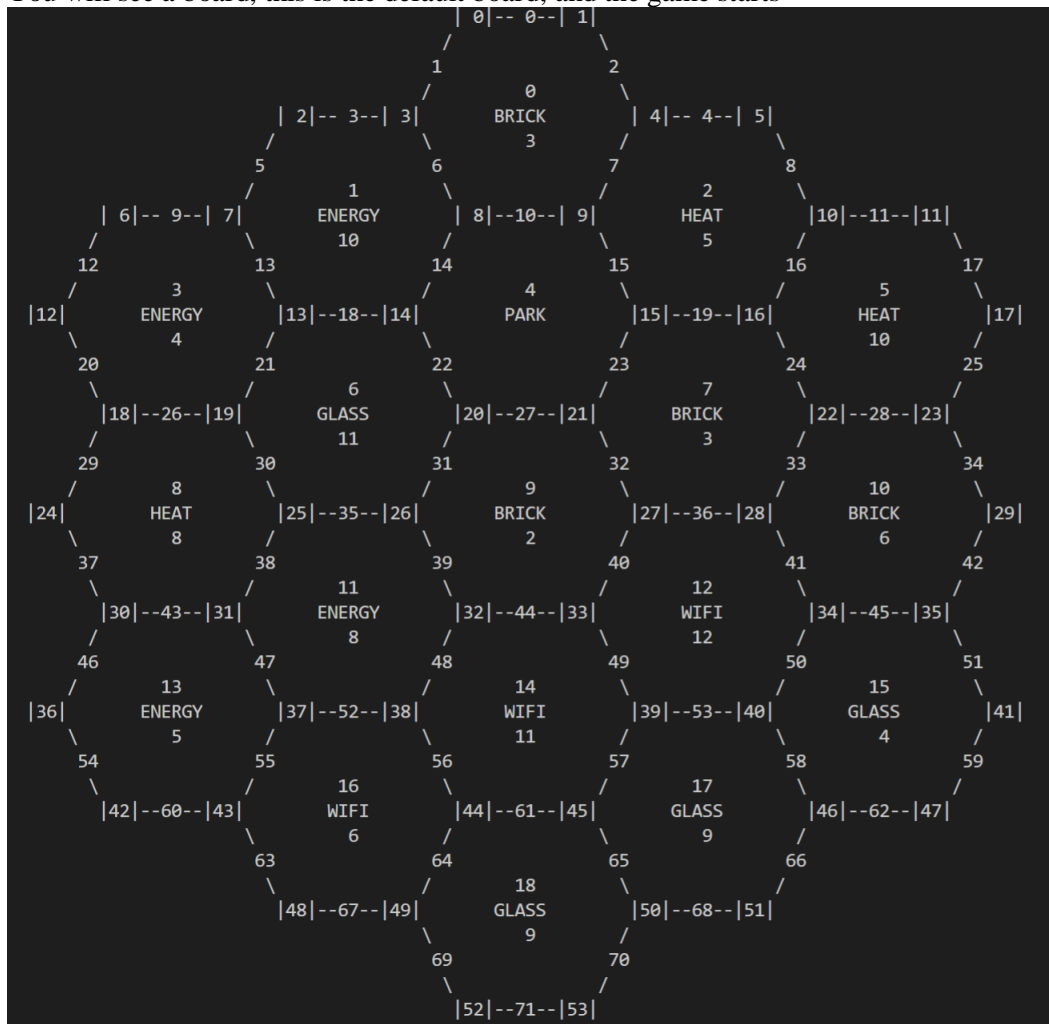
For example, please enter “trade-enter-yellow-BRICK-ENERGY” or “roll-enter-3”, instead of “trade yellow BRICK ENERGY” or “roll 3”. Thank you very much.

When testing the load command, we will provide several files in order to test some complicated features quickly.

1. Enter the game with a default board

To start, type `./constructor`

You will see a board, this is the default board, and the game starts



And firstly, the builders need to build house each turn in **order** of “blue—red—orange—yellow—yellow—orange—red—blue”

If the input is **not a number**, or **not a valid number**, the program requires player to re-enter until it's valid. Also, **it tells in which positions where buildings has been built**.

```
Builder Blue where do you want to build a basement? [end] to end game, [print] to print the board.
> hi
ERROR: Builder Blue where do you want to build a basement? isn't a valid integer.
> -1
ERROR: Builder Blue where do you want to build a basement? isn't a valid integer.
> 54
You cannot build here.
Basements already exist as locations:
> 0
```

```

Builder Blue where do you want to build a basement? [end] to end game, [print] to print the board.
> 0
Builder Red where do you want to build a basement? [end] to end game, [print] to print the board.
> print
      |BB|-- 0--| 1|
      /         \
    1             2
    /           \
  | 2|-- 3--| 3| 0 BRICK 3 | 4|-- 4--| 5|
    /         \   /       \
  5             6       7       8
  /           \   /       \   /       \
| 6|-- 9--| 7| 1 ENERGY 10 | 8|--10--| 9| 2 HEAT 5 | 10|--11--|11|
  /         \   /       \   /       \   /       \
12           13       14       15       16       17
|12| 3 ENERGY 4 |13|--18--|14| 4 PARK 4 |15|--19--|16| 5 HEAT 10 |17|
  /         \   /       \   /       \   /       \
20           21       22       23       24       25
|18|--26--|19| 6 GLASS 11 |20|--27--|21| 7 BRICK 3 |22|--28--|23|
  /         \   /       \   /       \   /       \
29           30       31       32       33       34
|24| 8 HEAT 8 |25|--35--|26| 9 BRICK 2 |27|--36--|28| 10 BRICK 6 |29|
  /         \   /       \   /       \   /       \
37           38       39       40       41       42
|30|--43--|31| 11 ENERGY 8 |32|--44--|33| 12 WIFI 12 |34|--45--|35|
  /         \   /       \   /       \   /       \
46           47       48       49       50       51
|36| 13 ENERGY 5 |37|--52--|38| 14 WIFI 11 |39|--53--|40| 15 GLASS 4 |41|
  /         \   /       \   /       \   /       \
54           55       56       57       58       59
|42|--60--|43| 16 WIFI 6 |44|--61--|45| 17 GLASS 9 |46|--62--|47|
  /         \   /       \   /       \   /       \
63           64       65       66
|48|--67--|49| 18 GLASS 9 |50|--68--|51|
  /         \   /       \   /       \   /       \
69           70
|52|--71--|53|
Builder Red where do you want to build a basement? [end] to end game, [print] to print the board.
> █
Builder Red where do you want to build a basement? [end] to end game, [print] to print the board.
> end
Bye :- )
j334hu@ubuntu1804-010:~/cs246/1209/constructor$ █

```

4

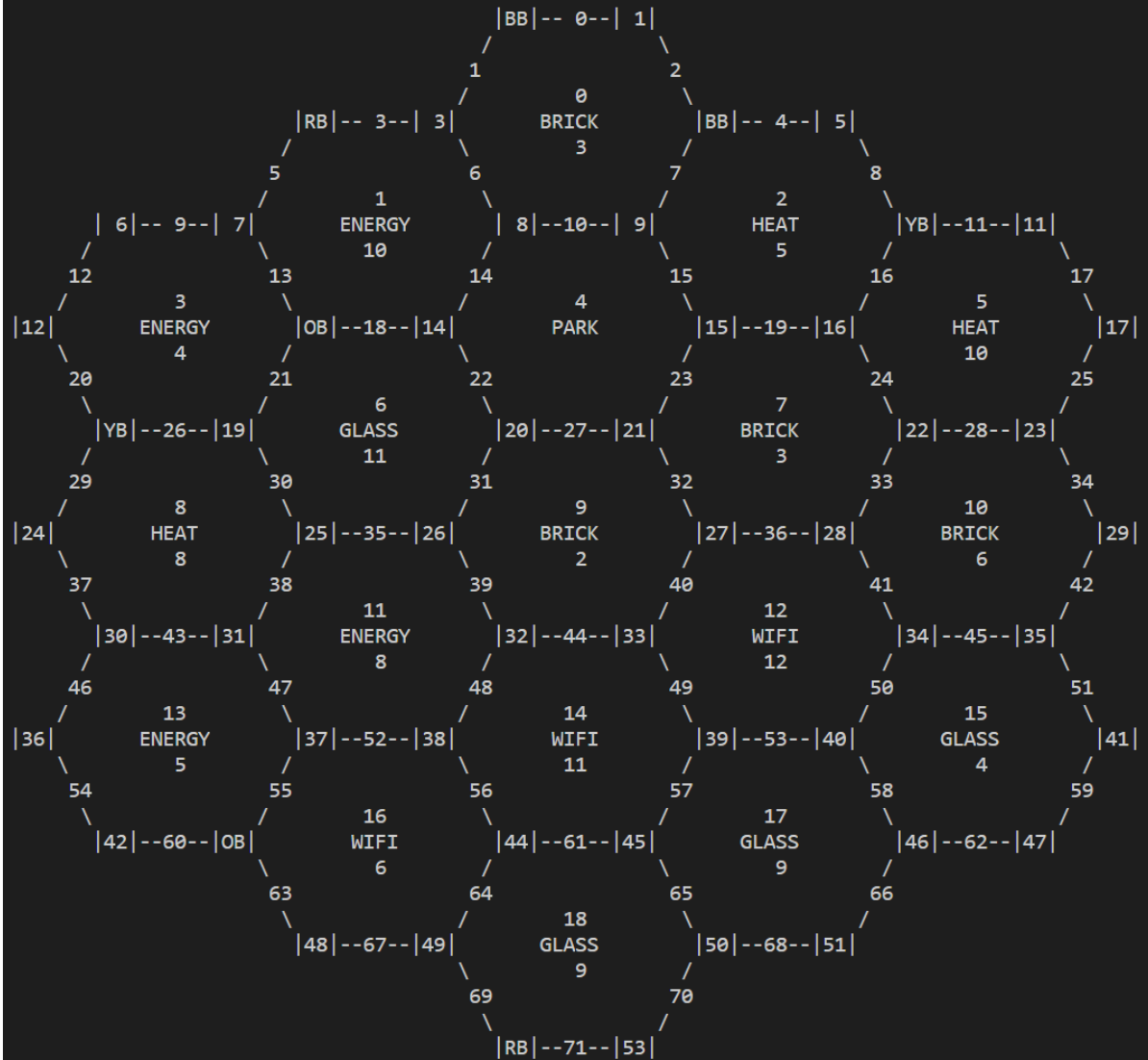
```

Builder Red where do you want to build a basement? [end] to end game, [print] to print the board.
> print
      |BB|-- 0--| 1|
      /      \
    1          2
    /          \
  | 2|-- 3--| 3| 0          | 4|-- 4--| 5|
    /          \  BRICK    /
  5            6          7          8
    /          \          /          \
| 6|-- 9--| 7| 1          | 8|--10--| 9| 2          |10|--11--|11|
    /          \ ENERGY /          \ HEAT
  12            13      14          15      16          17
    /          \          /          \          /          \
|12|            |13|--18--|14| 4          |15|--19--|16| 5          |17|
    /          \          \ PARK      /          \ HEAT
  20            21          22          23          24          25
    /          \          /          \          /          \
|18|--26--|19| 6          |20|--27--|21| 7          |22|--28--|23| 10
    /          \ GLASS   /          \ BRICK      /          \
  29            30      31          32          33          34
    /          \          /          \          /          \
|24|            |25|--35--|26| 9          |27|--36--|28| 10          |29|
    /          \ BRICK  /          \ BRICK      /          \
  37            38      39          40          41          42
    /          \          /          \          /          \
|30|--43--|31| 11         |32|--44--|33| 12         |34|--45--|35|
    /          \ ENERGY /          \ WIFI      /          \
  46            47      48          49          50          51
    /          \          /          \          /          \
|36|            |37|--52--|38| 14         |39|--53--|40| 15         |41|
    /          \ WIFI   /          \ GLASS    /          \
  54            55      56          57          58          59
    /          \          /          \          /          \
|42|--60--|43| 16         |44|--61--|45| 17         |46|--62--|47|
    /          \ WIFI   /          \ GLASS    /          \
  63            64      65          66          67          68
    /          \          /          \          /          \
|48|--67--|49| 18         |50|--68--|51| 18         |52|--71--|53|
    /          \ GLASS /          \ GLASS    /          \
  69            70      71          72          73          74
    /          \          /          \          /          \
|52|--71--|53| 18         |54|--72--|55| 18         |56|--73--|57|
    /          \ GLASS /          \ GLASS    /          \
  75            76      77          78          79          80
    /          \          /          \          /          \
|58|--74--|59| 18         |60|--75--|61| 18         |62|--76--|63|
    /          \ GLASS /          \ GLASS    /          \
  81            82      83          84          85          86
    /          \          /          \          /          \
|64|--77--|65| 18         |66|--78--|67| 18         |68|--79--|69|
    /          \ GLASS /          \ GLASS    /          \
  87            88      89          90          91          92
    /          \          /          \          /          \
|70|--79--|71| 18         |72|--80--|73| 18         |74|--81--|75|
    /          \ GLASS /          \ GLASS    /          \
  93            94      95          96          97          98
    /          \          /          \          /          \
|76|--81--|77| 18         |78|--82--|79| 18         |80|--83--|81|
    /          \ GLASS /          \ GLASS    /          \
  99            100     101         102         103         104
    /          \          /          \          /          \
|82|--83--|83| 18         |84|--84--|85| 18         |86|--85--|87|
    /          \ GLASS /          \ GLASS    /          \
  105           106     107         108         109         110
    /          \          /          \          /          \
|84|--85--|85| 18         |86|--86--|87| 18         |88|--87--|89|
    /          \ GLASS /          \ GLASS    /          \
  111           112     113         114         115         116
    /          \          /          \          /          \
|86|--87--|87| 18         |88|--88--|89| 18         |90|--89--|91|
    /          \ GLASS /          \ GLASS    /          \
  117           118     119         120         121         122
    /          \          /          \          /          \
|88|--89--|89| 18         |90|--90--|91| 18         |92|--91--|93|
    /          \ GLASS /          \ GLASS    /          \
  123           124     125         126         127         128
    /          \          /          \          /          \
|90|--91--|91| 18         |92|--92--|93| 18         |94|--93--|95|
    /          \ GLASS /          \ GLASS    /          \
  129           130     131         132         133         134
    /          \          /          \          /          \
|92|--93--|93| 18         |94|--94--|95| 18         |96|--95--|97|
    /          \ GLASS /          \ GLASS    /          \
  135           136     137         138         139         140
    /          \          /          \          /          \
|94|--95--|95| 18         |96|--96--|97| 18         |98|--97--|99|
    /          \ GLASS /          \ GLASS    /          \
  141           142     143         144         145         146
    /          \          /          \          /          \
|96|--97--|97| 18         |98|--98--|99| 18         |100|--99--|101|
    /          \ GLASS /          \ GLASS    /          \
  147           148     149         150         151         152
    /          \          /          \          /          \
|98|--99--|99| 18         |100|--100--|101| 18         |102|--101--|103|
    /          \ GLASS /          \ GLASS    /          \
  153           154     155         156         157         158
    /          \          /          \          /          \
|100|--101--|101| 18         |102|--102--|103| 18         |104|--103--|105|
    /          \ GLASS /          \ GLASS    /          \
  159           160     161         162         163         164
    /          \          /          \          /          \
|102|--103--|103| 18         |104|--104--|105| 18         |106|--105--|107|
    /          \ GLASS /          \ GLASS    /          \
  165           166     167         168         169         170
    /          \          /          \          /          \
|104|--105--|105| 18         |106|--106--|107| 18         |108|--107--|109|
    /          \ GLASS /          \ GLASS    /          \
  171           172     173         174         175         176
    /          \          /          \          /          \
|106|--107--|107| 18         |108|--108--|109| 18         |110|--109--|111|
    /          \ GLASS /          \ GLASS    /          \
  177           178     179         180         181         182
    /          \          /          \          /          \
|108|--109--|109| 18         |110|--110--|111| 18         |112|--111--|113|
    /          \ GLASS /          \ GLASS    /          \
  183           184     185         186         187         188
    /          \          /          \          /          \
|110|--111--|111| 18         |112|--112--|113| 18         |114|--113--|115|
    /          \ GLASS /          \ GLASS    /          \
  189           190     191         192         193         194
    /          \          /          \          /          \
|112|--113--|113| 18         |114|--114--|115| 18         |116|--115--|117|
    /          \ GLASS /          \ GLASS    /          \
  195           196     197         198         199         200
    /          \          /          \          /          \
|114|--115--|115| 18         |116|--116--|117| 18         |118|--117--|119|
    /          \ GLASS /          \ GLASS    /          \
  201           202     203         204         205         206
    /          \          /          \          /          \
|116|--117--|117| 18         |118|--118--|119| 18         |120|--119--|121|
    /          \ GLASS /          \ GLASS    /          \
  207           208     209         210         211         212
    /          \          /          \          /          \
|118|--119--|119| 18         |120|--120--|121| 18         |122|--121--|123|
    /          \ GLASS /          \ GLASS    /          \
  213           214     215         216         217         218
    /          \          /          \          /          \
|120|--121--|121| 18         |122|--122--|123| 18         |124|--123--|125|
    /          \ GLASS /          \ GLASS    /          \
  219           220     221         222         223         224
    /          \          /          \          /          \
|122|--123--|123| 18         |124|--124--|125| 18         |126|--125--|127|
    /          \ GLASS /          \ GLASS    /          \
  225           226     227         228         229         230
    /          \          /          \          /          \
|124|--125--|125| 18         |126|--126--|127| 18         |128|--127--|129|
    /          \ GLASS /          \ GLASS    /          \
  231           232     233         234         235         236
    /          \          /          \          /          \
|126|--127--|127| 18         |128|--128--|129| 18         |130|--129--|131|
    /          \ GLASS /          \ GLASS    /          \
  237           238     239         240         241         242
    /          \          /          \          /          \
|128|--129--|129| 18         |130|--130--|131| 18         |132|--131--|133|
    /          \ GLASS /          \ GLASS    /          \
  243           244     245         246         247         248
    /          \          /          \          /          \
|130|--131--|131| 18         |132|--132--|133| 18         |134|--133--|135|
    /          \ GLASS /          \ GLASS    /          \
  249           250     251         252         253         254
    /          \          /          \          /          \
|132|--133--|133| 18         |134|--134--|135| 18         |136|--135--|137|
    /          \ GLASS /          \ GLASS    /          \
  255           256     257         258         259         260
    /          \          /          \          /          \
|134|--135--|135| 18         |136|--136--|137| 18         |138|--137--|139|
    /          \ GLASS /          \ GLASS    /          \
  261           262     263         264         265         266
    /          \          /          \          /          \
|136|--137--|137| 18         |138|--138--|139| 18         |140|--139--|141|
    /          \ GLASS /          \ GLASS    /          \
  267           268     269         270         271         272
    /          \          /          \          /          \
|138|--139--|139| 18         |140|--140--|141| 18         |142|--141--|143|
    /          \ GLASS /          \ GLASS    /          \
  273           274     275         276         277         278
    /          \          /          \          /          \
|140|--141--|141| 18         |142|--142--|143| 18         |144|--143--|145|
    /          \ GLASS /          \ GLASS    /          \
  279           280     281         282         283         284
    /          \          /          \          /          \
|142|--143--|143| 18         |144|--144--|145| 18         |146|--145--|147|
    /          \ GLASS /          \ GLASS    /          \
  285           286     287         288         289         290
    /          \          /          \          /          \
|144|--145--|145| 18         |146|--146--|147| 18         |148|--147--|149|
    /          \ GLASS /          \ GLASS    /          \
  291           292     293         294         295         296
    /          \          /          \          /          \
|146|--147--|147| 18         |148|--148--|149| 18         |150|--149--|151|
    /          \ GLASS /          \ GLASS    /          \
  297           298     299         300         301         302
    /          \          /          \          /          \
|148|--149--|149| 18         |150|--150--|151| 18         |152|--151--|153|
    /          \ GLASS /          \ GLASS    /          \
  303           304     305         306         307         308
    /          \          /          \          /          \
|150|--151--|151| 18         |152|--152--|153| 18         |154|--153--|155|
    /          \ GLASS /          \ GLASS    /          \
  309           310     311         312         313         314
    /          \          /          \          /          \
|152|--153--|153| 18         |154|--154--|155| 18         |156|--155--|157|
    /          \ GLASS /          \ GLASS    /          \
  315           316     317         318         319         320
    /          \          /          \          /          \
|154|--155--|155| 18         |156|--156--|157| 18         |158|--157--|159|
    /          \ GLASS /          \ GLASS    /          \
  321           322     323         324         325         326
    /          \          /          \          /          \
|156|--157--|157| 18         |158|--158--|159| 18         |160|--159--|161|
    /          \ GLASS /          \ GLASS    /          \
  327           328     329         330         331         332
    /          \          /          \          /          \
|158|--159--|159| 18         |160|--160--|161| 18         |162|--161--|163|
    /          \ GLASS /          \ GLASS    /          \
  333           334     335         336         337         338
    /          \          /          \          /          \
|160|--161--|161| 18         |162|--162--|163| 18         |164|--163--|165|
    /          \ GLASS /          \ GLASS    /          \
  339           340     341         342         343         344
    /          \          /          \          /          \
|162|--163--|163| 18         |164|--164--|165| 18         |166|--165--|167|
    /          \ GLASS /          \ GLASS    /          \
  345           346     347         348         349         350
    /          \          /          \          /          \
|164|--165--|165| 18         |166|--166--|167| 18         |168|--167--|169|
    /          \ GLASS /          \ GLASS    /          \
  351           352     353         354         355         356
    /          \          /          \          /          \
|166|--167--|167| 18         |168|--168--|169| 18         |170|--169--|171|
    /          \ GLASS /          \ GLASS    /          \
  357           358     359         360         361         362
    /          \          /          \          /          \
|168|--169--|169| 18         |170|--170--|171| 18         |172|--171--|173|
    /          \ GLASS /          \ GLASS    /          \
  363           364     365         366         367         368
    /          \          /          \          /          \
|170|--171--|171| 18         |172|--172--|173| 18         |174|--173--|175|
    /          \ GLASS /          \ GLASS    /          \
  369           370     371         372         373         374
    /          \          /          \          /          \
|172|--173--|173| 18         |174|--174--|175| 18         |176|--175--|177|
    /          \ GLASS /          \ GLASS    /          \
  375           376     377         378         379         380
    /          \          /          \          /          \
|174|--175--|175| 18         |176|--176--|177| 18         |178|--177--|179|
    /          \ GLASS /          \ GLASS    /          \
  381           382     383         384         385         386
    /          \          /          \          /          \
|176|--177--|177| 18         |178|--178--|179| 18         |180|--179--|181|
    /          \ GLASS /          \ GLASS    /          \
  387           388     389         390         391         392
    /          \          /          \          /          \
|178|--179--|179| 18         |180|--180--|181| 18         |182|--181--|183|
    /          \ GLASS /          \ GLASS    /          \
  393           394     395         396         397         398
    /          \          /          \          /          \
|180|--181--|181| 18         |182|--182--|183| 18         |184|--183--|185|
    /          \ GLASS /          \ GLASS    /          \
  399           400     401         402         403         404
    /          \          /          \          /          \
|182|--183--|183| 18         |184|--184--|185| 18         |186|--185--|187|
    /          \ GLASS /          \ GLASS    /          \
  405           406     407         408         409         410
    /          \          /          \          /          \
|184|--185--|185| 18         |186|--186--|187| 18         |188|--187--|189|
    /          \ GLASS /          \ GLASS    /          \
  411           412     413         414         415         416
    /          \          /          \          /          \
|186|--187--|187| 18         |188|--188--|189| 18         |190|--189--|191|
    /          \ GLASS /          \ GLASS    /          \
  417           418     419         420         421         422
    /          \          /          \          /          \
|188|--189--|189| 18         |190|--190--|191| 18         |192|--191--|193|
    /          \ GLASS /          \ GLASS    /          \
  423           424     425         426         427         428
    /          \          /          \          /          \
|190|--191--|191| 18         |192|--192--|193| 18         |194|--193--|195|
    /          \ GLASS /          \ GLASS    /          \
  429           430     431         432         433         434
    /          \          /          \          /          \
|192|--193--|193| 18         |194|--194--|195| 18         |196|--195--|197|
    /          \ GLASS /          \ GLASS    /          \
  435           436     437         438         439         440
    /          \          /          \          /          \
|194|--195--|195| 18         |196|--196--|197| 18         |198|--197--|199|
    /          \ GLASS /          \ GLASS    /          \
  441           442     443         444         445         446
    /          \          /          \          /          \
|196|--197--|197| 18         |198|--198--|199| 18         |200|--199--|201|
    /          \ GLASS /          \ GLASS    /          \
  447           448     449         450         451         452
    /          \          /          \          /          \
|198|--199--|199| 18         |200|--200--|201| 18         |202|--201--|203|
    /          \ GLASS /          \ GLASS    /          \
  453           454     455         456         457         458
    /          \          /          \          /          \
|200|--201--|201| 18         |202|--202--|203| 18         |204|--203--|205|
    /          \ GLASS /          \ GLASS    /          \
  459           460     461         462         463         464
    /          \          /          \          /          \
|202|--203--|203| 18         |204|--204--|205| 18         |206|--205--|207|
    /          \ GLASS /          \ GLASS    /          \
  465           466     467         468         469         470
    /          \          /          \          /          \
|204|--205--|205| 18         |206|--206--|207| 18         |208|--207--|209|
    /          \ GLASS /          \ GLASS    /          \
  471           472     473         474         475         476
    /          \          /          \          /          \
|206|--207--|207| 18         |208|--208--|209| 18         |210|--209--|211|
    /          \ GLASS /          \ GLASS    /          \
  477           478     479         480         481         482
    /          \          /          \          /          \
|208|--209--|209| 18         |210|--210--|211| 18         |212|--211--|213|
    /          \ GLASS /          \ GLASS    /          \
  483           484     485         486         487         488
    /          \          /          \          /          \
|210|--211--|211| 18         |212|--212--|213| 18         |214|--213--|215|
    /          \ GLASS /          \ GLASS    /          \
  489           490     491         492         493         494
    /          \          /          \          /          \
|212|--213--|213| 18         |214|--214--|215| 18         |216|--215--|217|
    /          \ GLASS /          \ GLASS    /          \
  495           496     497         498         499         500
    /          \          /          \          /          \
|214|--215--|215| 18         |216|--216--|217| 18         |218|--217--|219|
    /          \ GLASS /          \ GLASS    /          \
  501           502     503         504         505         506
    /          \          /          \          /          \
|216|--217--|217| 18         |218|--218--|219| 18         |220|--219--|221|
    /          \ GLASS /          \ GLASS    /          \
  507           508     509         510         511         512
    /          \          /          \          /          \
|218|--219--|219| 18         |220|--220--|221| 18         |222|--221--|223|
    /          \ GLASS /          \ GLASS    /          \
  513           514     515         516         517         518
    /          \          /          \          /          \
|220|--221--|221| 18         |222|--222--|223| 18         |224|--223--|225|
    /          \ GLASS /          \ GLASS    /          \
  519           520     521         522         523         524
    /          \          /          \          /          \
|222|--223--|223| 18         |224|--224--|225| 18         |226|--225--|227|
    /          \ GLASS /          \ GLASS    /          \
  525           526     527         528         529         530
    /          \          /          \          /          \
|224|--225--|225| 18         |226|--226--|227| 18         |228|--227--|229|
    /          \ GLASS /          \ GLASS    /          \
  531           532     533         534         535         536
    /          \          /          \          /          \
|226|--227--|227| 18         |228|--228--|229| 18         |230|--229--|231|
    /          \ GLASS /          \ GLASS    /          \
  537           538     539         540         541         542
    /          \          /          \          /          \
|228|--229--|229| 18         |230|--230--|231| 18         |232|--231--|233|
    /          \ GLASS /          \ GLASS    /          \
  543           544     545         546         547         548
    /          \          /          \          /          \
|230|--231--|231| 18         |232|--232--|233| 18         |234|--233--|235|
    /          \ GLASS /          \ GLASS    /          \
  549           550     551         552         553         554
    /          \          /          \          /          \
|232|--233--|233| 18         |234|--234--|235| 18         |236|--235--|237|
    /          \ GLASS /          \ GLASS    /          \
  555           556     557         558         559         560
    /          \          /          \          /          \
|234|--235--|235| 18         |236|--236--|237| 18         |238|--237--|239|
    /          \ GLASS /          \ GLASS    /          \
  561           562     563         564         565         566
    /          \          /          \          /          \
|236|--237--|237| 18         |238|--238--|239| 18         |240|--239--|241|
    /          \ GLASS /          \ GLASS    /          \
  567           568     569         570         571         572
    /          \          /          \          /          \
|238|--239--|239| 18         |240|--240--|241| 18         |242|--241--|243|
    /          \ GLASS /          \ GLASS    /          \
  573           574     575         576         577         578
    /          \          /          \          /          \
|240|--241--|241| 18         |242|--242--|243| 18         |244|--243--|245|
    /          \ GLASS /          \ GLASS    /          \
  579           580     581         582         583         584
    /          \          /          \          /          \
|242|--243--|243| 18         |244|--244--|245| 18         |246|--245--|247|
    /          \ GLASS /          \ GLASS    /          \
  585           586     587         588         589         590
    /          \          /          \          /          \
|244|--245--|245| 18         |246|--246--|247| 18         |248|--247--|249|
    /          \ GLASS /          \ GLASS    /          \
  591           592     593         594         595         596
    /          \          /          \          /          \
|246|--247--|247| 18         |248|--248--|249| 18         |250|--249--|251|
    /          \ GLASS /          \ GLASS    /          \
  597           598     599         600         601         602
    /          \          /          \          /          \
|248|--249--|249| 18         |250|--250--|251| 18         |252|--251--|253|
    /          \ GLASS /          \ GLASS    /          \
  603           604     605         606         607         608
    /          \          /          \          /          \
|250|--251--|251| 18         |252|--252--|253| 18         |254|--253--|255|
    /          \ GLASS /          \ GLASS    /          \
  609           610     611         612         613         614
    /          \          /          \          /          \
|252|--253--|253| 18         |254|--254--|255| 18         |256|--255--|257|
    /          \ GLASS /          \ GLASS    /          \
  615           616     617         618         619         620
    /          \          /          \          /          \
|254|--255--|255| 18         |256|--256--|257| 18         |258|--257--|259|
    /          \ GLASS /          \ GLASS    /          \
  621           622     623         624         625         626
    /          \          /          \          /          \
|256|--257--|257| 18         |258|--258--|259| 18         |260|--259--|261|
    /          \ GLASS /          \ GLASS    /          \
  627           628     629         630         631         632
    /          \          /          \          /          \
|258|--259--|259| 18         |260|--260--|261| 18         |262|--261--|263|
    /          \ GLASS /          \ GLASS    /          \
  633           634     635         636         637         638
    /          \          /          \          /          \
|260|--261--|261| 18         |262|--262--|263| 18         |264|--263--|265|
    /          \ GLASS /          \ GLASS    /          \
  639           640     641         642         643         644
    /          \          /          \          /          \
|262|--263--|263| 18         |264|--264--|265| 18         |266|--265--|267|
    /          \ GLASS /          \ GLASS    /          \
  645           646     647         648         649         650
    /          \          /          \          /          \
|264|--265--|265| 18         |266|--266--|267| 18         |268|--267--|269|
    /          \ GLASS /          \ GLASS    /          \
  651           652     653         654         655         656
    /          \          /          \          /          \
|266|--267--|267| 18         |268|--268--|269| 18         |270|--269--|271|
    /          \ GLASS /          \ GLASS    /          \
  657           658     659         660         661         662
    /          \          /          \          /          \
|268|--269--|269| 18         |270|--270--|271| 18         |272|--271--|273|
    /          \ GLASS /          \ GLASS    /          \
  663           664     665         666         667         668
    /          \          /          \          /          \
|270|--271--|271| 18         |272|--272--|273| 18         |274|--273--|275|
    /          \ GLASS /          \ GLASS    /          \
  669           670     671         672         673         674
    /          \          /          \          /          \
|272|--273--|273| 18         |274|--274--|275| 18         |276|--275--|277|
    /          \ GLASS /          \ GLASS    /          \
  675           676     677         678         679         680
    /          \          /          \          /          \
|274|--275--|275| 18         |276|--276--|277| 18         |278|--277--|279|
    /          \ GLASS /          \ GLASS    /          \
  681           682     683         684         685         686
    /          \          /          \          /          \
|276|--277--|277| 18         |278|--278--|279| 18         |280|--279--|281|
    /          \ GLASS /          \ GLASS    /          \
  687           688     689         690         691         692
    /          \          /          \          /          \
|278|--279--|279| 18         |280|--280--|281| 18         |282|--281--|283|
    /          \ GLASS /          \ GLASS    /          \
  693           694     695         696         697         698
    /          \          /          \          /          \
|280|--281--|281| 18         |282|--282--|283| 18         |284|--283--|285|
    /          \ GLASS /          \ GLASS    /          \
  699           700     701         
```

```

> 14
You cannot build here.
Basements already exist as locations: 0 2 10 13
Builder Yellow where do you want to build a basement? [end] to end game, [print] to print the board.
> 18
Builder Orange where do you want to build a basement? [end] to end game, [print] to print the board.
> 43
Builder Red where do you want to build a basement? [end] to end game, [print] to print the board.
> 52
Builder Blue where do you want to build a basement? [end] to end game, [print] to print the board.
> 4

```



We are now in the round of “rolling dice to get resource”, order of “blue—red—orange—yellow—blue....”

Type *help* to see all the command you can enter.

```

Builder Blue's turn.
> help
Valid commands:
~ load : changes current builder's dice type to 'loaded'
~ fair : changes current builder's dice type to 'fair'
~ roll : rolls the dice and distributes resources.
~ status : prints the current status of all builders in order from builder 0 to 3.
~ help : prints out the list of commands.
~ end: end the game now.
> █

```

load: set the dice to loaded (which is default)

fair: set the dice to fair

```

> load
Builder Blue now has loaded Dice.
> fair
Builder Blue now has fair Dice.
> load
Builder Blue now has loaded Dice.
> █

```

status: print the current status of all builders

```

> status
Builder Blue   has 2 building points, 0 BRICK, 0 ENERGY, 0 GLASS, 0 HEAT, 0 WIFI.
Builder Red    has 2 building points, 0 BRICK, 0 ENERGY, 0 GLASS, 0 HEAT, 0 WIFI.
Builder Orange has 2 building points, 0 BRICK, 0 ENERGY, 0 GLASS, 0 HEAT, 0 WIFI.
Builder Yellow has 2 building points, 0 BRICK, 0 ENERGY, 0 GLASS, 0 HEAT, 0 WIFI.
> █

```

end: end the game, and automatically save the information of the game into “*backup.sv*” (we will come to this later)

let's roll the loaded dice: type *roll + enter*

```

> roll
Input a roll between 2 and 12:
> █

```

Again, it will keep reading input until you enter a valid number.

Assume we roll *10*

```
Builder Blue's turn.  
> roll  
Input a roll between 2 and 12:  
> 1  
Invalid roll 1.  
> -1  
ERROR: isn't a valid integer.  
> what  
ERROR: isn't a valid integer.  
> 13  
Invalid roll 13.  
> 10  
The number you rolled is 10.  
Builder Red gained:  
1 ENERGY  
Builder Orange gained:  
1 ENERGY  
Builder Yellow gained:  
1 HEAT  
Enter a command:  
> █
```

10 is a valid roll. And when we check the board, block 1 (ENERGY) has number 10, and since we have RB and OB in block 1, so Red and Orange each gets one ENERGY. Also block 5(HEAT) has number 11, since YB is in block 5, so Yellow gets a HEAT.

Type *next* to let yellow roll, to test another situation of rolling a loaded dice
Again we *roll* the loaded dice, this time, we roll *3* and see what happens

```
Builder Red's turn.  
> roll  
Input a roll between 2 and 12:  
> 3  
The number you rolled is 3.  
Builder Blue gained:  
2 BRICK  
Enter a command:  
> █
```


There are **two BB in block 0** (number 3), so Blue gains **two BRICK** from block 0.

Type **next** to let yellow rolls, to test another situation of rolling a loaded dice

We now **roll 7**, and we can choose where to put **geese**!

(since no player has more than 10 resources, so nobody loses resource. I will test this in 4.Loading a board)

```
Builder Orange's turn.  
> roll  
Input a roll between 2 and 12:  
> 7  
The number you rolled is 7.  
Choose where to place the GEESE.  
> █
```

Type **13**

(Also here, it will keep asking you until you input a valid number)

```
> 7  
The number you rolled is 7.  
Choose where to place the GEESE.  
> ?  
ERROR: Choose where to place the GEESE. isn't a valid integer.  
> 13  
Builder Orange has no builders to steal from.  
> Enter a command:  
> █
```

Since in block7, there is only one OB, and that **YOU CANNOT STEAL YOURSELF**, so orange has no one to steal.

Geese appears in the board (type **board**):


```
[RB] --71
Builder Yellow's turn.
> roll
Input a roll between 2 and 12:
> 7
The number you rolled is 7.
Choose where to place the GEESE.
> 0
Builder Yellow can choose to steal from > Blue.
Choose a builder to steal from.
> Red
They can't be stolen from.
Choose a builder to steal from.
> Blue
Builder Yellow steals BRICK from builder Blue.
Enter a command:
> █
```

Since there are two BB in block 0, so it you can ONLY steal from blue. When asking who to steal from, you have to enter a valid color to steal. Since so far blue has only 2 BRICK, so it automatically steals one BRICK from blue.

Type *next* to test another situation

Here we *roll + enter + 9* to give red some resource for testing. And enter *next*.

Type *status* to see the current status.

Type *roll + enter + 7* to put the geese at position *15*

```

      0
    /   \
  |RB|-- 3--| 3|   BRICK 3   |BB|-- 4--| 5|
    /       \       /       \
  5           6       7       8
    /       \       /       \
  | 6|-- 9--| 7|   ENERGY 10   | 8|--10--| 9|   HEAT 5   |YB|--11--|11|
    /       \       /       \
  12          13       14       15       16       17
    /       \       /       \       /       \
|12|   ENERGY 4   |OB|--18--|14|   PARK 4   |15|--19--|16|   HEAT 10   |17|
    /       \       /       \       /       \
  20          21       22       23       24       25
    /       \       /       \       /       \
  |YB|--26--|19|   GLASS 6   |20|--27--|21|   BRICK 7   |22|--28--|23|
    /       \       /       \       /       \
  29          30       31       32       33       34
    /       \       /       \       /       \
|24|   HEAT 8   |25|--35--|26|   BRICK 9   |27|--36--|28|   BRICK 10   |29|
    /       \       /       \       /       \
  37          38       39       40       41       42
    /       \       /       \       /       \
  |30|--43--|31|   ENERGY 11   |32|--44--|33|   WIFI 12   |34|--45--|35|
    /       \       /       \       /       \
  46          47       48       49       50       51
    /       \       /       \       /       \
|36|   ENERGY 13   |37|--52--|38|   WIFI 14   |39|--53--|40|   GLASS 15   |41|
    /       \       /       \       /       \
  54          55       56       57       58       59
    /       \       /       \       /       \
  |42|--60--|OB|   WIFI 16   |44|--61--|45|   GLASS 17   |46|--62--|47|
    /       \       /       \       /       \
  63          64       65       66
    /       \       /       \       /       \
  |48|--67--|49|   GLASS 18   |50|--68--|51|
    /       \       /       \       /       \
  69          70
    /       \
  |RB|--71--|53|

Builder Red's turn.
> status
Builder Blue   has 2 building points, 1 BRICK, 0 ENERGY, 0 GLASS, 0 HEAT, 0 WIFI.
Builder Red    has 2 building points, 0 BRICK, 1 ENERGY, 1 GLASS, 0 HEAT, 0 WIFI.
Builder Orange has 2 building points, 0 BRICK, 1 ENERGY, 0 GLASS, 0 HEAT, 0 WIFI.
Builder Yellow has 2 building points, 1 BRICK, 0 ENERGY, 0 GLASS, 0 HEAT, 0 WIFI.
> roll
Input a roll between 2 and 12:
> 7
The number you rolled is 7.
Choose where to place the GEESE.
> 15
Builder Red has no builders to steal from.
> Enter a command:
>

```

Block 15 has no buildings. So for sure Red has no builder to steal from

Type *next* to test another situation

Type *roll + enter + 7* to put the geese at position *1*, steals from *Red*

Type *next* to test another situation

Type *roll + enter + 7* to put the geese at position *1*

```

> roll
Input a roll between 2 and 12:
> 7
The number you rolled is 7.
Choose where to place the GEESE.
> 1
Geese can't move here.
> █

```

Since we have put geese at 1 last turn, and we CANNOT put geese at the same place in two continuous turn of rolling 7, so it requires us to put another place. We type *15* and steals from no one.

Type *next* to test another situation

Type *roll + enter + 7* to put the geese at position *1*

This time, it works

```

> 1
Builder Blue can choose to steal from > Red, Orange.
Choose a builder to steal from.
> orange
Builder Blue steals GLASS from builder Orange.
Enter a command:
> status
Builder Blue   has 2 building points, 1 BRICK, 0 ENERGY, 1 GLASS, 0 HEAT, 0 WIFI.
Builder Red    has 2 building points, 0 BRICK, 1 ENERGY, 0 GLASS, 0 HEAT, 0 WIFI.
Builder Orange has 2 building points, 0 BRICK, 1 ENERGY, 0 GLASS, 0 HEAT, 0 WIFI.
Builder Yellow has 2 building points, 1 BRICK, 0 ENERGY, 0 GLASS, 0 HEAT, 0 WIFI.
Enter a command:
> █

```

We type *Orange*, since Orange has one ENERGY and one GLASS, it randomly steals one resource (GLASS) from orange. Type *status* to check that orange does lose one GLASS and blue does gains one GLASS.

Type *next*

We test fair dice here. Type *fair + roll*

```

Builder Red's turn.
> fair
Builder Red now has fair Dice.
> roll
The number you rolled is 12.
No builders gained resources.
Enter a command:
> █

```

Fair dice **randomly** gives you a valid number (12) and dice number 12 doesn't give any one resources.

So far, we have finish testing all the features in "rolling dice turn" (except geese randomly steals resources from player who has more than 10 resources).

Next, we go to the next turn "operation turn". Type **help** to see all operations

```
Enter a command:
> help
Valid commands :
~ board : prints the current board.
~ status : prints the current status of all builders in order from builder 0 to 3.
~ residences : prints the residences the current builder has currently completed.
~ build - road <road#> : attempts to builds the road at <road#>.
~ build - res <housing#> : attempts to builds a basement at <housing#>.
~ improve <housing#> : attempts to improve the residence at <housing#>.
~ trade <colour> <give> <take> : attempts to trade with builder <colour>, giving one resource of type <give> and receiving one resource of type <take>.
~ market <sell> <buy> : attempts to sell resources on the market, giving four resource of type <sell> and receiving one resource of type <buy>.
~ next : passes control onto the next builder in the game.
~ save <file> : saves the current game state to <file>.
~ help : prints out the list of commands.
~ end : end the game.
Enter a command:
> █
```

We have tested **board**, which just simply print the current board.

We have tested **status**, which presents the current status.

We have tested **next**, which goes to the next person.

end terminates the game, and save the game **into back.sv**

We will test (**residences**, **build-road**, **build-res**, **improve**, **trade**, **market**, **save**) in **4.Loading a board**. They have the same function in all 4 types of game modes. For your convenience, loading a board is easier for testing those features.

Type **end** and we goes to the next mode.

You may check backup.sv, it becomes

```
1 9
2 1 0 1 0 0 r h 0 B 4 B
3 0 1 0 0 0 r h 2 B 52 B
4 0 1 0 0 0 r h 13 B 43 B
5 1 0 0 0 0 r h 10 B 18 B
6 0 3 1 10 3 5 1 4 5 7 3 10 2 11 0 3 3 8 0 2 0 6 1 8 4 12 1 5 4 11 2 4 4 6 2 9 2 9
7 1
8
```

This is the information of the game that we just played.

2. Enter the game with a random board

type `./constructor -random-board`, you can receive different boards randomly.

```
j334hu@ubuntu1804-010:~/cs246/1209/constructor$ ./constructor -random-board
| 0|-- 0--| 1|
|
1      2
|      |
| 2|-- 3--| 3|      0      4|-- 4--| 5|
|      |      ENERGY      |
|      |      11      |
|      |      |      |
5      6      7      8
|      |      |      | | | |
| 6|-- 9--| 7|      1      2      10|--11--|11|
|      |      GLASS      WIFI      |
|      |      10      8      |
|      |      |      |
12     13     14     15     16     17
|      |      |      |      |      |
|12|      3      4      13|--18--|14|      4      15|--19--|16|      5      17|
|      GLASS      HEAT      |      GLASS
|      4      8      |      9
|      |      |      |
20     21     22     23     24     25
|      |      |      |      |      |
|18|--26--|19|      6      7      22|--28--|23|
|      ENERGY      ENERGY      |
|      5      3      |
|      |      |      |
29     30     31     32     33     34
|      |      |      |      |      |
|24|      8      9      27|--36--|28|      10     29|
|      HEAT      WIFI      |      HEAT
|      6      4      |      9
|      |      |      |
37     38     39     40     41     42
|      |      |      |      |      |
|30|--43--|31|      11     12     34|--45--|35|
|      PARK      GLASS      |
|      |      2      |
|      |      |      |
46     47     48     49     50     51
|      |      |      |      |      |
|36|      13     14     39|--53--|40|      15     41|
|      WIFI      BRICK      |      ENERGY
|      5      12      |      11
|      |      |      |
54     55     56     57     58     59
|      |      |      |      |      |
|42|--60--|43|      16     17     46|--62--|47|
|      BRICK      BRICK      |
|      10      6      |
|      |      |      |
63     64     65     66
|      |      |      |
|48|--67--|49|      18     50|--68--|51|
|      BRICK      |
|      3
|      |
69     70
|      |
|52|--71--|53|

Builder Blue where do you want to build a basement? [end] to end game, [print] to print the board.
> |
```

```
j334hu@ubuntu1804-010:~/cs246/1209/constructor$ ./constructor -random-board
      | 0|-- 0--| 1|
      /         \
    1             2
    /             \
  | 2|-- 3--| 3|   0   ENERGY   5   | 4|-- 4--| 5|
    /         \   /         \
  5             6             7             8
  /             \   /             \
| 6|-- 9--| 7|   1   GLASS   12   | 8|--10--| 9|   2   PARK   2   |10|--11--|11|
  /         \   /         \   /         \
12            13            14            15            16            17
|12|          |13|--18--|14|          |15|--19--|16|          |17|
  \         /   \         /   \         /   \         /
20            21            22            23            24            25
|18|--26--|19|          6   BRICK   8   |20|--27--|21|          7   WIFI   11   |22|--28--|23|
  /         \   /         \   /         \   /         \
29            30            31            32            33            34
|24|          |25|--35--|26|          |27|--36--|28|          |29|
  \         /   \         /   \         /   \         /
37            38            39            40            41            42
|30|--43--|31|          11  HEAT   4   |32|--44--|33|          12  ENERGY   9   |34|--45--|35|
  /         \   /         \   /         \   /         \
46            47            48            49            50            51
|36|          |37|--52--|38|          |39|--53--|40|          |15  BRICK   11   |41|
  \         /   \         /   \         /   \         /
54            55            56            57            58            59
|42|--60--|43|          16  BRICK   6   |44|--61--|45|          17  ENERGY   5   |46|--62--|47|
  /         \   /         \   /         \   /         \
63            64            65            66
|48|--67--|49|          18  WIFI   9   |50|--68--|51|
  \         /   \         /   \         /   \         /
69            70
|52|--71--|53|

Builder Blue where do you want to build a basement? [end] to end game, [print] to print the board.
> 
```



```
j334hu@ubuntu1804-010:~/cs246/1209/constructor$ ./constructor -random-board
      | 0|-- 0--| 1|
      /       \
    1           2
    /           \
  | 2|-- 3--| 3|   0
    /       \   GLASS
  5           6   3
  /           \
| 6|-- 9--| 7|   | 4|-- 4--| 5|
 /       \   | 8|--10--| 9|   2
5           7   ENERGY
 /           \   5
|12|         |13|         |14|         |15|         |16|         |17|
 \       /   \       /   \       /   \       /   \
20      12      13      14      15      16      17
 \       /   \       /   \       /   \       /   \
|18|--26--|19|   6       4       7       5
 \       /   BRICK     GLASS     WIFI     BRICK
  21      6       6       10      9
 /       \   6       11      10
|24|         |25|         |26|         |27|         |28|         |29|
 \       /   ENERGY   HEAT     PARK
  37      12      11      11      2
 /       \   11      2
|30|--43--|31|   |32|--44--|33|   |34|--45--|35|
 \       /   11      2
46      13      14      12      15
|36|         |37|         |38|         |39|         |40|         |41|
 \       /   BRICK     HEAT     GLASS     WIFI
  54      5       4       2       4
 /       \   5       10      4
|42|--60--|43|   |44|--61--|45|   |46|--62--|47|
 \       /   8       10
63      16      17
 \       /   WIFI     ENERGY
  55      8      10
 /       \   8
|48|--67--|49|   |50|--68--|51|
 \       /   8
69      18
 \       /   HEAT
  70
 /       \
|52|--71--|53|

Builder Blue where do you want to build a basement? [end] to end game, [print] to print the board.
> |
```

As you can see, those boards are randomly presented (random distribution of resources and dice-number of each block)

You may play your game normally at any random board.

3. Enter the game with a seed

Firstly, enter `./constructor -random-board -seed 9`

[illegible]

You receive a random board that is BASED ON your seed.

i.e. if you try another seed (such as 520) *./constructor -random-board -seed 520*, you get a different board

```
j334hu@ubuntu1804-010:~/cs246/1209/constructor$ ./constructor -random-board -seed 520
      | 0|-- 0--| 1|
      | 1      | 2
      | 2|-- 3--| 3|      0
      | 5      | 6      | 4|-- 4--| 5|
      | 6|-- 9--| 7|      | 8      | 7
      | 12     | 13     | 14     | 15     | 16     | 17
      | 12     | 13     | 14     | 15     | 16     | 17
      | 20     | 21     | 22     | 23     | 24     | 25
      | 18|--26--| 19|      | 20|--27--| 21|      | 22|--28--| 23|
      | 29     | 30     | 31     | 32     | 33     | 34
      | 24     | 25     | 26     | 27     | 28     | 29
      | 37     | 38     | 39     | 40     | 41     | 42
      | 30|--43--| 31|      | 32|--44--| 33|      | 34|--45--| 35|
      | 46     | 47     | 48     | 49     | 50     | 51
      | 36     | 37     | 38     | 39     | 40     | 41
      | 54     | 55     | 56     | 57     | 58     | 59
      | 42|--60--| 43|      | 44|--61--| 45|      | 46|--62--| 47|
      | 63     | 64     | 65     | 66
      | 48|--67--| 49|      | 50|--68--| 51|
      | 69     | 70
      | 52|--71--| 53|

Builder Blue where do you want to build a basement? [end] to end game, [print] to print the board.
> 
```

Same seed will give same board all the time, also, seed will change the randomness of the game!
i.e. if this game is seed 9, and we roll the first fair dice to get 2, then, every time we use this seed to play this game, using the same command, and the first fair dice we roll will be 2 because the seed will control the randomness of the game.

4. Loading a board

to load a game, we need to prepare a file with valid information.

Let's name this file `test1.txt`.

```
1 9
2 1 2 3 4 5 r h 0 B 15 B
3 0 0 0 0 0reside r 21 30 h 2 B 13 B 25 H
4 10 10 10 10 10 r 16 11 17 19 h 4 B 10 B 17 H
5 2 2 2 2 3 r h 6 B 8 B
6 3 11 0 11 2 12 2 8 5 7 2 3 2 5 1 9 3 9 3 4 4 5 1 10 4 2 0 10 4 6 1 6 0 3 0 8 1 4
7 8
8
```

Enter `./constructor -load test1.txt`

Since $\text{term} = 9$, $9 \% 4 = 1$, so it's red's term.

Enter `roll 9`

```
Builder Red's turn.
> roll
Input a roll between 2 and 12:
> 9
The number you rolled is 9.
Builder Blue gained:
1 ENERGY
Enter a command:
> █
```

Since geese is in block 8, so block 8 doesn't provide any resource even if 9 is rolled. Block 7 gives one ENERGY to blue.

Enter `board` and `status` to check that it satisfies test1.txt

Type `residences`

```
> residences
Red has built:
2 B
13 B
25 H
Enter a command:
> █
```

This is also correct

Enter `next`

Enter `roll 7`

```

[52]--71--[53]
Builder Orange's turn.
> roll
Input a roll between 2 and 12:
> 7
The number you rolled is 7.
Builder Blue loses 8 resources to the geese. They lose :
2 ENERGY
3 GLASS
3 WIFI
Builder Orange loses 25 resources to the geese. They lose :
8 BRICK
1 ENERGY
6 GLASS
6 HEAT
4 WIFI
Builder Yellow loses 5 resources to the geese. They lose :
1 BRICK
1 GLASS
2 HEAT
1 WIFI
Choose where to place the GEESE.
> 18
Builder Orange has no builders to steal from.
> Enter a command:
> █

```

Since blue has 16 (≥ 10) resources, blue randomly loses 8 ($16/2$) resources to geese.
 Since orange has 50 (≥ 10) resources, orange randomly loses 25 ($50/2$) resources to geese.
 Since yellow has 11 (≥ 10) resources, yellow randomly loses 5 ($11/2$) resources to geese.
 Put geese at **18**

Check status:

Enter **status** (notice: since the resources are randomly lost, so status may be different when you are testing here)

```

> status
Builder Blue   has 2 building points, 1 BRICK, 1 ENERGY, 0 GLASS, 4 HEAT, 2 WIFI.
Builder Red    has 4 building points, 1 BRICK, 1 ENERGY, 1 GLASS, 0 HEAT, 1 WIFI.
Builder Orange has 4 building points, 2 BRICK, 9 ENERGY, 4 GLASS, 4 HEAT, 6 WIFI.
Builder Yellow has 2 building points, 1 BRICK, 2 ENERGY, 1 GLASS, 0 HEAT, 2 WIFI.
Enter a command:
> █

```

It changes.

Now let's test **improve**

Enter **improve**

Again, it needs valid input: number between 0 and 53 inclusive

```

> improve
> -1
ERROR:  isn't a valid integer.
> 54
Invalid residence.
> █

```

If the position is empty: enter *improve 53*

```

> improve
> 53
Invalid residence.
Enter a command:
> █

```

Same situation happens if the position has other player's building: *improve 0*

```

> improve
> 0
Invalid residence.
Enter a command:
> █

```

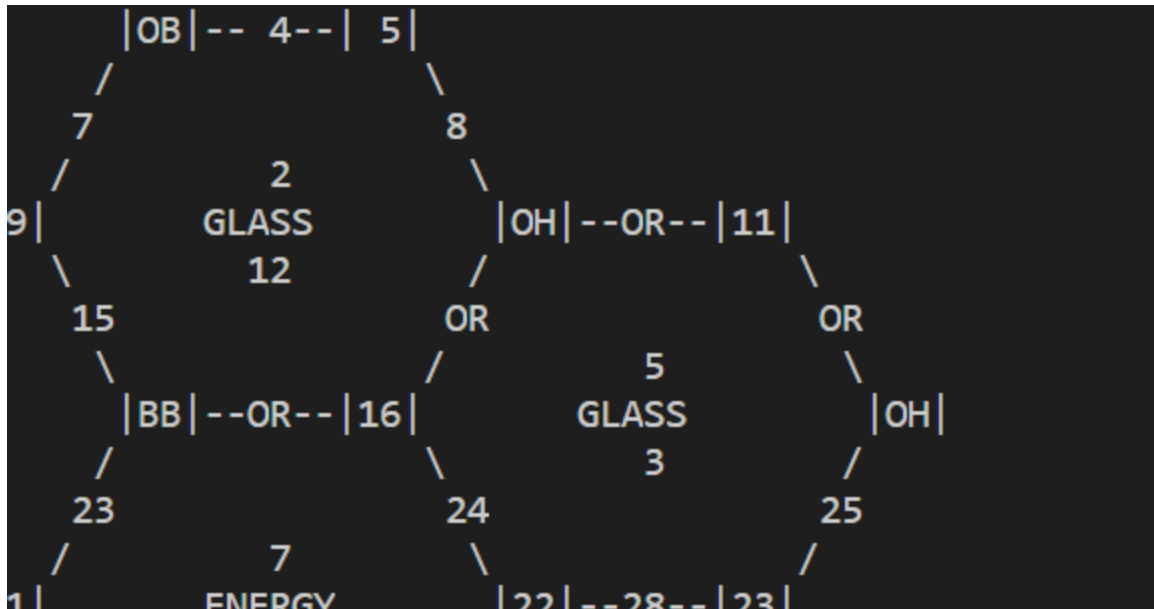
if you have enough resources and improve your basement: *improve 10 status*

```

> status
Builder Blue   has 2 building points, 1 BRICK, 1 ENERGY, 0 GLASS, 4 HEAT, 2 WIFI.
Builder Red    has 4 building points, 1 BRICK, 1 ENERGY, 1 GLASS, 0 HEAT, 1 WIFI.
Builder Orange has 5 building points, 2 BRICK, 9 ENERGY, 2 GLASS, 1 HEAT, 6 WIFI.
Builder Yellow has 2 building points, 1 BRICK, 2 ENERGY, 1 GLASS, 0 HEAT, 2 WIFI.
Enter a command:
> █

```

Enter *board*



Status and board have been updated.

Type *end*

Using test1.txt again: *./constructor -load test1.txt*

Enter: *roll 4*

If you don't have enough resource, you may not improve anything

Enter: *improve 2*: (try to improve a basement)

```
Enter a command:
> improve
> 2
> You do not have enough resources.

The cost to improve a Basement to a House is two GLASS and three HEAT resource.
The cost to improve a House to a Tower is three BRICK, two ENERGY, two GLASS, one WIFI, and two HEAT.
Enter a command:
> █
```

Enter : *improve 25* (try to improve a house)

```
Enter a command:
> improve
> 25
> You do not have enough resources.

The cost to improve a Basement to a House is two GLASS and three HEAT resource.
The cost to improve a House to a Tower is three BRICK, two ENERGY, two GLASS, one WIFI, and two HEAT.
Enter a command:
> █
```

Enter *next roll 4*

Enter *improve 17* (successfully improve a house to tower)

You may enter *board*, *status*, *residences* to see the data being updated.

Enter *save res1.txt*, then you can see the game saved in the file res1.txt that you may continue playing in the future by entering *./constructor -load res1.txt*

End *end*

Testing build-res + build-road

Using file `test2.txt`:

```
test2.txt
1 9
2 1 2 3 4 5 r h 0 B 15 B
3 1 1 1 0 0 r 21 30 26 h 2 B 13 B 25 H
4 100 100 100 100 100 r 16 70 71 11 17 28 25 19 h 4 B 10 B 17 H 50 T 52 H
5 2 2 2 2 3 r h 6 B 8 B
6 3 11 0 11 2 12 2 8 5 7 2 3 2 5 1 9 3 9 3 4 4 5 1 10 4 2 0 10 4 6 1 6 0 3 0 8 1 4
7 8
8
```

Enter: `./constructor -load test2.txt`

Enter: `roll 2`

When doesn't have enough resource but trying to build-road: `build-road 11 build-road 18`

```
Enter a command:
> build-road
> 11
You do not have enough resources.
The cost of a Road is one HEAT and one WIFI resource.
> You cannot build here.
Enter a command:
> build-road
> 18
You do not have enough resources.
The cost of a Road is one HEAT and one WIFI resource.
> You cannot build here.
Enter a command:
> 
```

When doesn't have enough resource but trying to build-res: `build-res 18`

```
Enter a command:
> build-res
> 2
You do not have enough resources.
The cost of a Basement is one BRICK, one ENERGY, one GLASS, and one WIFI resource.
Enter a command:
> 
```

Enter: `next roll 2`

When trying to build-road at invalid position: `build-road 500`


```
Enter a command:
> build-road
> 500
> You cannot build here.
Enter a command:
> █
```

When the position already has a road: *build-road 70*

```
> build-road
> 70
> You cannot build here.
Enter a command:
> █
```

When the position is empty but not connected with the current player's building: *build-road 0*

```
Enter a command:
> build-road
> 0
> You cannot build here.
Enter a command:
> █
```

When try to build a road (connected to the current player's road but also connect to a another player's building): *build-road 27*

```
Enter a command:
> build-road
> 23
> You cannot build here.
Enter a command:
> █
```

When successfully build a road at a empty place that is connect to the current player's another road: *build-road 24*

```
Enter a command:
> build-road
> 24
> Builder Orange successfully built a Road at 24.
Enter a command:
```

When successfully build a road at a empty place that is connect to the current player's building: *build-road 69*

```
> 69
> Builder Orange successfully built a Road at 69.
Enter a command:
> 
```

You may use *board*, *status* to check that the data has been updated after building roads.

Now test build-res

When input is invalid:

```
> build-res
> ?
ERROR:  isn't a valid integer.
> 55
> You cannot build here.
Enter a command:
> 
```

When the current position has a building already: *build-res 52*

```
Enter a command:
> build-res
> 52
> You cannot build here.
Enter a command:
> 
```

When the position is empty, but it is connected to other buildings: *build-res 53*

```
Enter a command:
> build-res
> 53
> You cannot build here.
Enter a command:
> 
```

When the position is empty, not connected to any building, but not connected to the current player's road: *build-res 18*

```
Enter a command:
> build-res
> 18
> You cannot build here.
Enter a command:
> 
```

When successfully build a basement: *build-res 22*

```
> build-res
> 22
> Builder Orange successfully built a Basement at 22.
Would you like to play again?
> █
```

After building a basement at 22, orange's points increases from 9 to 10, the game end. Then you may choose to play again (yes) or quit (no).

If you want to play again: enter *yes*

```
Would you like to play again?
> yes

      | 0|-- 0--| 1|
      /       \
    1           2
    /           \
  | 2|-- 3--| 3|   0
    /       \   HEAT
  5           6   11
    /       \   /
  | 6|-- 9--| 7|   1
    /       \   BRICK
  12          13   11
    /       \   /
|12|          14   4
  /       \   PARK
 20          21   11
  /       \   /
|18|--26--|19|   6
  /       \   GLASS
 29          30   5
  /       \   /
|24|          31   8
  /       \   HEAT
 37          38   9
  /       \   /
|30|--43--|31|   11
  /       \   ENERGY
 46          47   10
  /       \   /
|36|          48   13
  /       \   BRICK
 54          55   10
  /       \   /
|42|--60--|43|   16
  /       \   BRICK
 63          64   3
  /       \   /
|48|--67--|49|   18
  /       \   ENERGY
 69          70   4
  /       \   /
|52|--71--|53|

Builder Blue where do you want to build a basement? [end] to end game, [print] to print the board.
> █
```

It uses the same graph, start from the beginning.

Now let's test trade and market

Enter *./constructor -load test2.txt*

Enter *roll 2 status*

```
Builder Red's turn.  
> roll  
Input a roll between 2 and 12:  
> 2  
The number you rolled is 2.  
No builders gained resources.  
Enter a command:  
> status  
Builder Blue   has 2 building points, 1 BRICK, 2 ENERGY, 3 GLASS, 4 HEAT, 5 WIFI.  
Builder Red    has 4 building points, 1 BRICK, 1 ENERGY, 1 GLASS, 0 HEAT, 0 WIFI.  
Builder Orange has 9 building points, 100 BRICK, 100 ENERGY, 100 GLASS, 100 HEAT, 100 WIFI.  
Builder Yellow has 2 building points, 2 BRICK, 2 ENERGY, 2 GLASS, 2 HEAT, 3 WIFI.  
Enter a command:  
> 
```

You cannot trade with yourself: *trade Red ENERGY HEAT*

```
Enter a command:  
> trade  
> Red  
> ENERGY  
> HEAT  
> Can't trade with yourself.  
Enter a command:  
> 
```

If you don't have enough resource but trade with others: *trade Orange WIFI BRICK*

```
Enter a command:  
> trade  
> Orange  
> WIFI  
> BRICK  
> You don't have enough ENERGY.  
Enter a command:  
> 
```

Enter *next roll 2 status*

When you have enough resource but the people you are trading don't have the resource that you want: *trade Red GLASS HEAT*

```
> tarde
Invalid command.
Please enter 'help' for a list of valid commands.
Enter a command:
> trade
> Red
> GLASS
> HEAT
> Red doesn't have enough HEAT.
Enter a command:
> █
```

Also, do not trade the same resource: *trade Red BRICK BRICK*

```
Enter a command:
> trade
> Red
> BRICK
> BRICK
> Why are you trading for the same resource...
Enter a command:
> █
```

If the trade is valid: *trade Red WIFI BRICK*

And Red refuse to trade: *no*

Status remain same: *status*

```

Enter a command:
> status
Builder Blue   has 2 building points, 1 BRICK, 2 ENERGY, 3 GLASS, 4 HEAT, 5 WIFI.
Builder Red    has 4 building points, 1 BRICK, 1 ENERGY, 1 GLASS, 0 HEAT, 0 WIFI.
Builder Orange has 9 building points, 100 BRICK, 100 ENERGY, 100 GLASS, 100 HEAT, 100 WIFI.
Builder Yellow has 2 building points, 2 BRICK, 2 ENERGY, 2 GLASS, 2 HEAT, 3 WIFI.
Enter a command:
> trade
> Red
> WIFI
> BRICK
> > > Orange offers Red one WIFI for one BRICK.
Does Red accept this offer?
> no
Red declined the trade.
Enter a command:
> status
Builder Blue   has 2 building points, 1 BRICK, 2 ENERGY, 3 GLASS, 4 HEAT, 5 WIFI.
Builder Red    has 4 building points, 1 BRICK, 1 ENERGY, 1 GLASS, 0 HEAT, 0 WIFI.
Builder Orange has 9 building points, 100 BRICK, 100 ENERGY, 100 GLASS, 100 HEAT, 100 WIFI.
Builder Yellow has 2 building points, 2 BRICK, 2 ENERGY, 2 GLASS, 2 HEAT, 3 WIFI.
Enter a command:
> █

```

If the trade is valid: *trade Red WIFI BRICK*

And Red agree to trade: *yes*

Status change: *status*

```

Enter a command:
> trade
> Red
> WIFI
> BRICK
> > > Orange offers Red one WIFI for one BRICK.
Does Red accept this offer?
> yes
Orange gains one BRICK and loses one WIFI,
Red gains one WIFI and loses one BRICK.
Enter a command:
> status
Builder Blue   has 2 building points, 1 BRICK, 2 ENERGY, 3 GLASS, 4 HEAT, 5 WIFI.
Builder Red    has 4 building points, 0 BRICK, 1 ENERGY, 1 GLASS, 0 HEAT, 1 WIFI.
Builder Orange has 9 building points, 101 BRICK, 100 ENERGY, 100 GLASS, 100 HEAT, 99 WIFI.
Builder Yellow has 2 building points, 2 BRICK, 2 ENERGY, 2 GLASS, 2 HEAT, 3 WIFI.
Enter a command:
> █

```

Enter *next roll 2 status*

```

Enter a command:
> status
Builder Blue   has 2 building points, 1 BRICK, 2 ENERGY, 3 GLASS, 4 HEAT, 5 WIFI.
Builder Red    has 4 building points, 0 BRICK, 1 ENERGY, 1 GLASS, 0 HEAT, 1 WIFI.
Builder Orange has 9 building points, 101 BRICK, 100 ENERGY, 100 GLASS, 100 HEAT, 99 WIFI.
Builder Yellow has 2 building points, 2 BRICK, 2 ENERGY, 2 GLASS, 2 HEAT, 3 WIFI.
Enter a command:
> █

```

Now let's test market

If you don't have enough resource (<4) but you try to market: *market WIFI HEAT status*

Market failed, and status remains same:

```

Enter a command:
> market
> WIFI
> HEAT
You don't have enough WIFI. You need 4. Enter a command:
> status
Builder Blue    has 2 building points, 1 BRICK, 2 ENERGY, 3 GLASS, 4 HEAT, 5 WIFI.
Builder Red     has 4 building points, 0 BRICK, 1 ENERGY, 1 GLASS, 0 HEAT, 1 WIFI.
Builder Orange  has 9 building points, 101 BRICK, 100 ENERGY, 100 GLASS, 100 HEAT, 99 WIFI.
Builder Yellow  has 2 building points, 2 BRICK, 2 ENERGY, 2 GLASS, 2 HEAT, 3 WIFI.
Enter a command:
> █

```

Enter next roll 2

When successfully market: *market HEAT WIFI status*

```

Enter a command:
> market
> HEAT
> WIFI
Blue gains one WIFI and loses four HEAT.
Enter a command:
> status
Builder Blue    has 2 building points, 1 BRICK, 2 ENERGY, 3 GLASS, 0 HEAT, 6 WIFI.
Builder Red     has 4 building points, 0 BRICK, 1 ENERGY, 1 GLASS, 0 HEAT, 1 WIFI.
Builder Orange  has 9 building points, 101 BRICK, 100 ENERGY, 100 GLASS, 100 HEAT, 99 WIFI.
Builder Yellow  has 2 building points, 2 BRICK, 2 ENERGY, 2 GLASS, 2 HEAT, 3 WIFI.
Enter a command:
> █

```

Also, you may not market the same resource: *market WIFI WIFI*

```

Enter a command:
> market
> wifi
> wifi
> Why are you buying the same resource?
Enter a command:
> █

```

Enter *end*

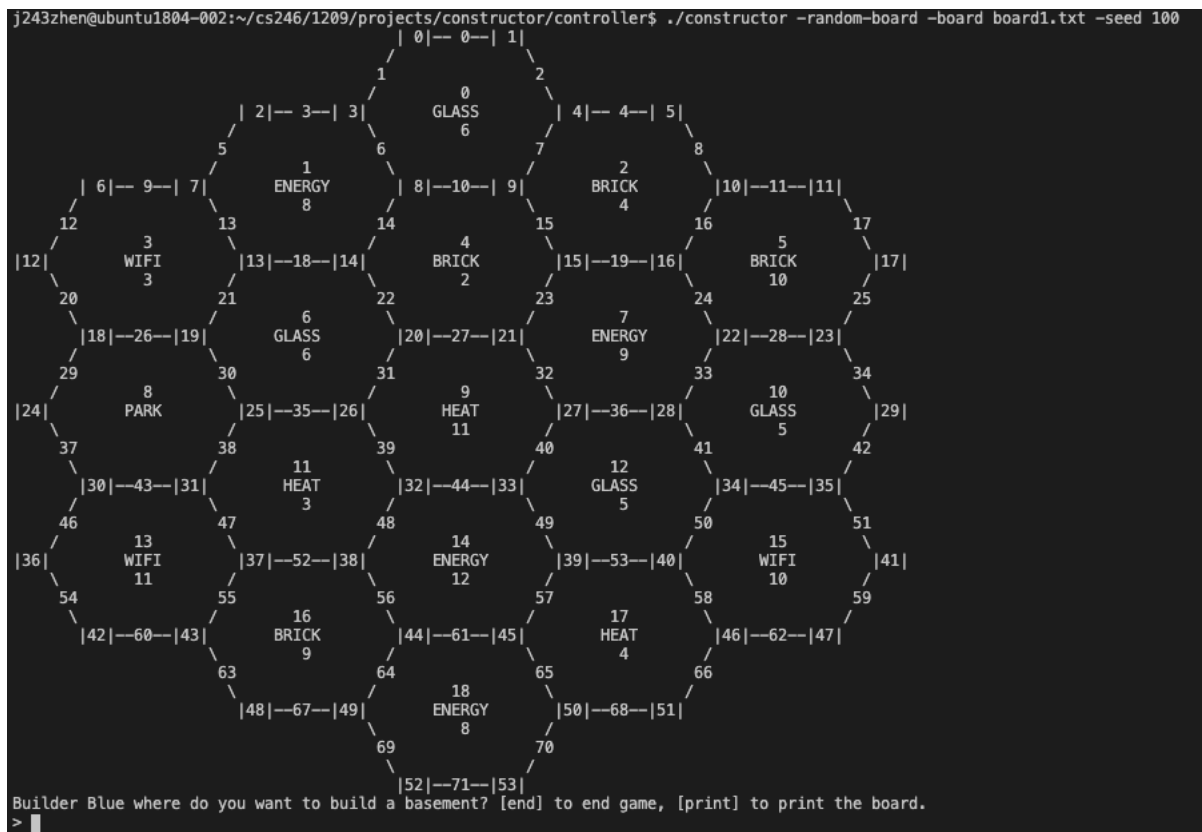
Invalid or special commands when initializing a board:

There are some invalid or special commands involved in the project, especially regarding the command line arguments.

As required by the instruction, if there is a loaded board/game, the `-random-board` command will be ignored.

Type `./constructor -random-board -board1.txt -seed 120`

```
j243zhen@ubuntu1804-002:~/cs246/1209/projects/constructor/controller$ ./constructor -random-board -board board1.txt -seed 100
```



```
Builder Blue where do you want to build a basement? [end] to end game, [print] to print the board.
>
```

The board is the actual board in `board1.txt`, not a random one, not associate with the seed number 120. The seed number here only controls the number of fair dice.

Note that `-load` and `-board` cannot be used together.

```
j243zhen@ubuntu1804-002:~/cs246/1209/projects/constructor/controller$ ./constructor -load test1.txt -board board1.txt
ERROR: already specified -board, can't also specify -load
```

As long as invalid command is entered, the game will not be started.

```
j243zhen@ubuntu1804-002:~/cs246/1209/projects/constructor/controller$ ./constructor -random-board -board board1.txt -seed 100 cs246
ERROR: unrecognized argument cs246
```

Loaded board/game can also have new seed to control the number of dice, for example, we type `./constructor -board.txt -seed 9`, the result of first fair dice is still 2.

```
Builder Blue's turn.
> fair
Builder Blue now has fair Dice.
> roll
The number you rolled is 2.
```


The argument -board can also detect invalid board. In board2.txt, one dice number is 13, and it is detected by the program.

```
j243zhen@ubuntu1804-002:~/cs246/1209/projects/constructor/controller$ ./constructor -board board2.txt  
Something went wrong when loading.
```

If any command line argument is missing, the game will not start.

```
j243zhen@ubuntu1804-002:~/cs246/1209/projects/constructor/controller$ ./constructor -board  
ERROR: -board missing seed argument  
j243zhen@ubuntu1804-002:~/cs246/1209/projects/constructor/controller$ ./constructor -seed  
ERROR: -seed missing seed argument  
j243zhen@ubuntu1804-002:~/cs246/1209/projects/constructor/controller$ ./constructor -load  
ERROR: -load missing seed argument
```

All supported files in our testing are submitted with my project on Marmoset.