#### Instance Creation



Robert Smallshire
COFOUNDER - SIXTY NORTH

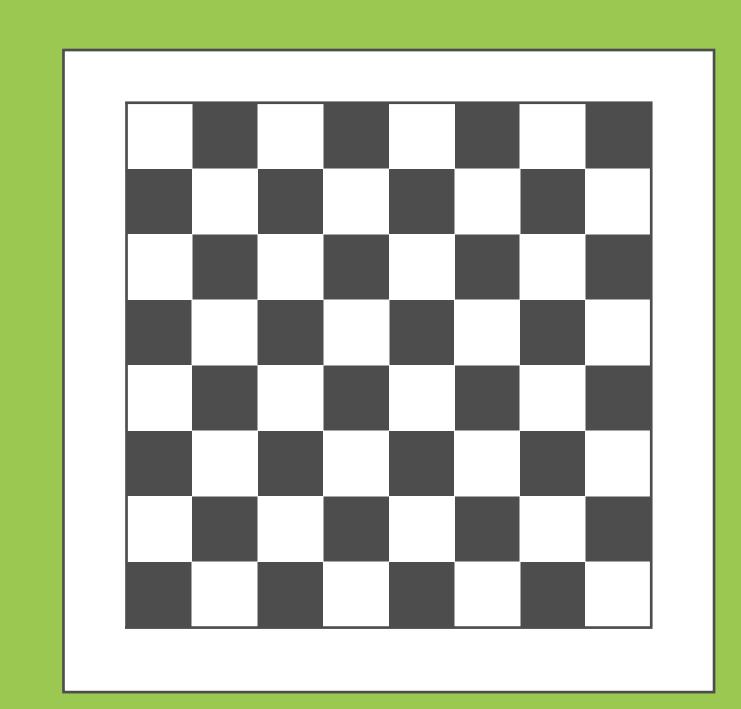
@robsmallshire rob@sixty-north.com

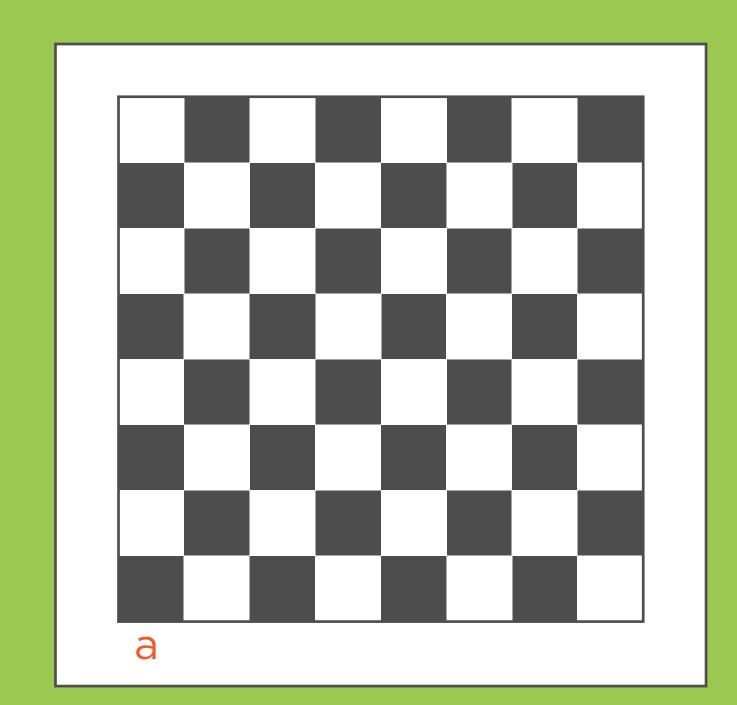
Allocation versus initialisation

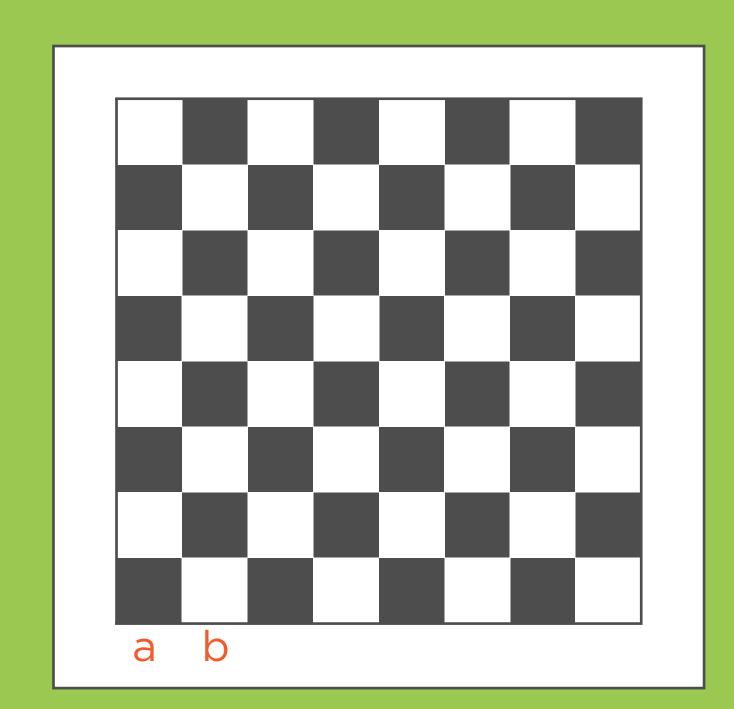
Allocation versus initialisation

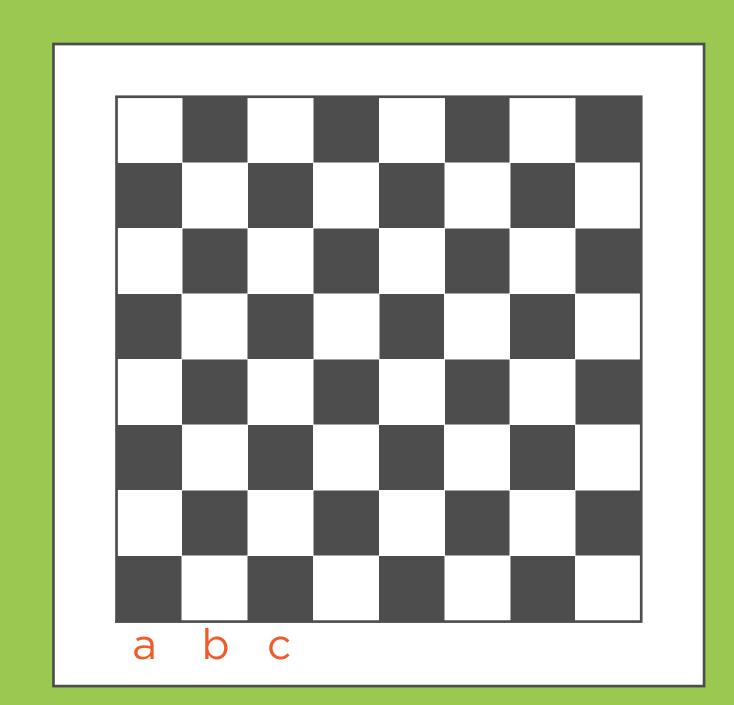
The role and signature of \_\_new\_\_()

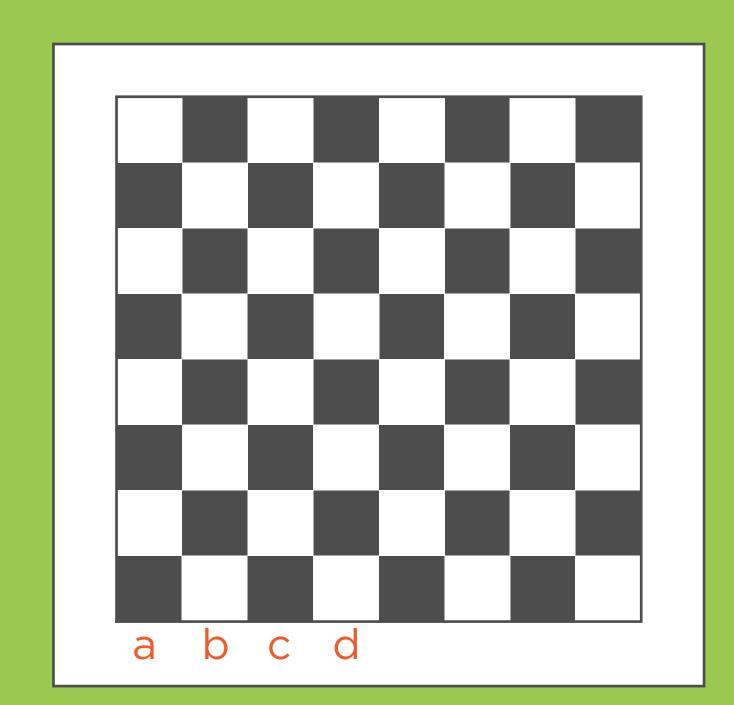
#### Allocation Versus Initialisation

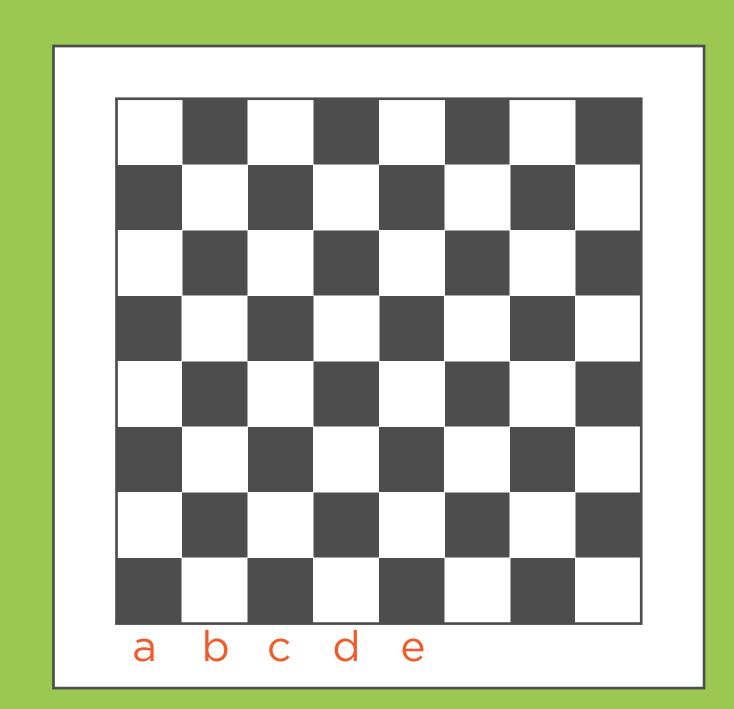


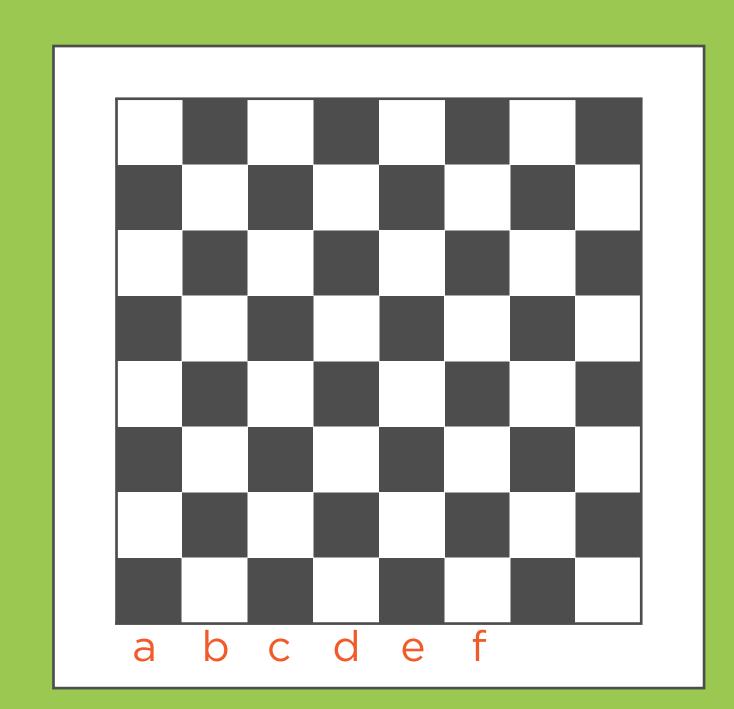


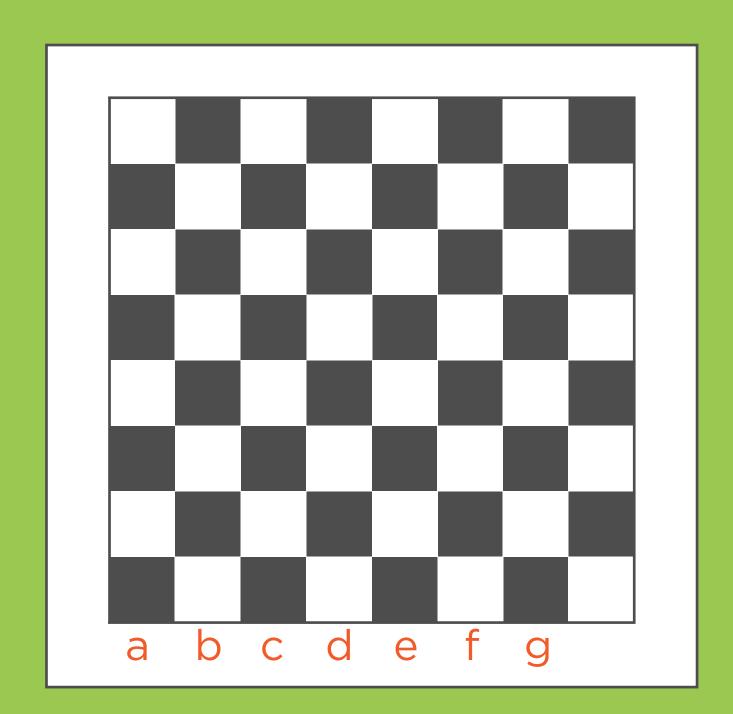


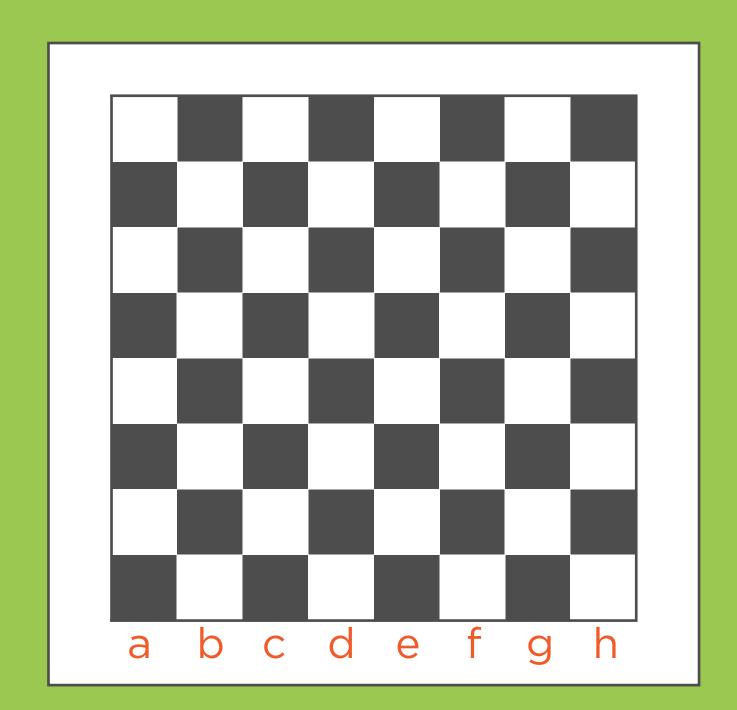


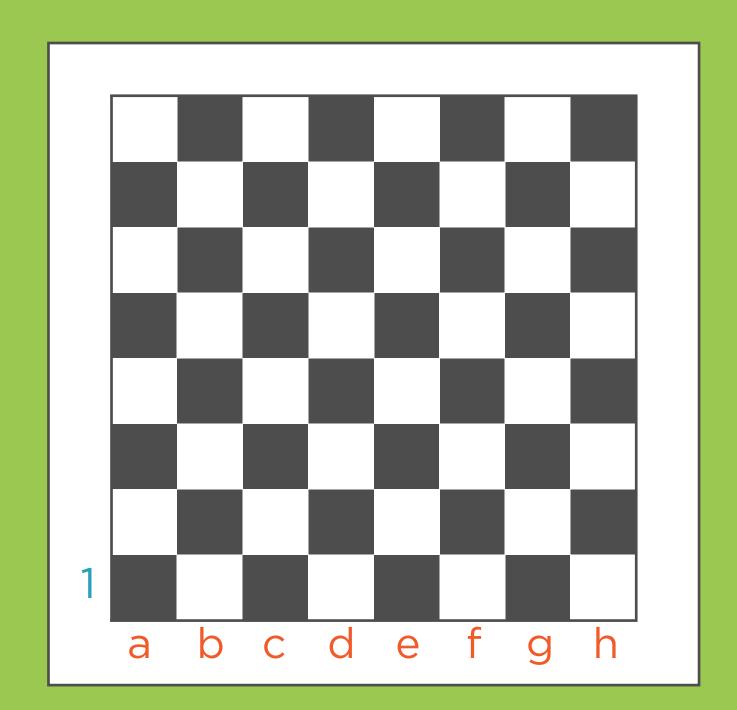


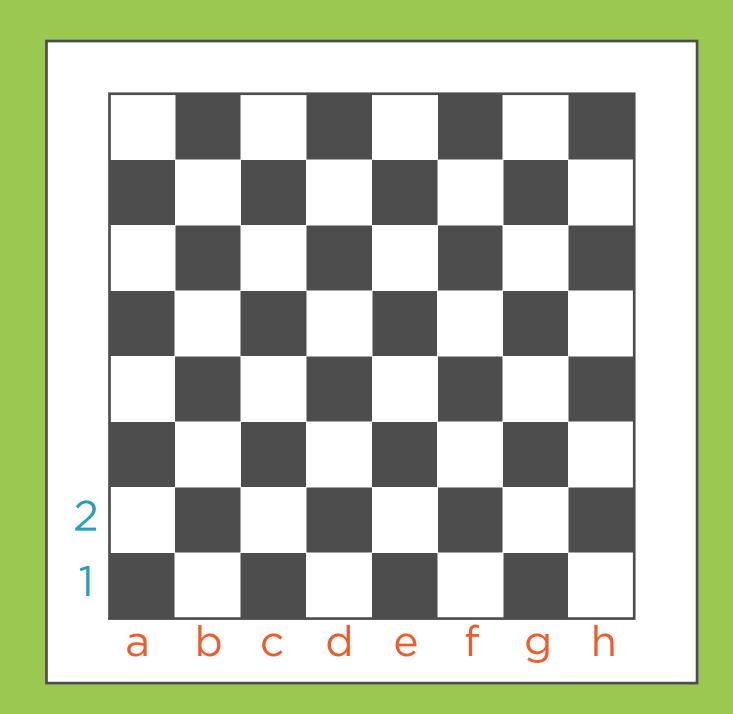


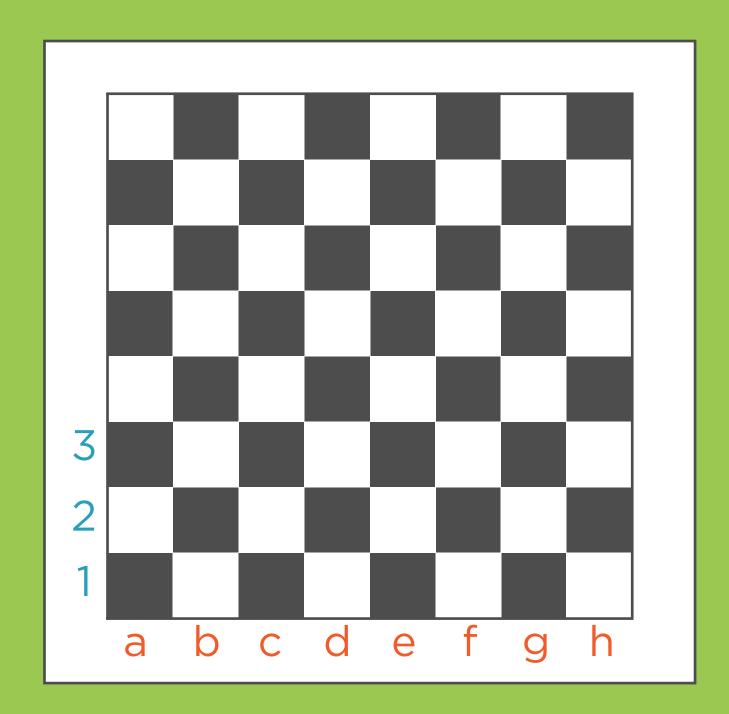


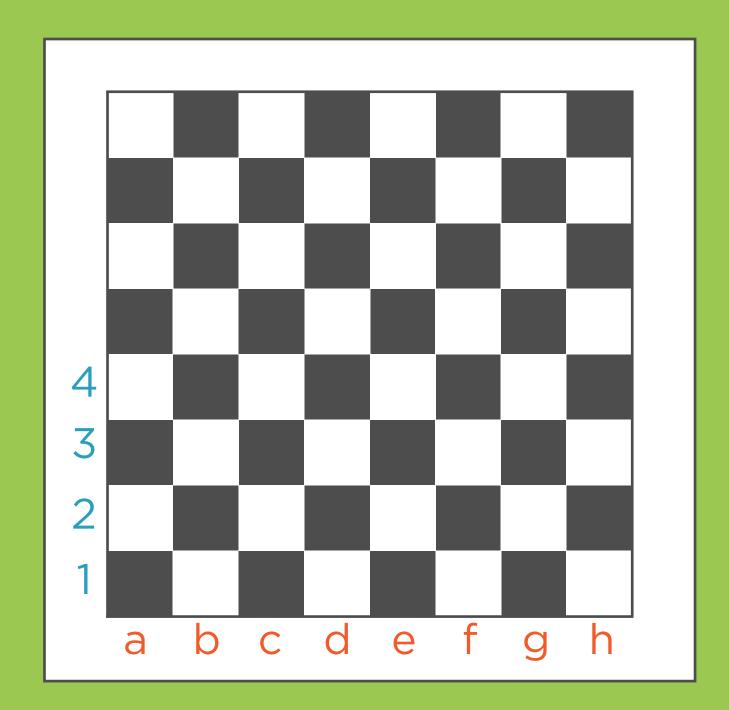


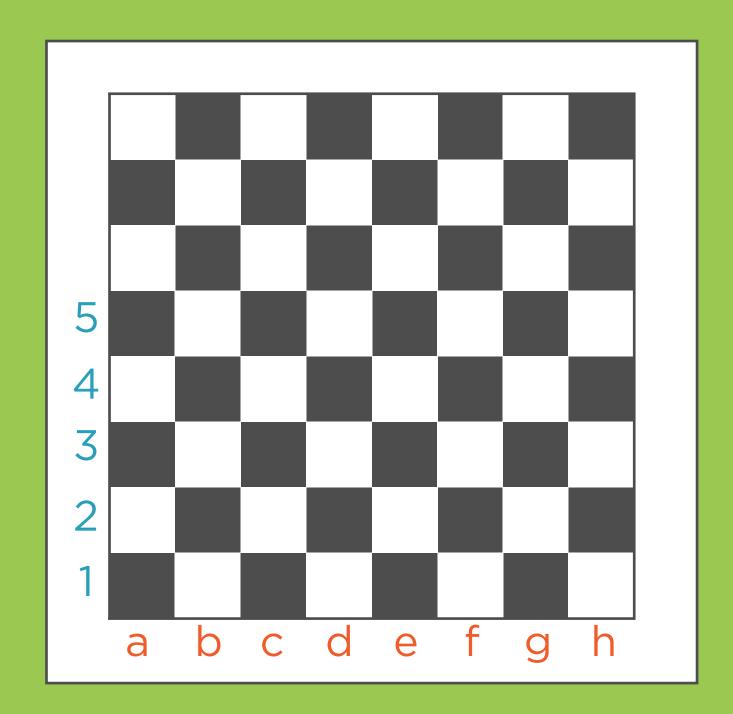


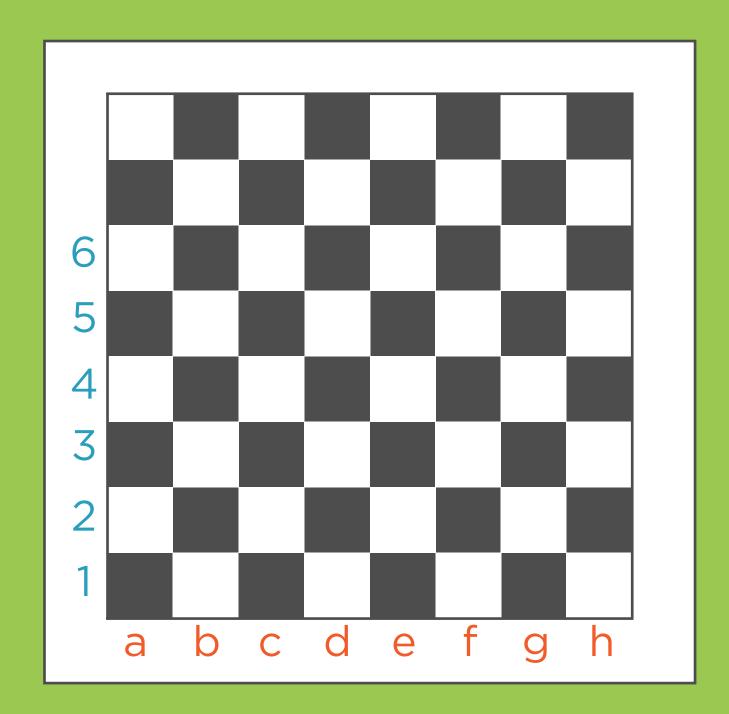


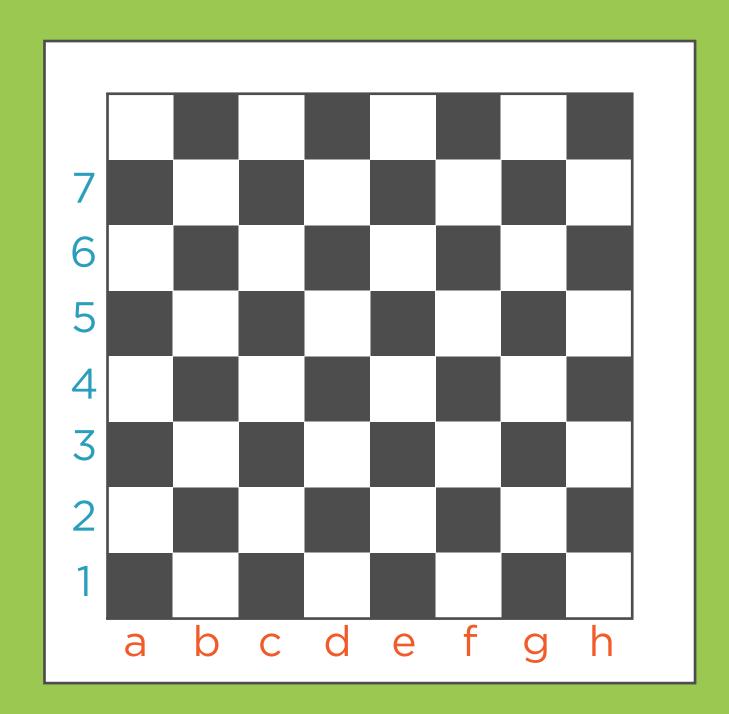


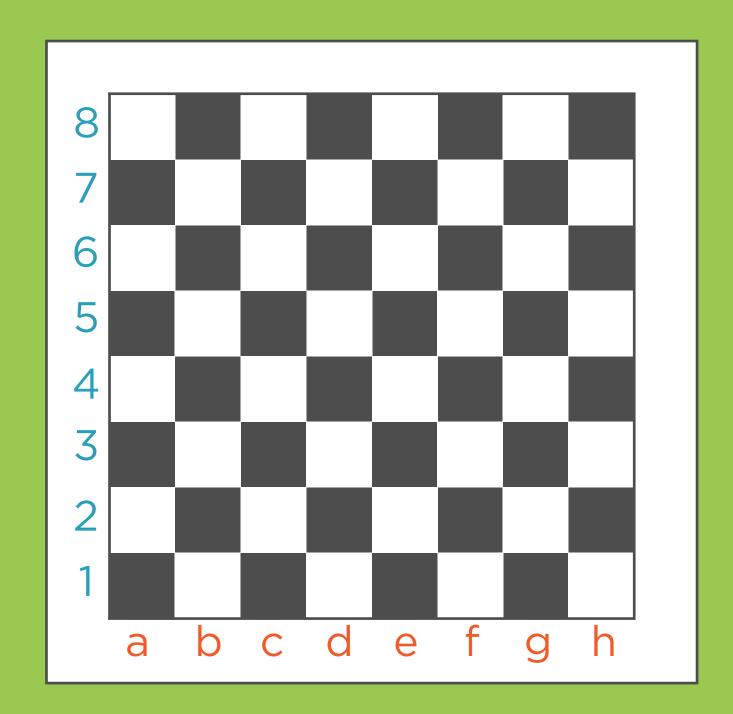


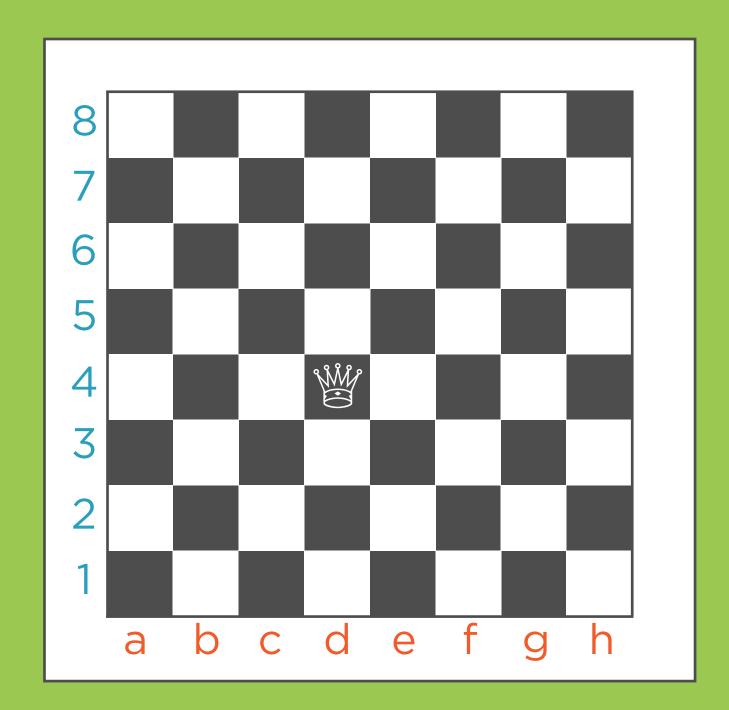












Allocation With \_\_new\_\_()

```
MyClass
```

```
__init__(self,...)
```

```
MyClass

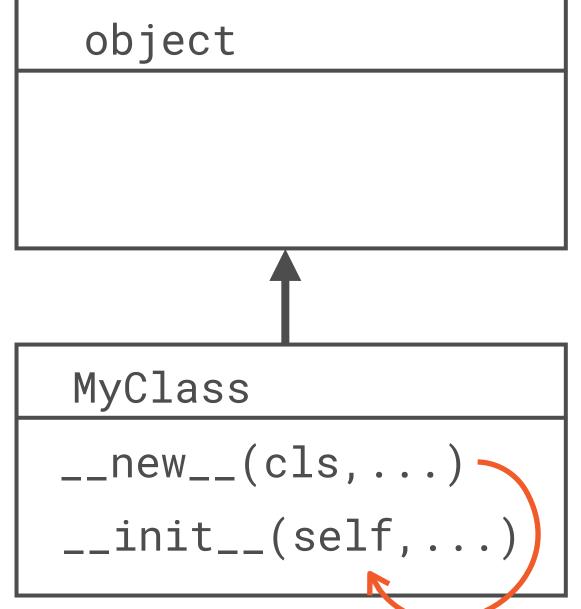
__new__(cls,...)

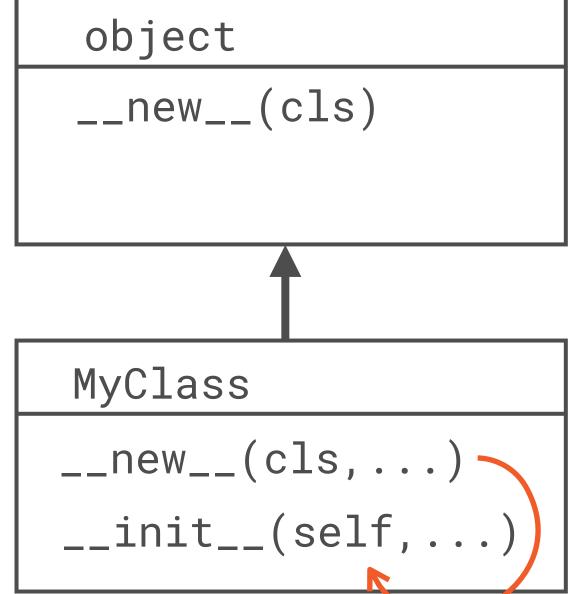
__init__(self,...)
```

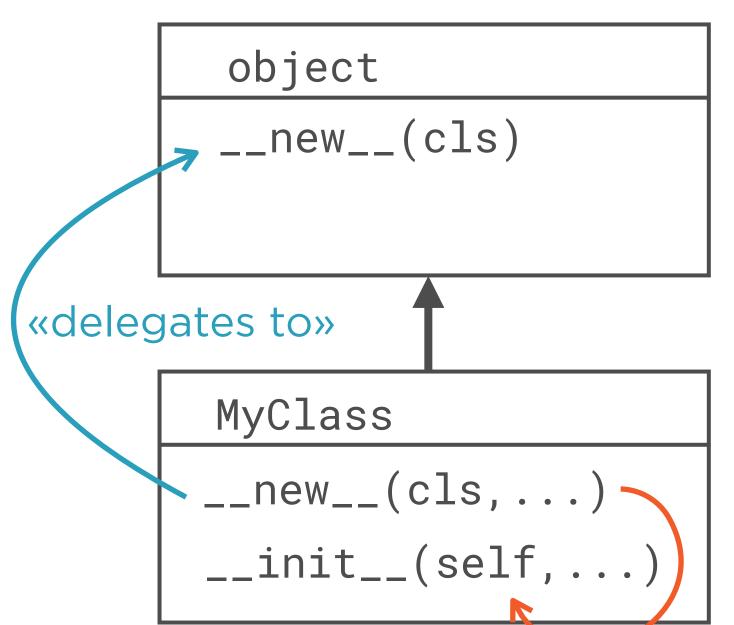
```
MyClass

__new__(cls,...)

__init__(self,...)
```







## Interning

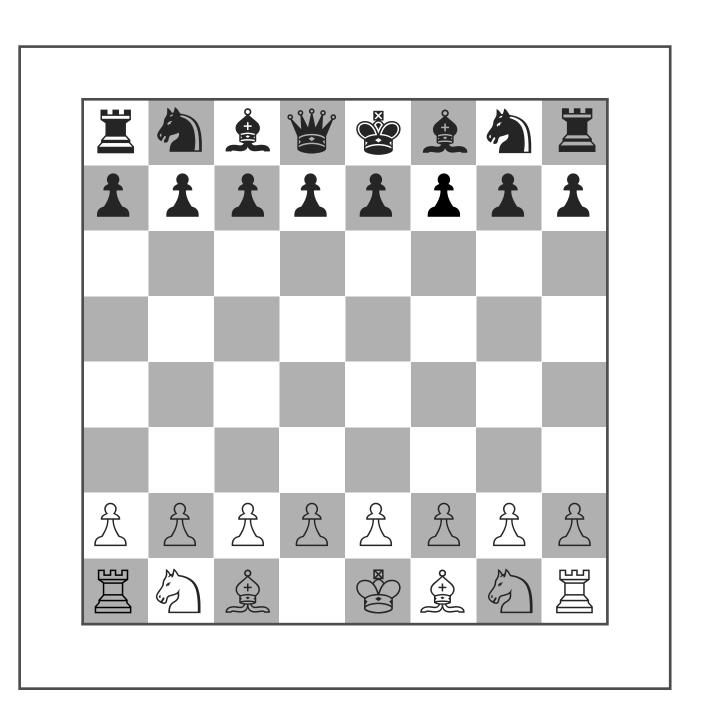
# Storing only one copy of each distinct value

#### Chess Piece Encoding

```
{'營堂': ChessCoordinate('a', 1),
'營②': ChessCoordinate('b', 1),
'營堂': ChessCoordinate('c', 1),
'營營': ChessCoordinate('d', 1),
'營營': ChessCoordinate('e', 1),
...
'營營': ChessCoordinate('f', 7),
'營營': ChessCoordinate('f', 7),
'營營': ChessCoordinate('g', 7),
'營營': ChessCoordinate('h', 7),

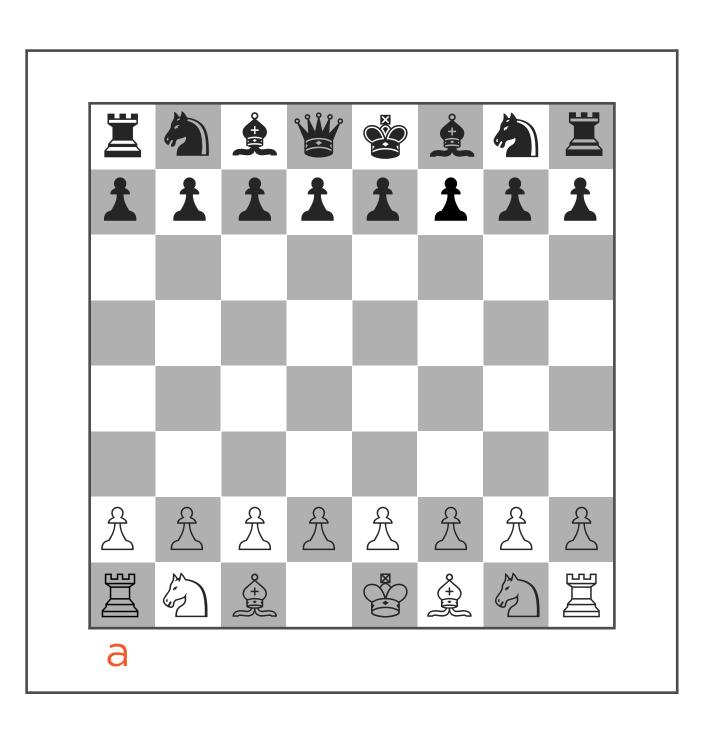
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'營營': ChessCoordinate('h', 7),
```



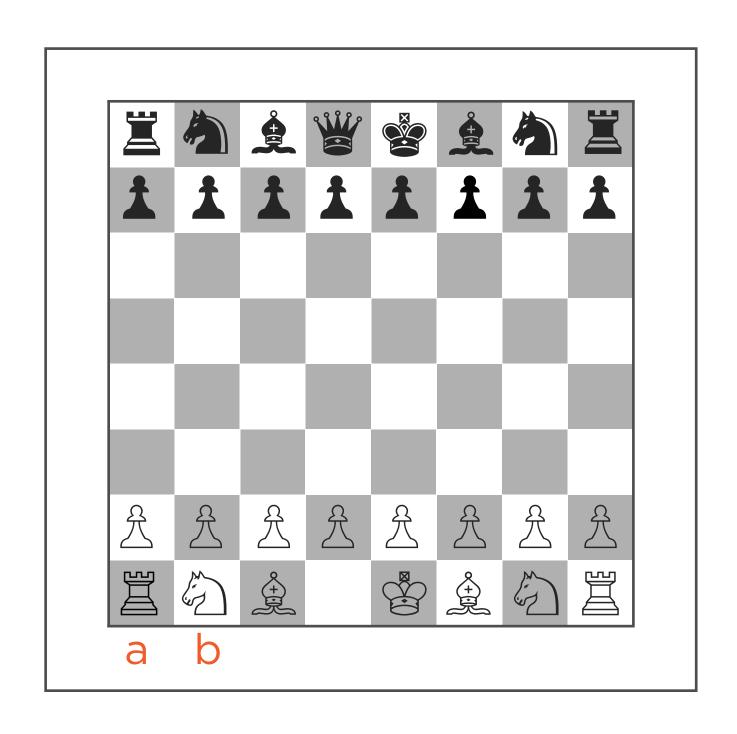
#### Chess Piece Encoding

```
{'營堂': ChessCoordinate('a', 1),
'營金': ChessCoordinate('b', 1),
'營金': ChessCoordinate('c', 1),
'營營': ChessCoordinate('d', 1),
'營金': ChessCoordinate('e', 1),
...
'營金': ChessCoordinate('f', 7),
'營金': ChessCoordinate('f', 7),
'營金': ChessCoordinate('f', 7),
'營金': ChessCoordinate('h', 7),
'營置': ChessCoordinate('h', 7),
}
```



#### Chess Piece Encoding

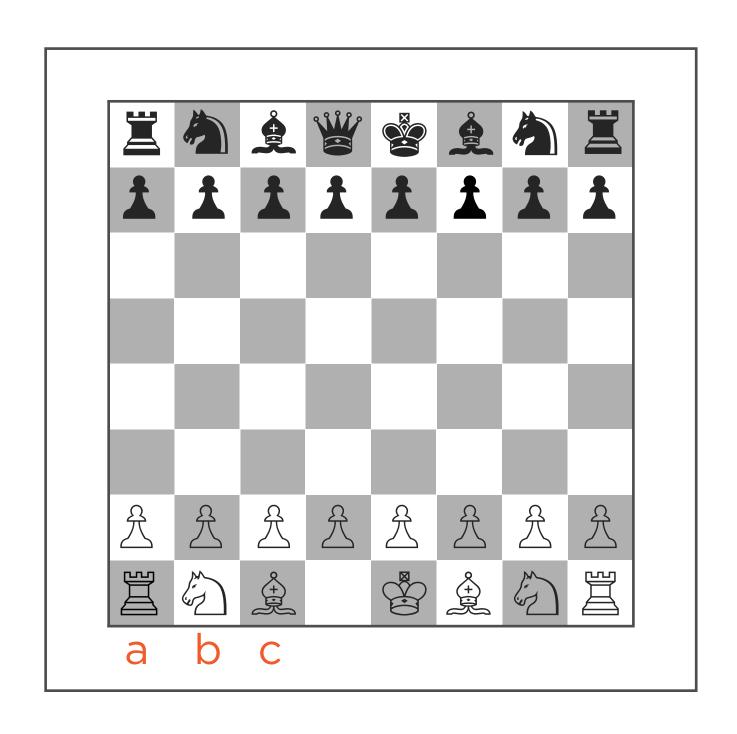
```
{'營堂': ChessCoordinate('a', 1),
'營金': ChessCoordinate('b', 1),
'營金': ChessCoordinate('c', 1),
'營營': ChessCoordinate('d', 1),
'營金': ChessCoordinate('e', 1),
...
'營金': ChessCoordinate('f', 7),
'營金': ChessCoordinate('f', 7),
'營金': ChessCoordinate('f', 7),
'營金': ChessCoordinate('h', 7),
'營置': ChessCoordinate('h', 7),
}
```



```
{'營堂': ChessCoordinate('a', 1),
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'營營': ChessCoordinate('d', 1),
'營營': ChessCoordinate('e', 1),
...
'營營': ChessCoordinate('f', 7),
'營營': ChessCoordinate('f', 7),
'營營': ChessCoordinate('g', 7),
'營營': ChessCoordinate('h', 7),

'營營': ChessCoordinate('h', 7),

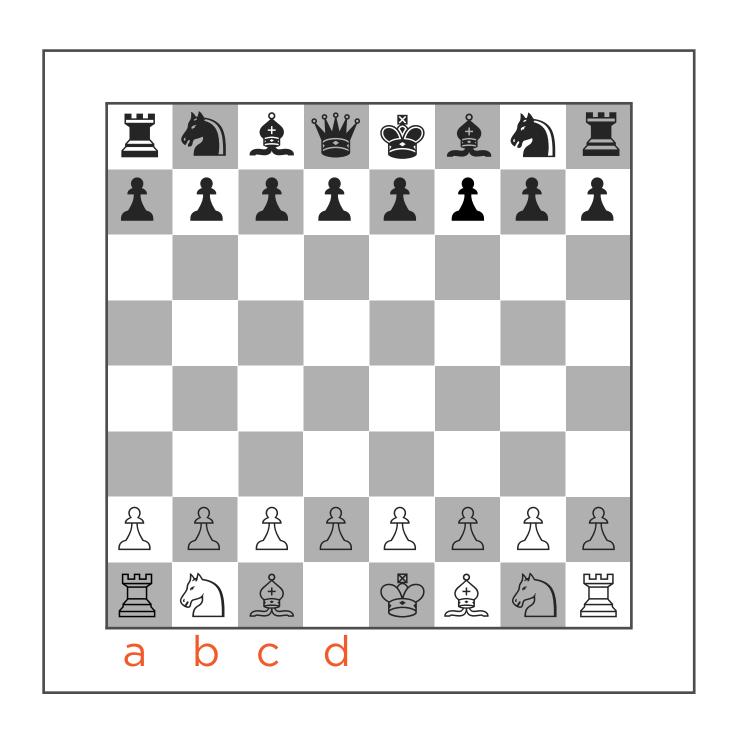
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```



```
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'營營': ChessCoordinate('e', 1),
...
'營營': ChessCoordinate('f', 7),
'營營': ChessCoordinate('f', 7),
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'營營': ChessCoordinate('h', 7),

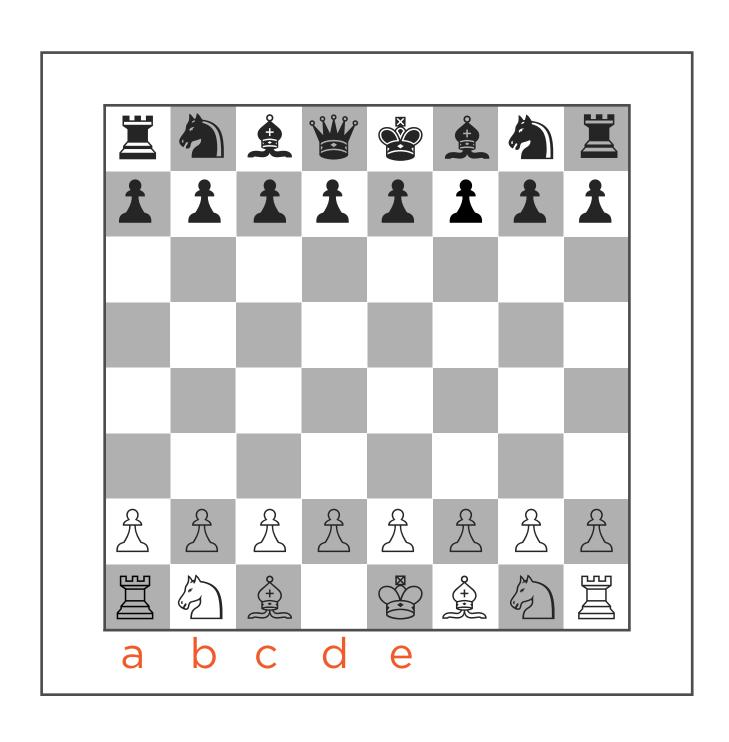
'營營': ChessCoordinate('h', 7),
```



```
{'營堂': ChessCoordinate('a', 1),
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...
'營營': ChessCoordinate('f', 7),
'營營': ChessCoordinate('f', 7),
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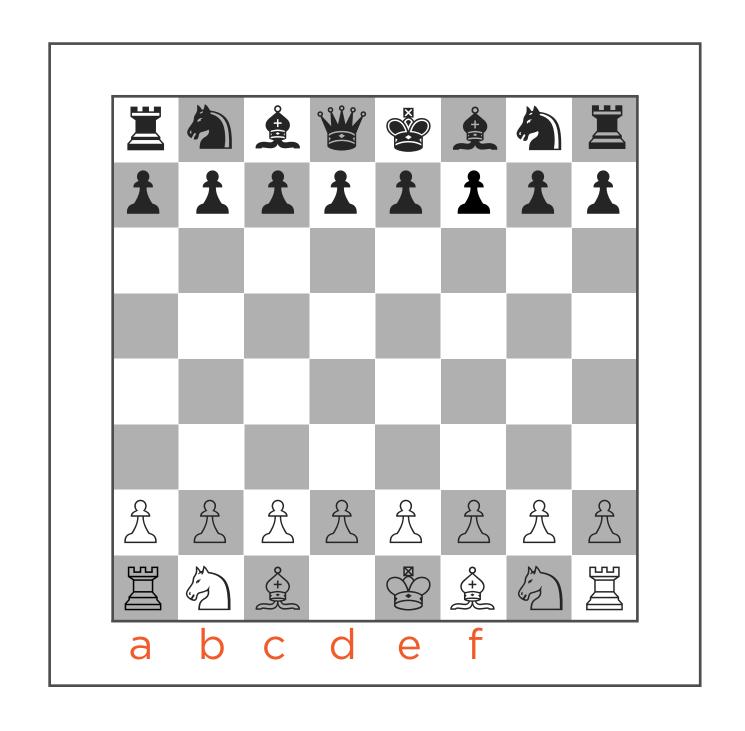
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```



```
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...
'營營': ChessCoordinate('f', 7),
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'營營': ChessCoordinate('h', 7),

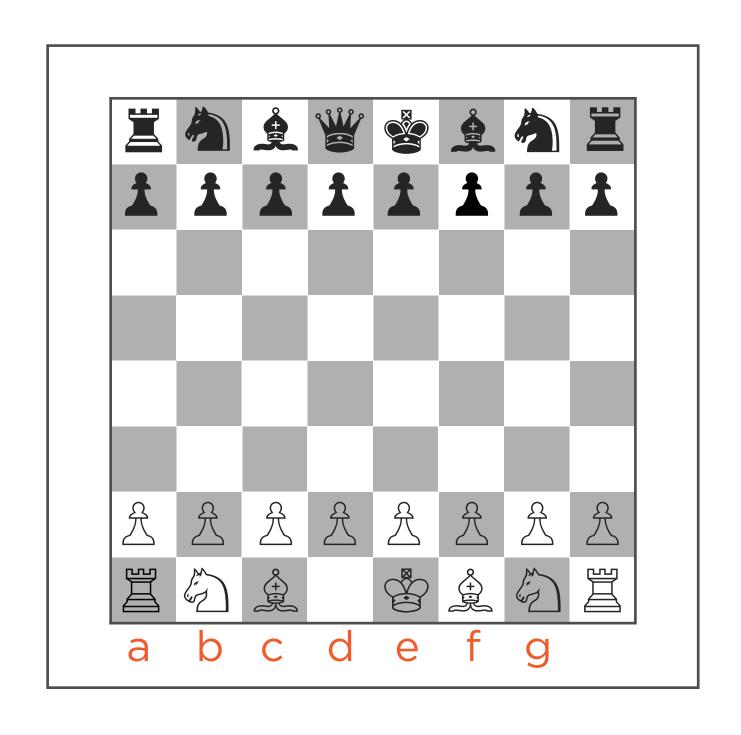
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```



```
{'營堂': ChessCoordinate('a', 1),
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...
'營營': ChessCoordinate('f', 7),
'營營': ChessCoordinate('f', 7),
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'營營': ChessCoordinate('h', 7),

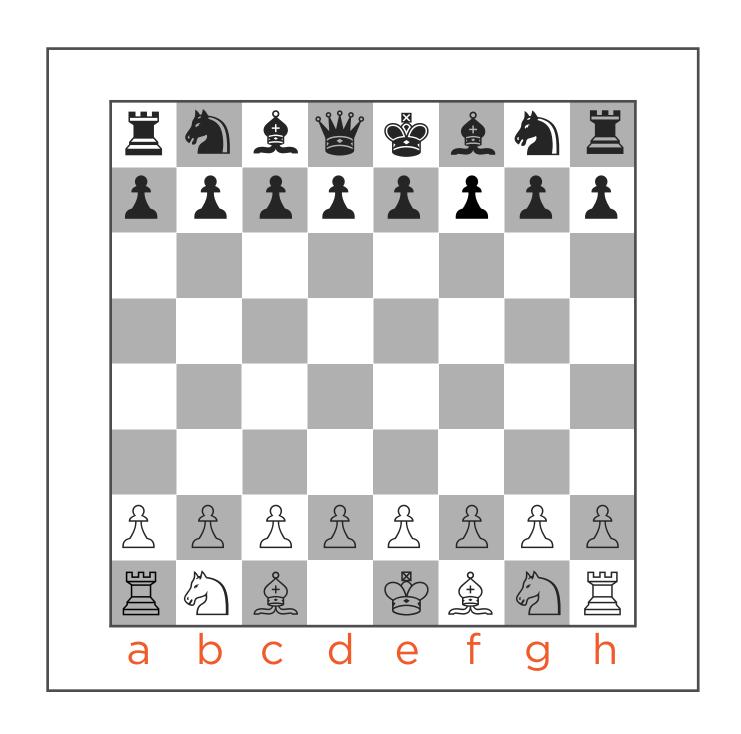
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```



```
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'營營': ChessCoordinate('f', 7),
'營營': ChessCoordinate('f', 7),
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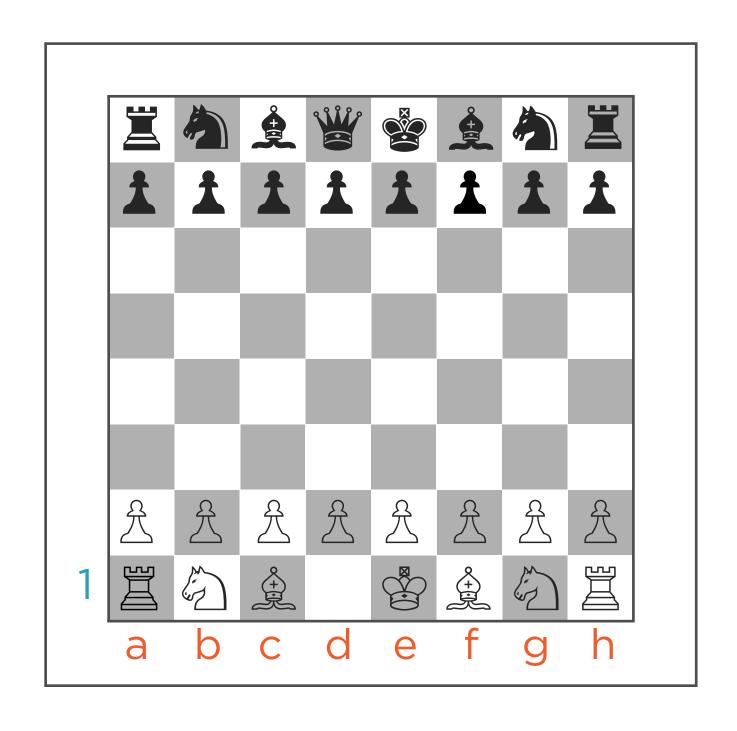
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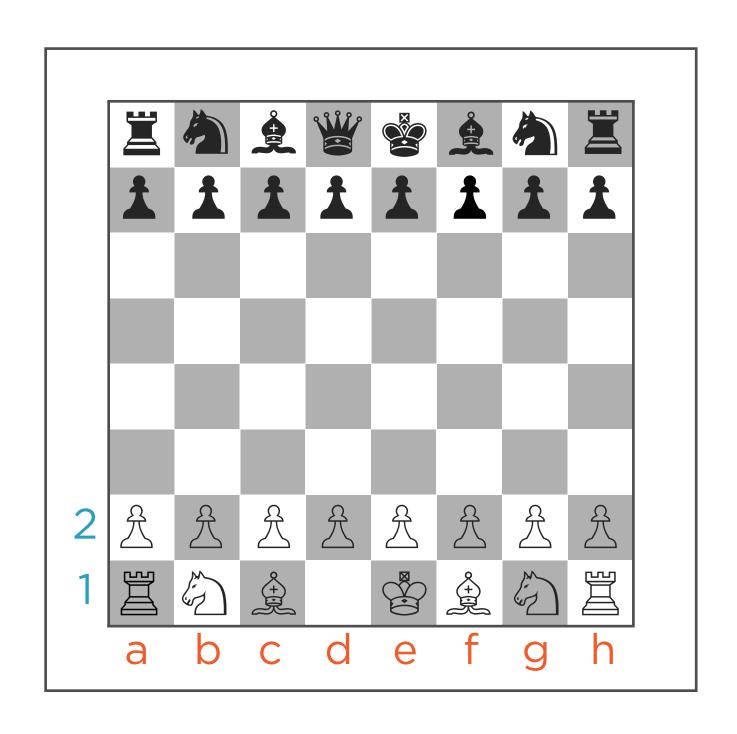
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...
'營營': ChessCoordinate('f', 7),
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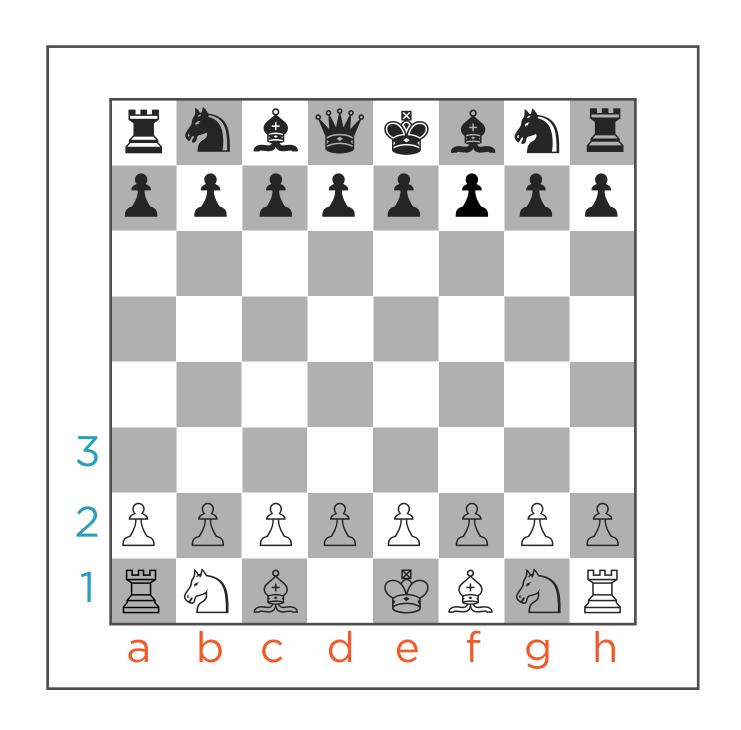
'營營': ChessCoordinate('h', 7),
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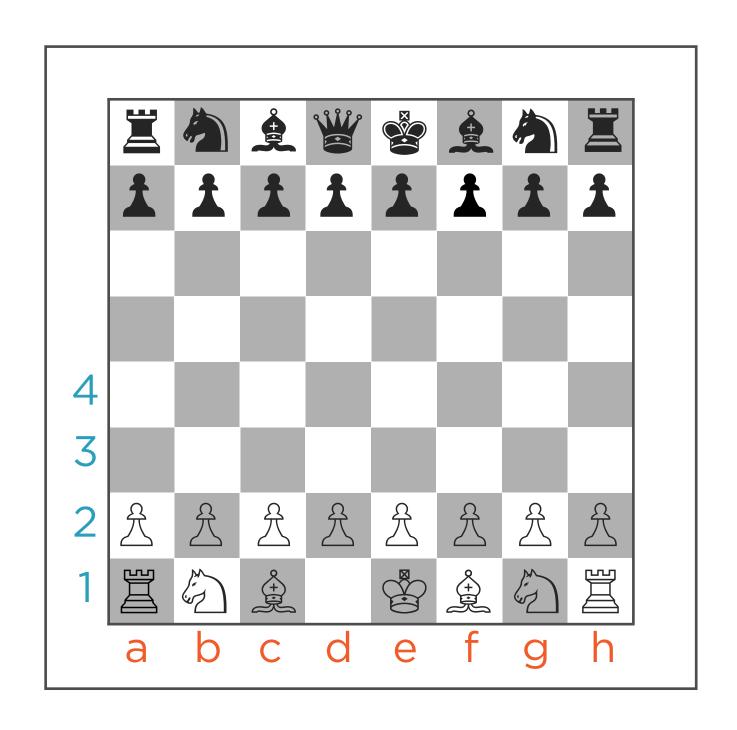
```
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...
'營戶上': ChessCoordinate('f', 7),
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}
```



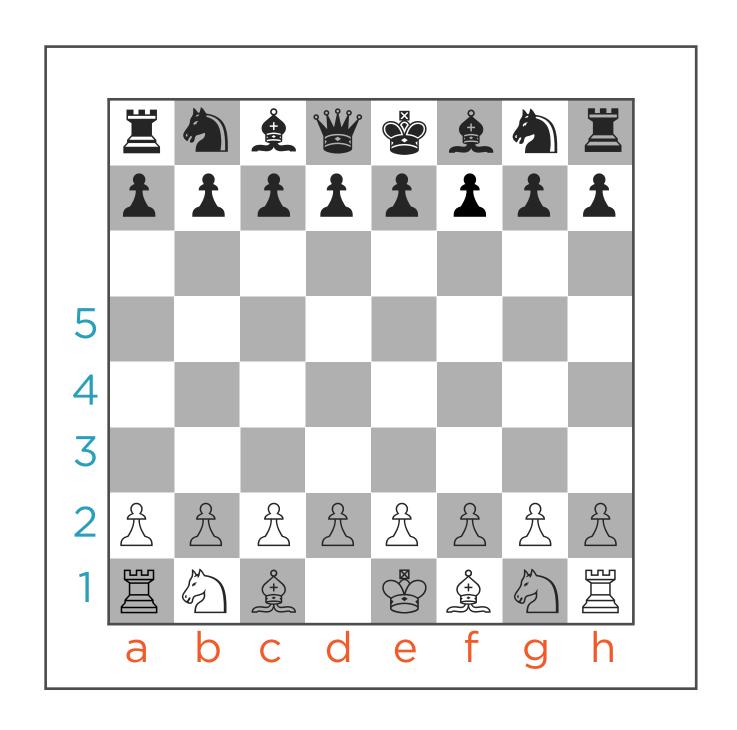
```
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'營營': ChessCoordinate('e', 1),
...
'營營': ChessCoordinate('f', 7),
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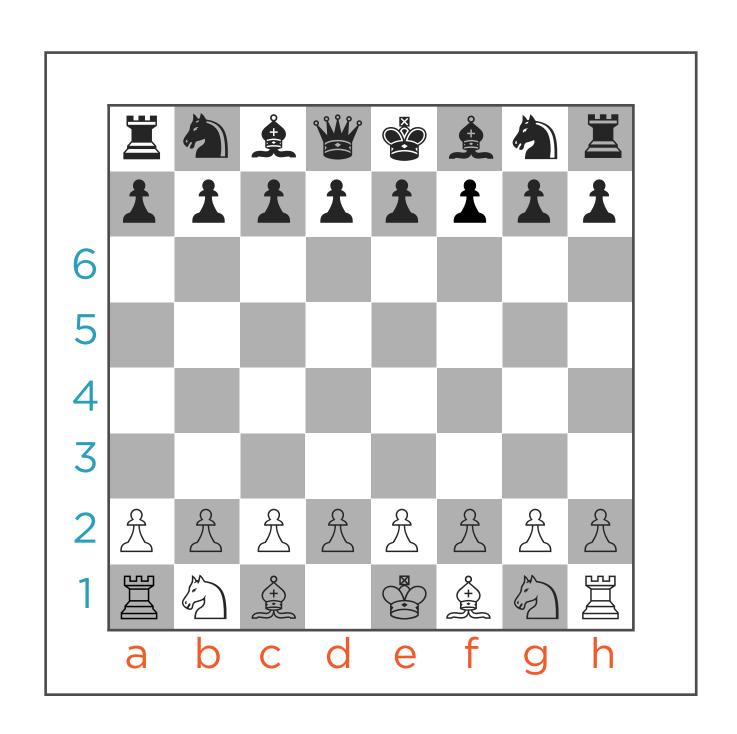
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...
'營營': ChessCoordinate('f', 7),
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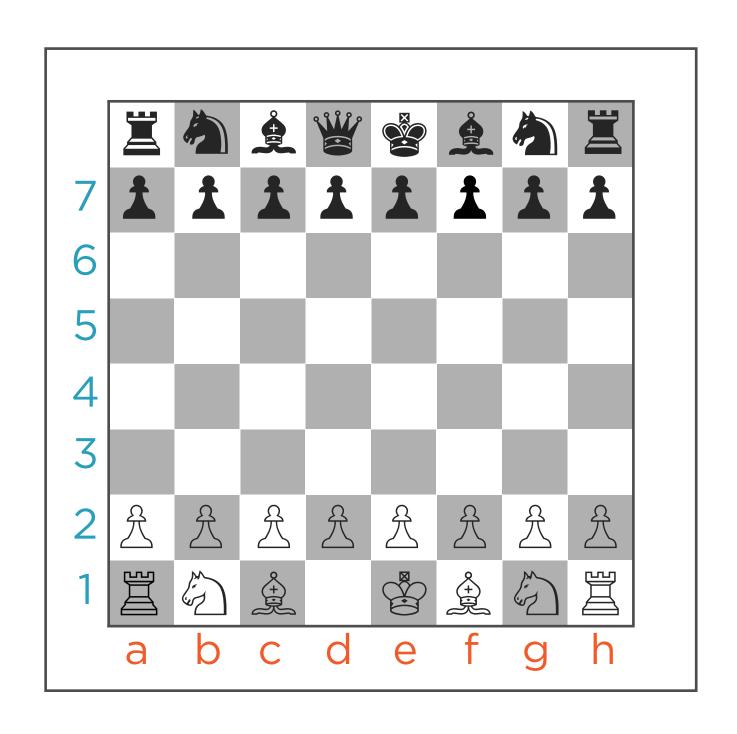
```
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...
'營營': ChessCoordinate('f', 7),
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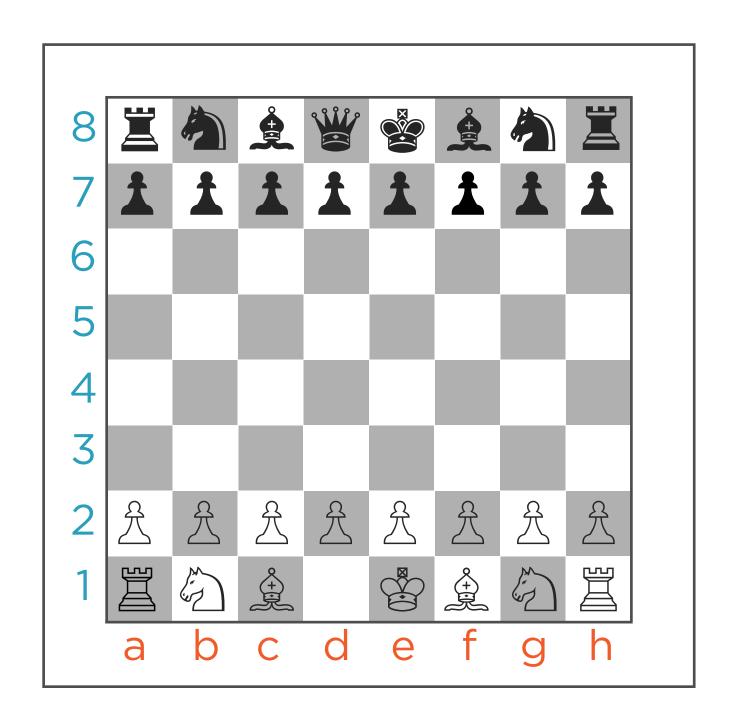
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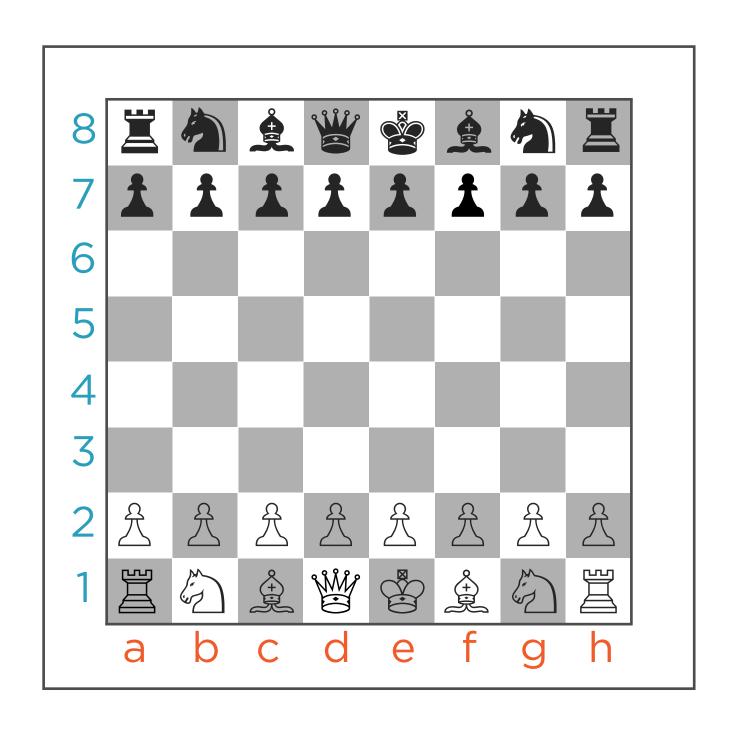
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...
'營園 ': ChessCoordinate('f', 7),
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}
```



```
{'營園': ChessCoordinate('a', 1),
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...
'營園 ': ChessCoordinate('f', 7),
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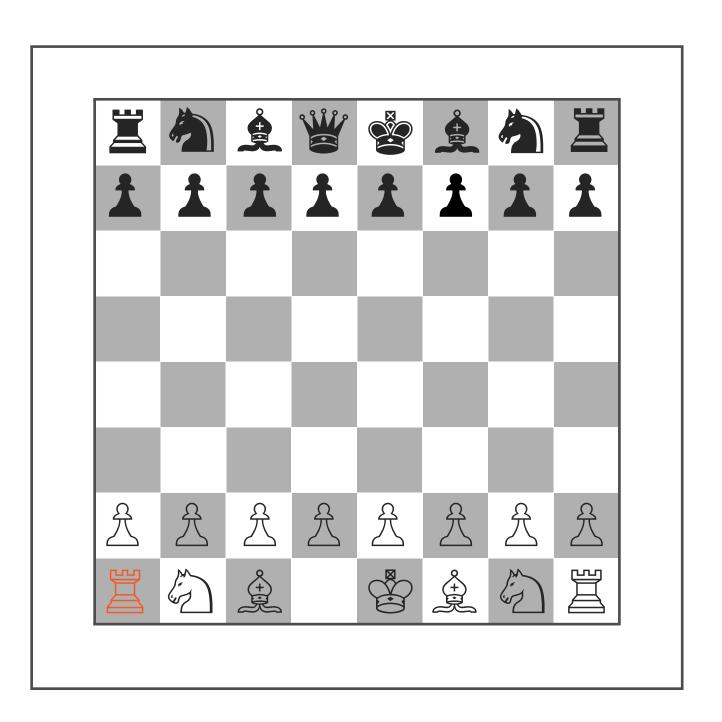


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...
'營營': ChessCoordinate('f', 7),
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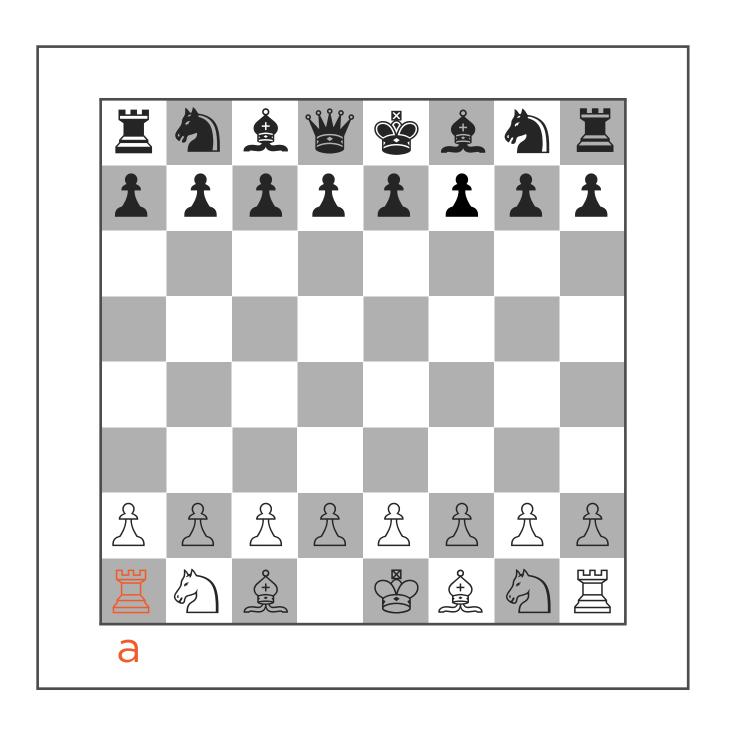
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'營園 ': ChessCoordinate('f', 7),
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}
```



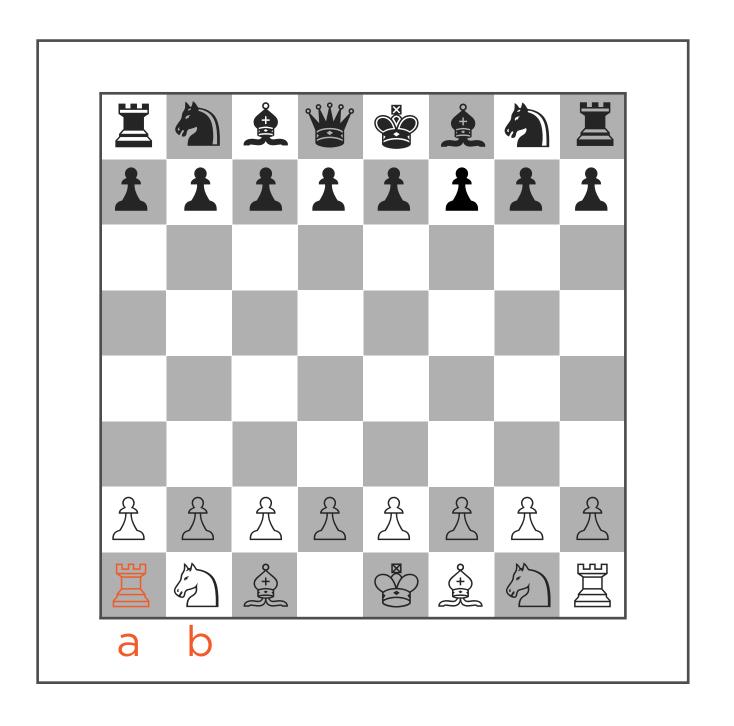


```
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...
'營戶': ChessCoordinate('f', 7),
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}
```

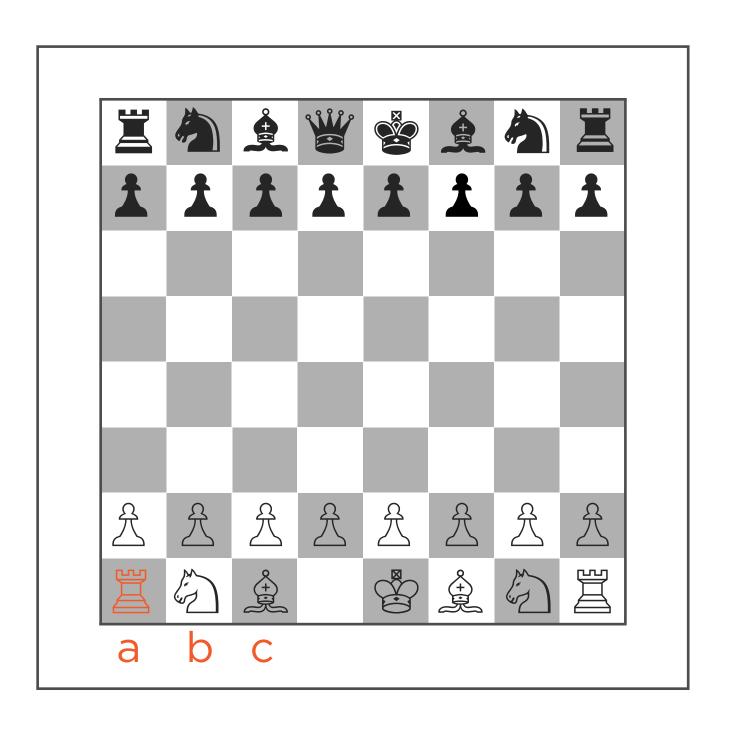




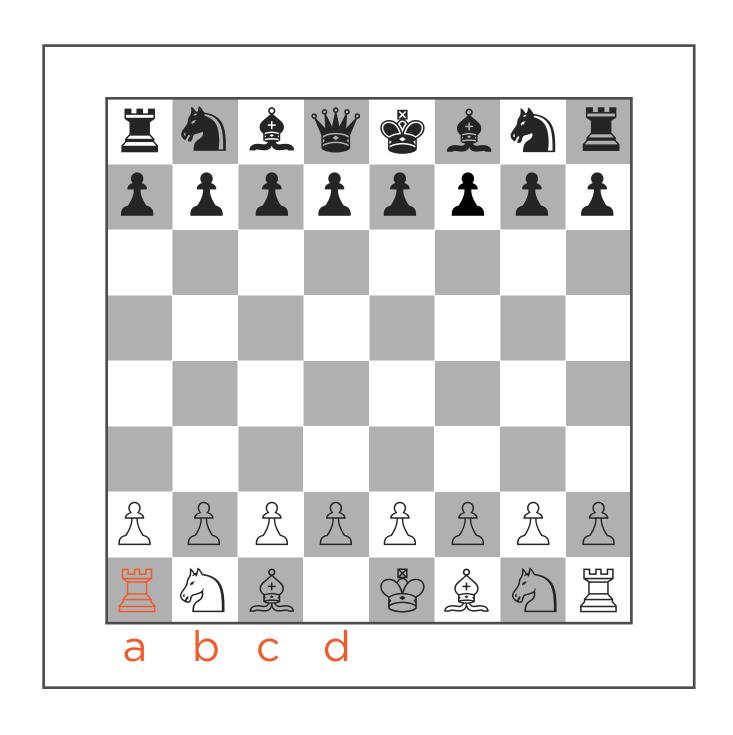
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...
'營園 ': ChessCoordinate('f', 7),
'營園 ': ChessCoordinate('f', 7),
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}
```



```
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'營堂': ChessCoordinate('f', 7),
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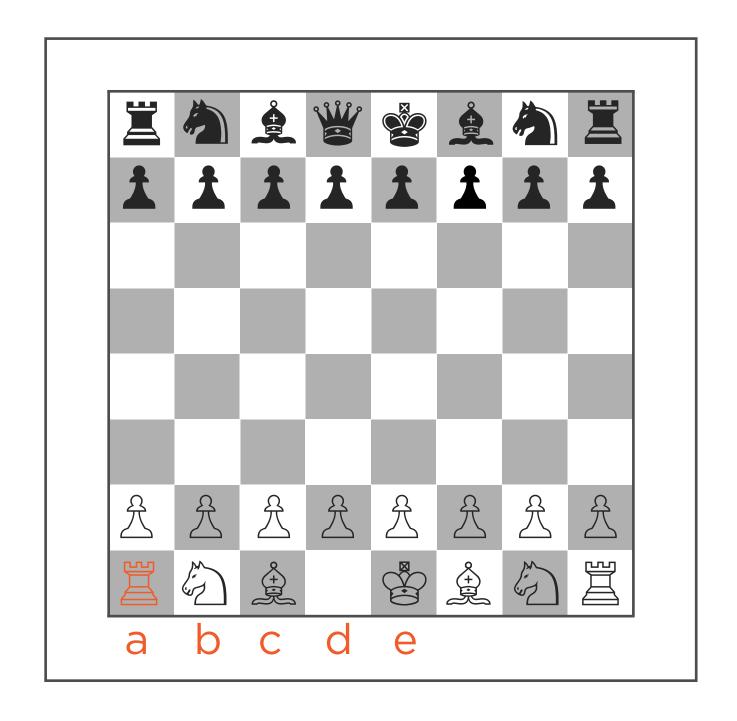


```
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...
'營園 ': ChessCoordinate('f', 7),
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```

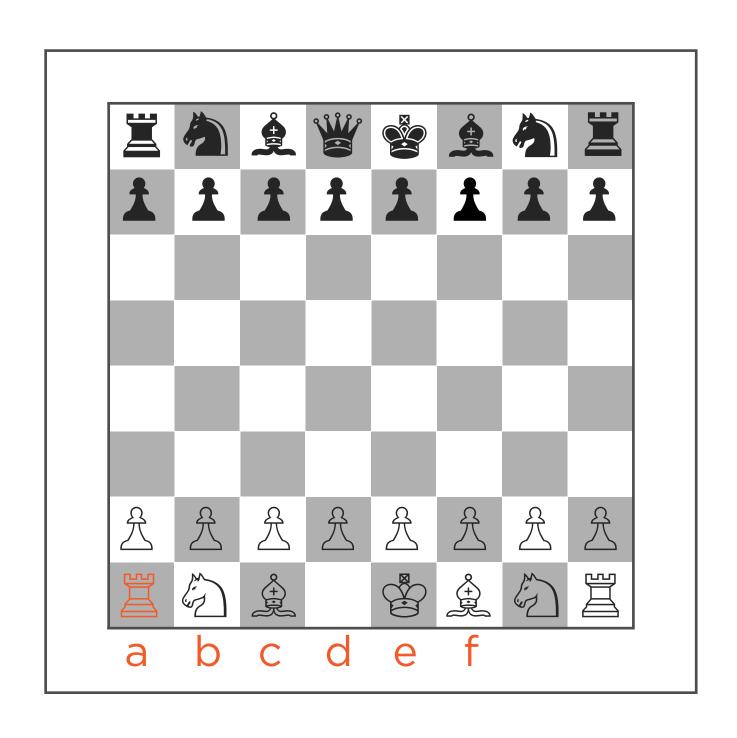


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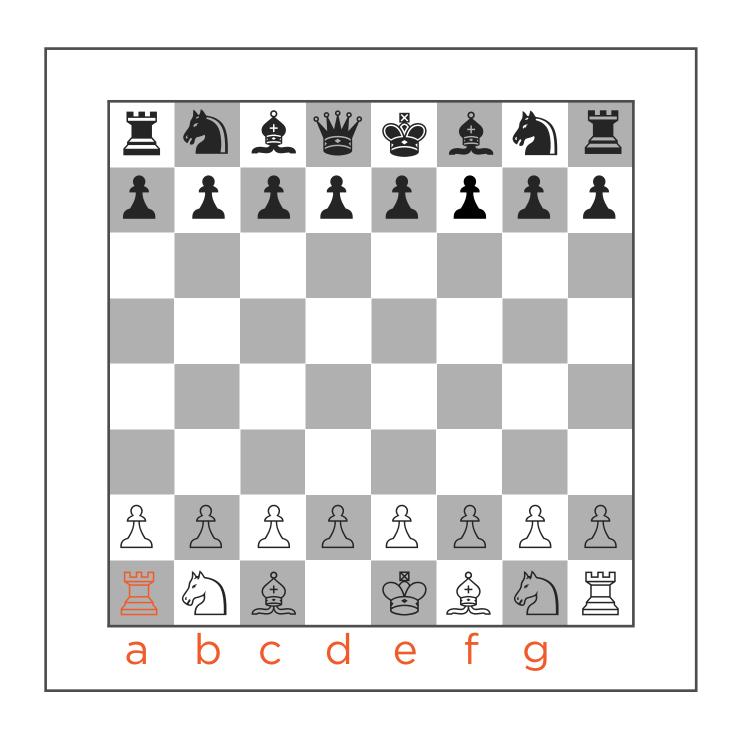
'營産土': ChessCoordinate('h', 7),
}
```



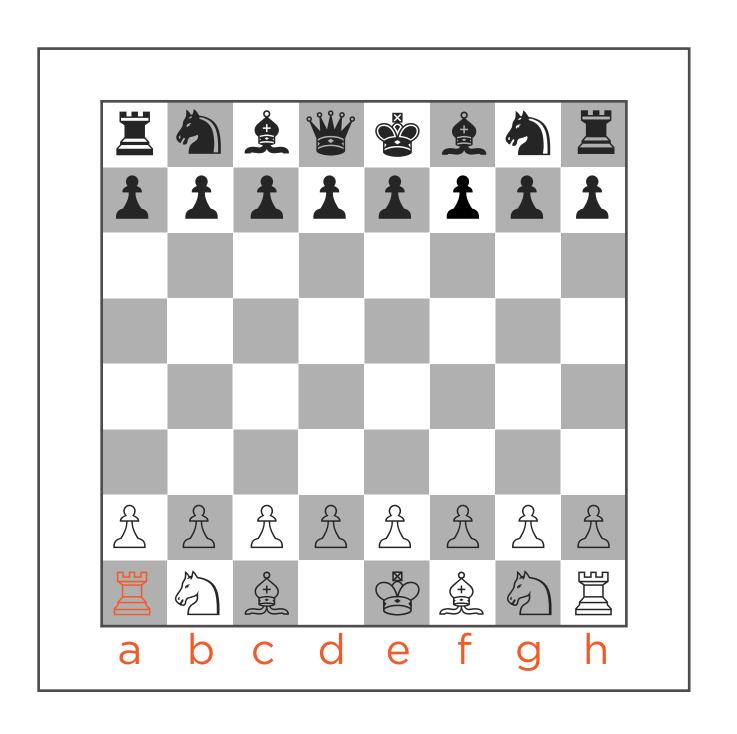
```
{'營園': ChessCoordinate('a', 1),
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...
'營園 ': ChessCoordinate('f', 7),
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'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('h', 7),
}
```



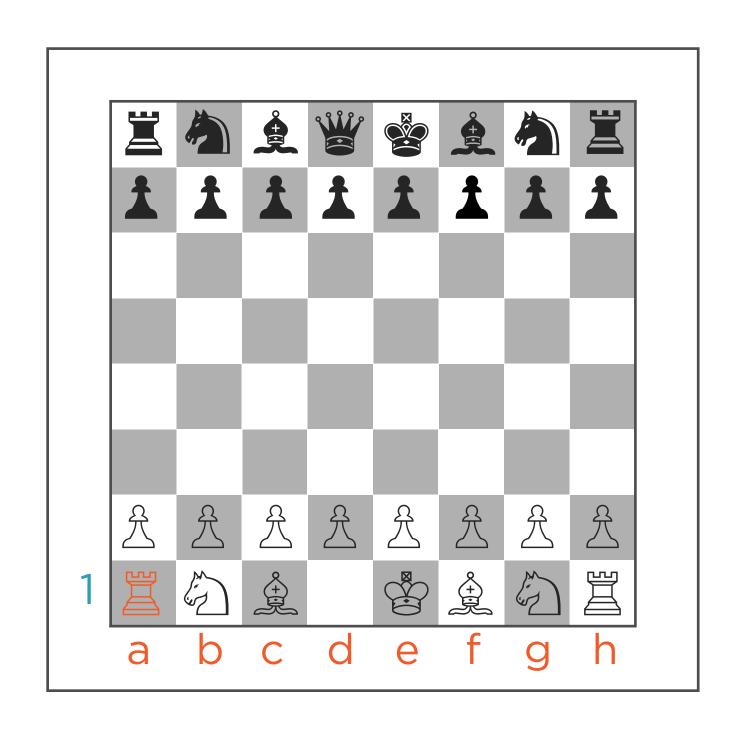
```
{'營堂': ChessCoordinate('a', 1),
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'營營': ChessCoordinate('d', 1),
'營營': ChessCoordinate('e', 1),
...
'營堂': ChessCoordinate('f', 7),
'營堂': ChessCoordinate('f', 7),
'營營': ChessCoordinate('g', 7),
'營營': ChessCoordinate('h', 7),
}
```



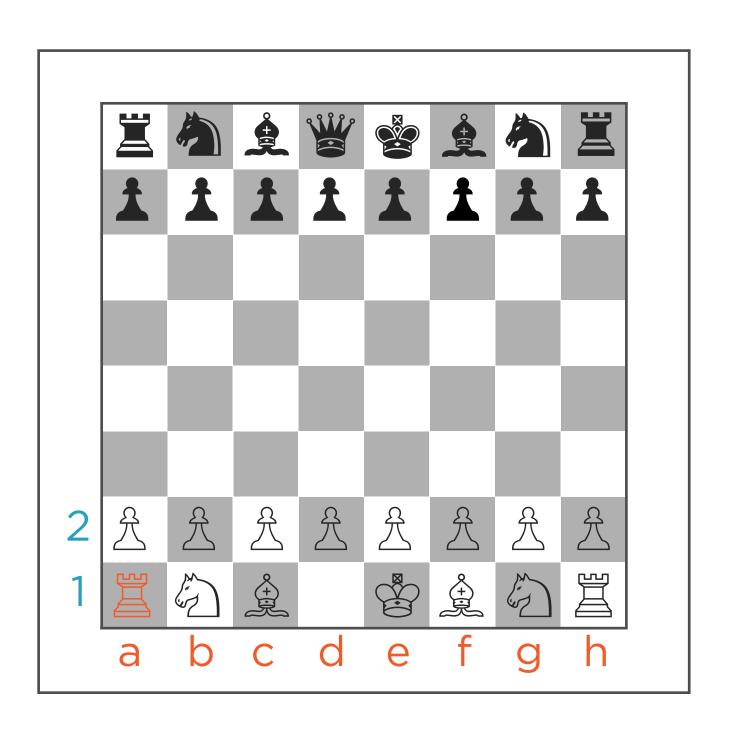
```
{'營園': ChessCoordinate('a', 1),
'營園': ChessCoordinate('b', 1),
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'營園': ChessCoordinate('e', 1),
...
'營園 ': ChessCoordinate('f', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('h', 7),
}
```



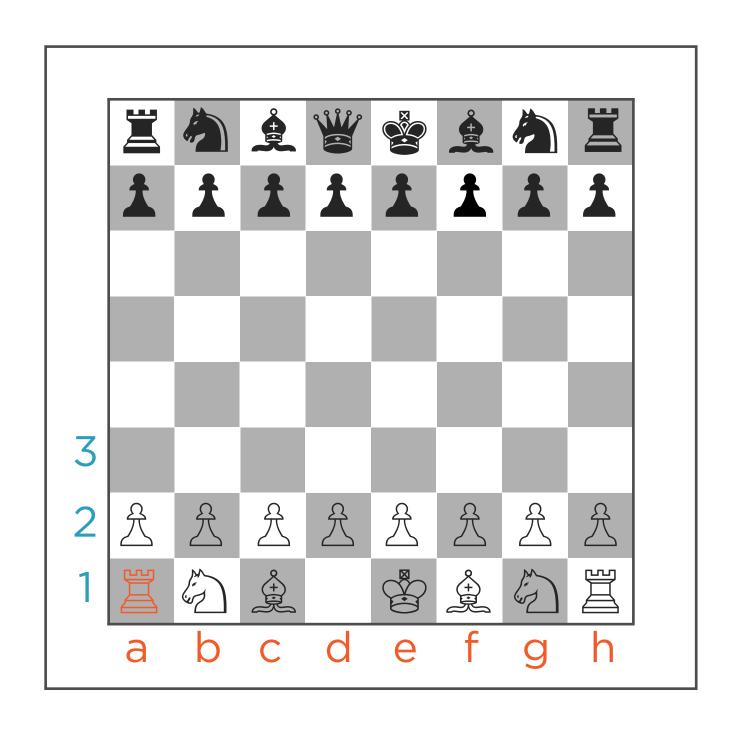
```
{'營園': ChessCoordinate('a', 1),
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'營園': ChessCoordinate('e', 1),
...
'營園 ': ChessCoordinate('f', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('h', 7),
}
```



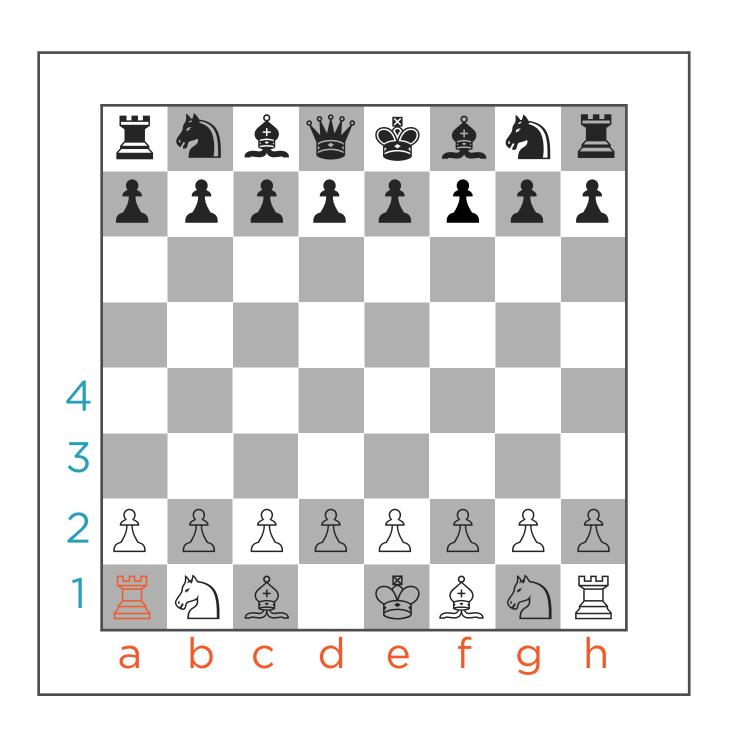
```
{'營園': ChessCoordinate('a', 1),
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'營園': ChessCoordinate('e', 1),
...
'營園 ': ChessCoordinate('f', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('h', 7),
}
```



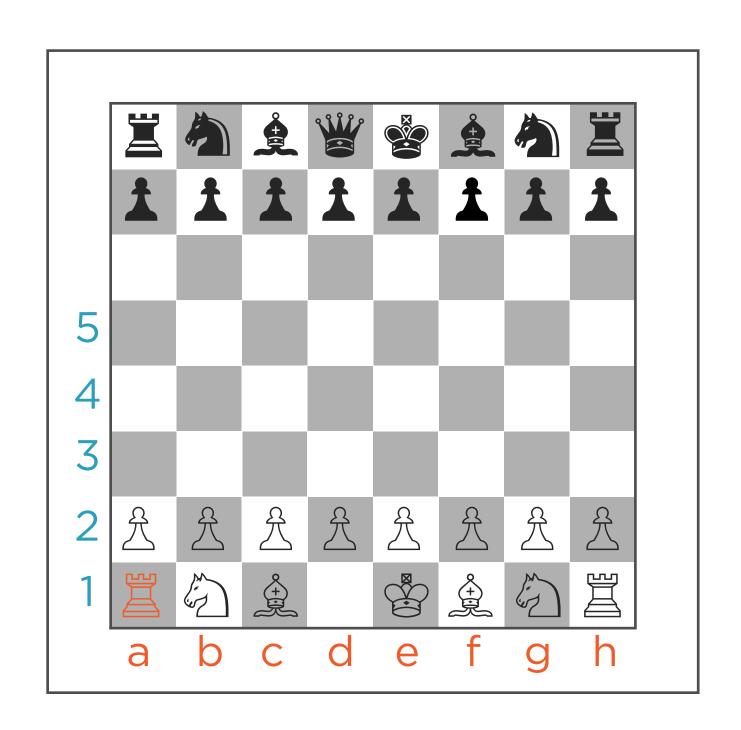
```
{'營園': ChessCoordinate('a', 1),
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'營園': ChessCoordinate('e', 1),
...
'營園 ': ChessCoordinate('f', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('h', 7),
}
```



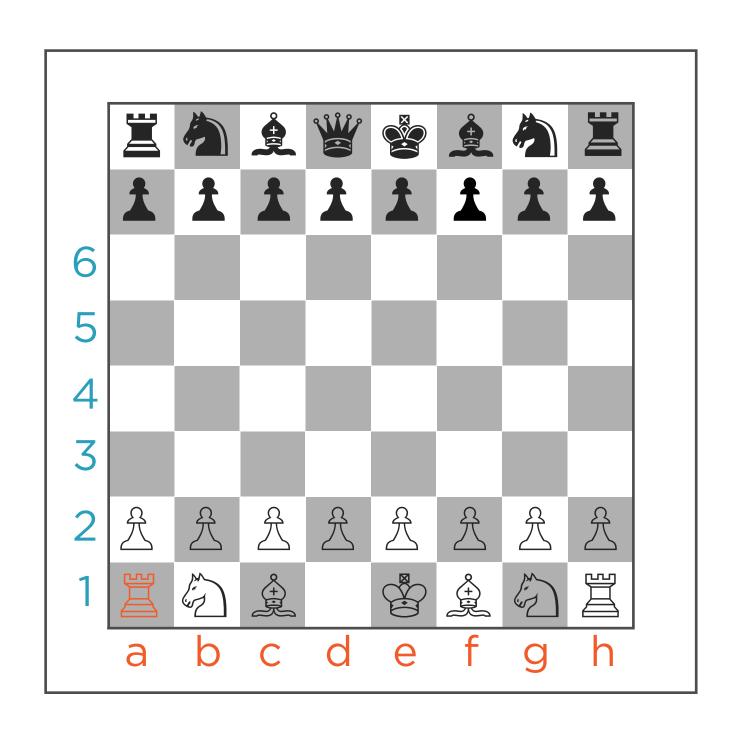
```
{'營園': ChessCoordinate('a', 1),
'營園': ChessCoordinate('b', 1),
'營園': ChessCoordinate('c', 1),
'營園': ChessCoordinate('d', 1),
'營園': ChessCoordinate('e', 1),
...
'營園 ': ChessCoordinate('f', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('h', 7),
}
```



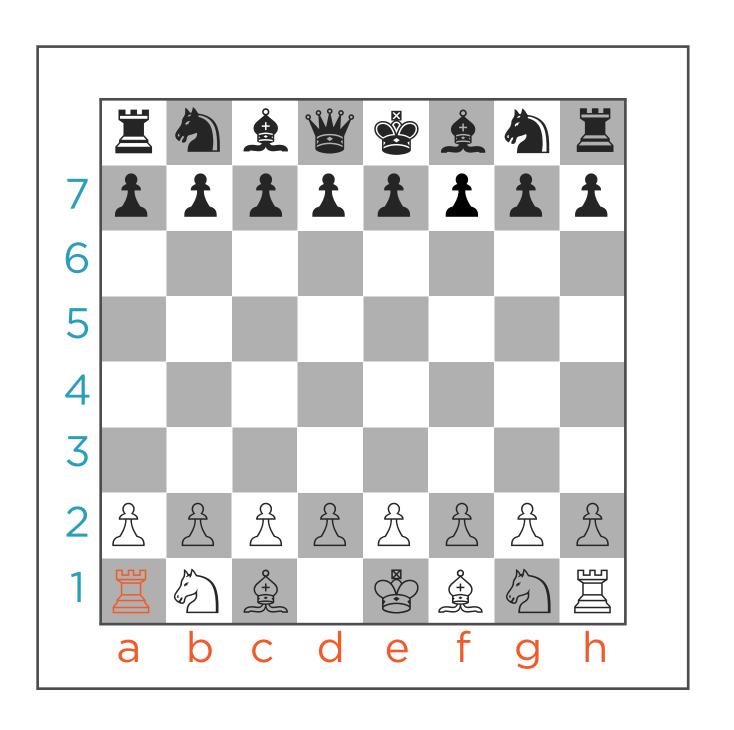
```
{'營園': ChessCoordinate('a', 1),
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'營園 ': ChessCoordinate('f', 7),
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}
```



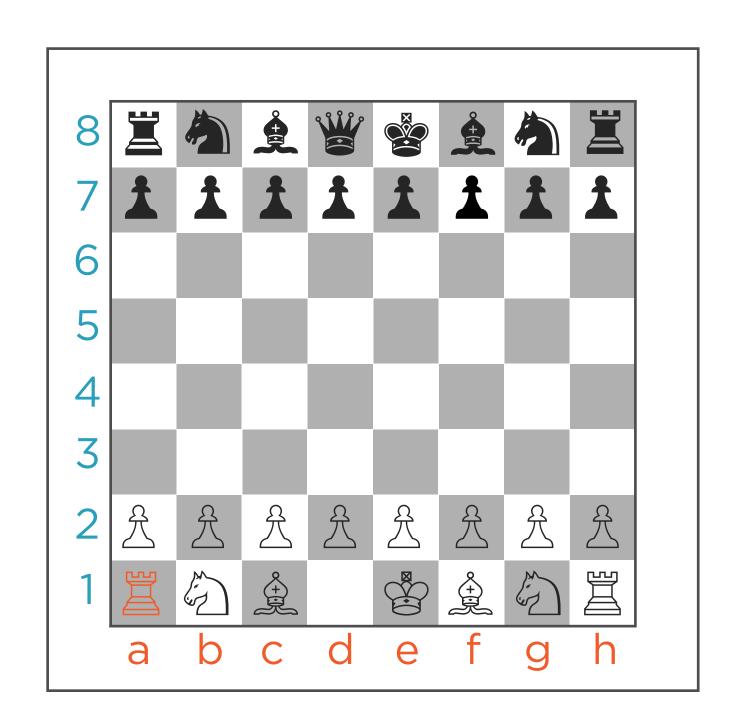
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{'營園': ChessCoordinate('a', 1),
'營園': ChessCoordinate('b', 1),
'營園': ChessCoordinate('c', 1),
'營園': ChessCoordinate('d', 1),
'營園': ChessCoordinate('e', 1),
...
'營園 ': ChessCoordinate('f', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('h', 7),
}
```



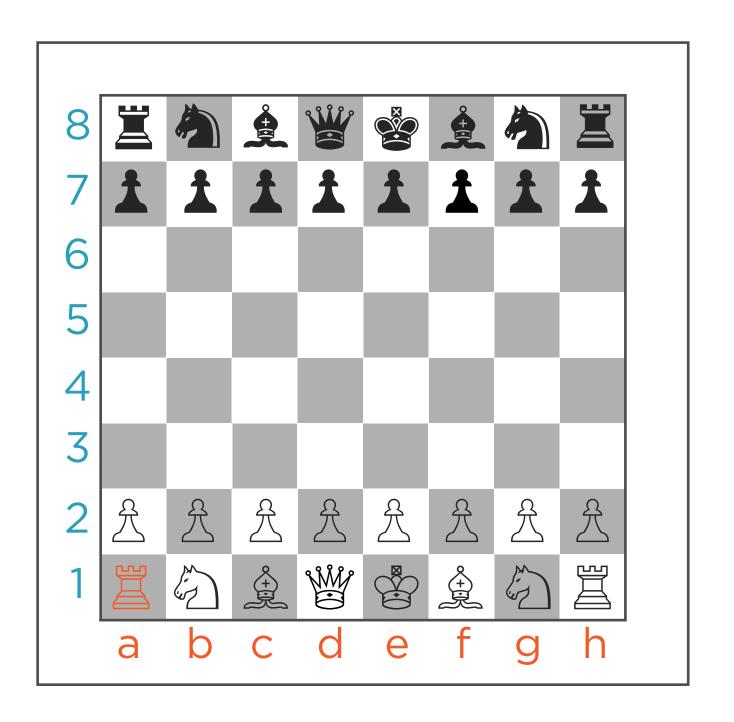
```
{'營園': ChessCoordinate('a', 1),
'營園': ChessCoordinate('b', 1),
'營園': ChessCoordinate('c', 1),
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'營園': ChessCoordinate('e', 1),
...
'營園 ': ChessCoordinate('f', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('h', 7),
}
```



```
{'營園': ChessCoordinate('a', 1),
'營園': ChessCoordinate('b', 1),
'營園': ChessCoordinate('c', 1),
'營園': ChessCoordinate('d', 1),
'營園': ChessCoordinate('e', 1),
...
'營園 ': ChessCoordinate('f', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('h', 7),
}
```

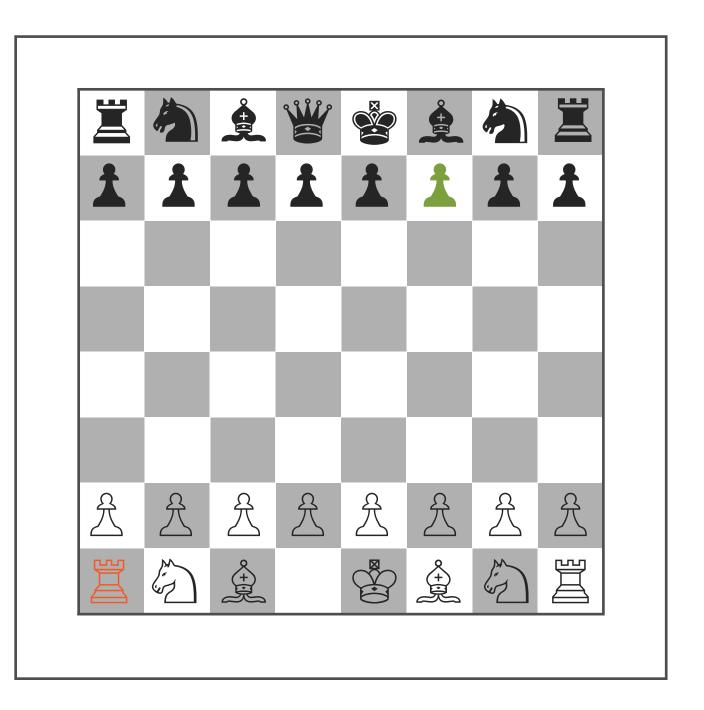


```
{'營園': ChessCoordinate('a', 1),
'營園': ChessCoordinate('b', 1),
'營園': ChessCoordinate('c', 1),
'營園': ChessCoordinate('d', 1),
'營園': ChessCoordinate('e', 1),
...
'營園 ': ChessCoordinate('f', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('h', 7),
}
```



```
{'營園': ChessCoordinate('a', 1),
'營園': ChessCoordinate('b', 1),
'營園': ChessCoordinate('c', 1),
'營園': ChessCoordinate('d', 1),
'營園': ChessCoordinate('e', 1),
...
'營園 ': ChessCoordinate('f', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('h', 7),
}
```

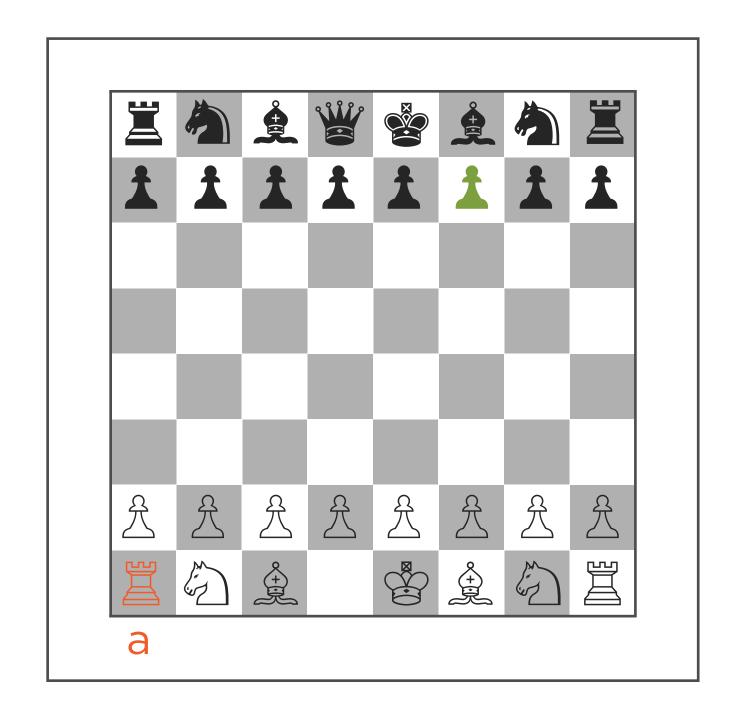




```
【'營堂': ChessCoordinate('a', 1),
'營令': ChessCoordinate('b', 1),
```

```
'營令': ChessCoordinate('b', 1),
'營食': ChessCoordinate('c', 1),
'營營': ChessCoordinate('d', 1),
'營營': ChessCoordinate('e', 1),
'營食': ChessCoordinate('f', 7),
'營食': ChessCoordinate('f', 7),
'營食': ChessCoordinate('g', 7),
'營養': ChessCoordinate('h', 7),
```





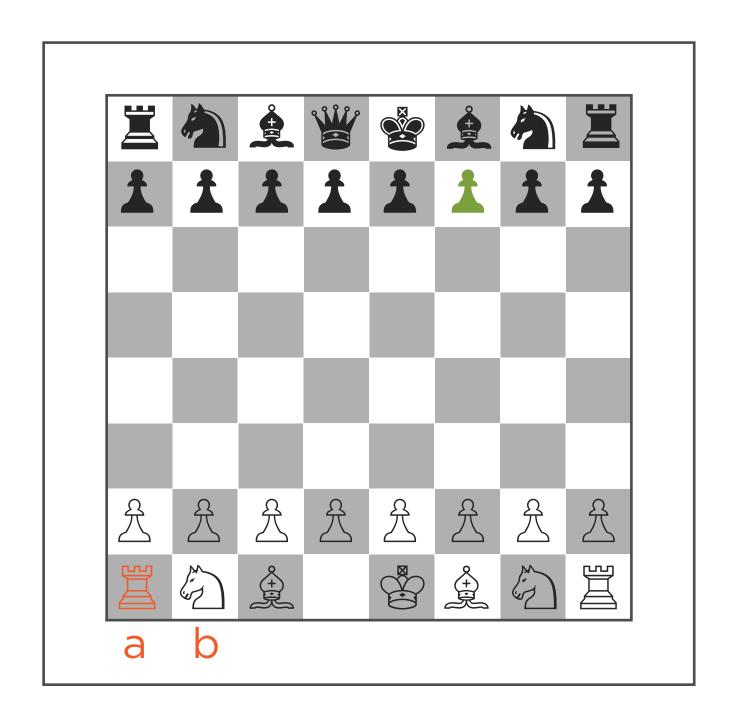
```
{'營堂': ChessCoordinate('a', 1),
'營戶': ChessCoordinate('b', 1),
'營戶': ChessCoordinate('c', 1),
'營貸': ChessCoordinate('d', 1),
'營貸': ChessCoordinate('e', 1),
```

' 👺 👲 🖈 ': ChessCoordinate('f', 7),

' \* ' : ChessCoordinate('g', 7),

'♚≝i': ChessCoordinate('h', 7),

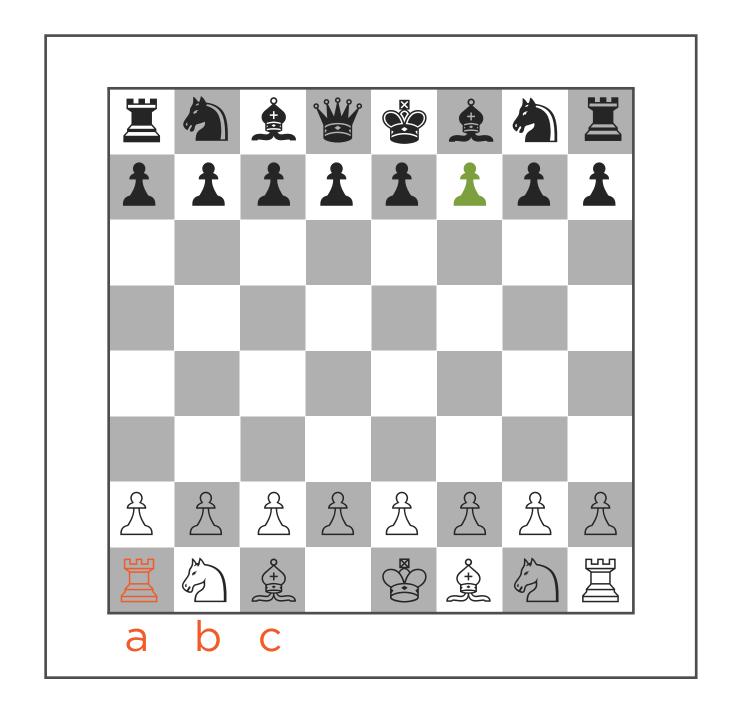




```
{'營園': ChessCoordinate('a', 1),
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'營園': ChessCoordinate('d', 1),
'營園': ChessCoordinate('e', 1),
...
'營園 : ChessCoordinate('f', 7),
'營園 : ChessCoordinate('f', 7),
```

'♚≝i': ChessCoordinate('h', 7),

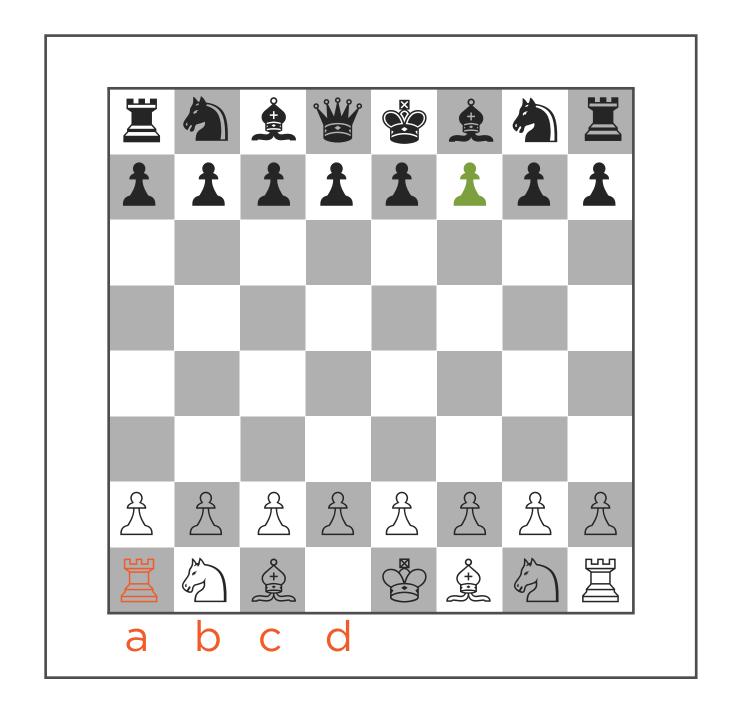




```
【'營堂': ChessCoordinate('a', 1),
```

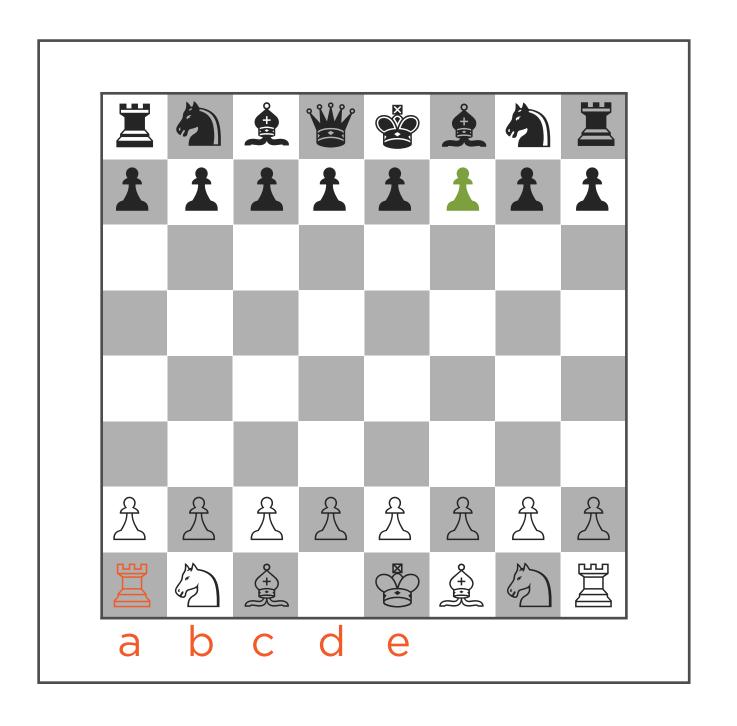
```
ThessCoordinate(a, 1),
'營令': ChessCoordinate('b', 1),
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'營令': ChessCoordinate('d', 1),
'營令': ChessCoordinate('e', 1),
...
'營令: ChessCoordinate('f', 7),
'營令: ChessCoordinate('f', 7),
'營令: ChessCoordinate('g', 7),
'營令: ChessCoordinate('h', 7),
```





```
【'營置': ChessCoordinate('a', 1),
'營心': ChessCoordinate('b', 1),
```

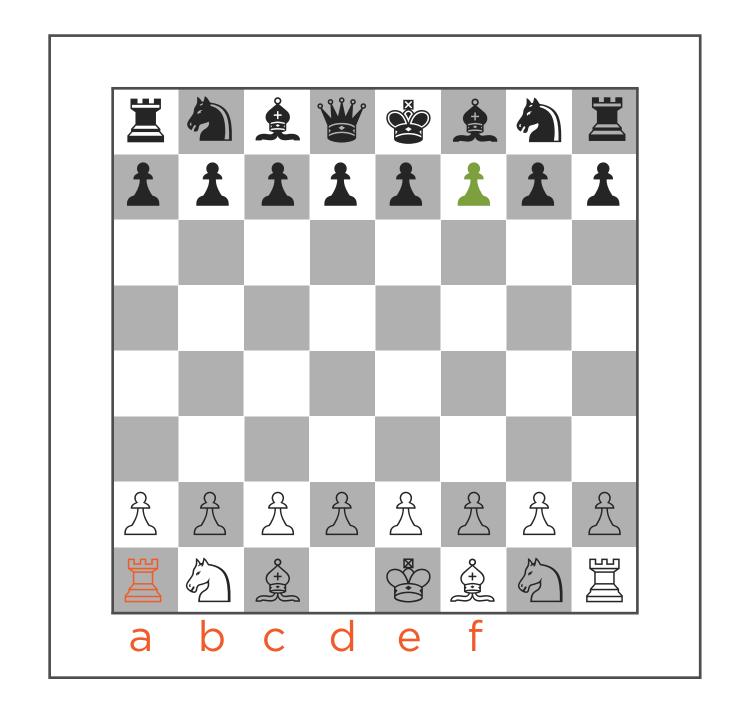
- '豐金': ChessCoordinate('c', 1),
  '豐豐': ChessCoordinate('d', 1),
  'ভ�': ChessCoordinate('e', 1),
- '♚≜ i': ChessCoordinate('f', 7),
  '♚ i': ChessCoordinate('g', 7),
  '♚ i': ChessCoordinate('h', 7),



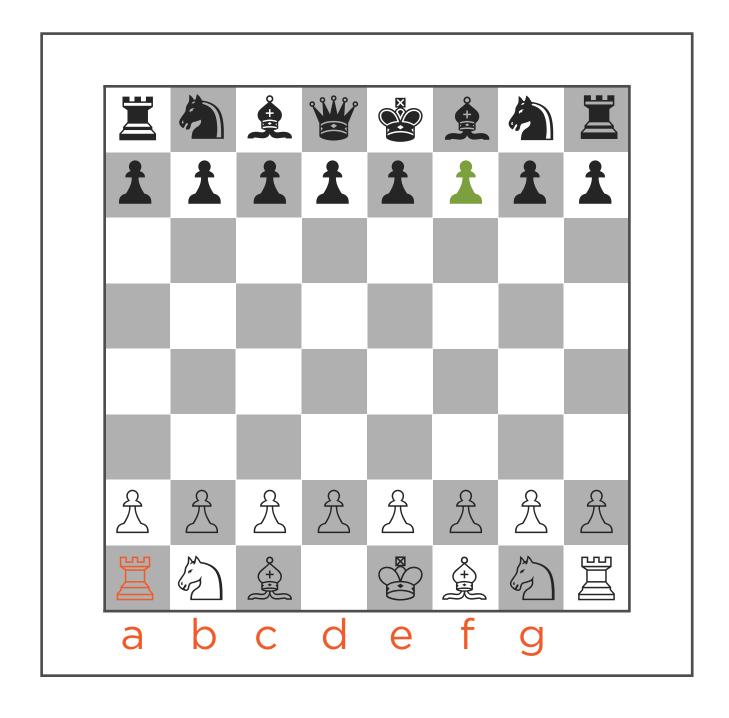
```
{'營邕': ChessCoordinate('a', 1), '營②': ChessCoordinate('b', 1), '營逸': ChessCoordinate('c', 1),
```

'"
'": ChessCoordinate('d', 1),
'"
'": ChessCoordinate('e', 1),
...
'"
'"
'": ChessCoordinate('f', 7),
'"
"": ChessCoordinate('g', 7),
'"
"": ChessCoordinate('h', 7),



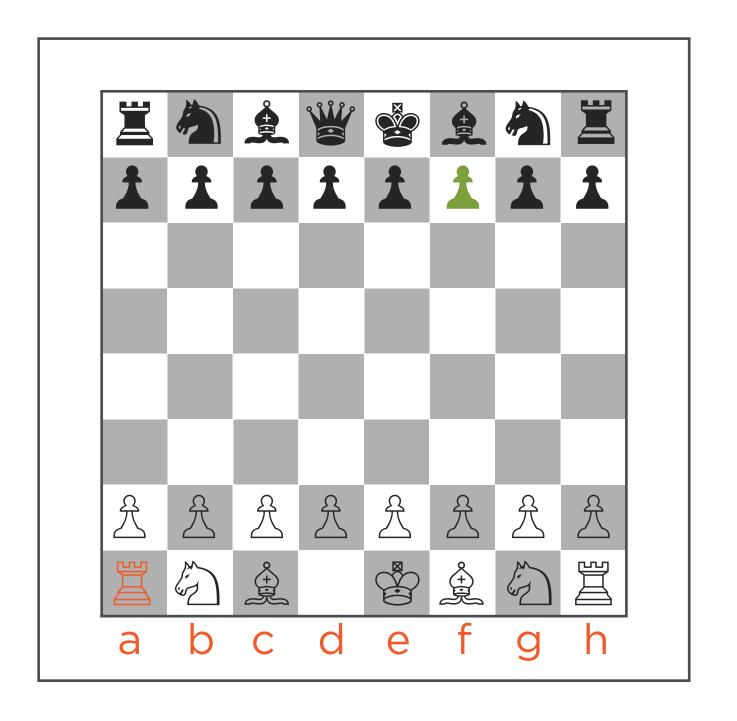


```
{'營園': ChessCoordinate('a', 1),
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'營園': ChessCoordinate('d', 1),
'營園': ChessCoordinate('e', 1),
...
'營園 ': ChessCoordinate('f', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('g', 7),
'營園 ': ChessCoordinate('h', 7),
}
```

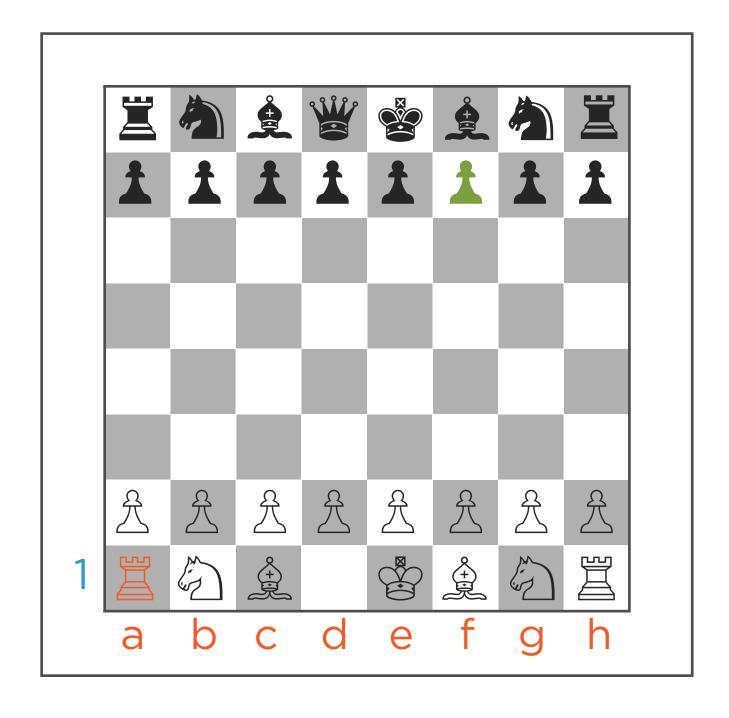


```
【'營置': ChessCoordinate('a', 1),
'營戶': ChessCoordinate('b', 1),
'營戶': ChessCoordinate('c', 1)
```

- '營金': ChessCoordinate('c', 1),
  '營營': ChessCoordinate('d', 1),
  '營營': ChessCoordinate('e', 1),
  ...
  '營金': ChessCoordinate('f', 7),
  '營金': ChessCoordinate('f', 7),
  '營金': ChessCoordinate('g', 7),
  '營金': ChessCoordinate('h', 7),



```
{'營堂': ChessCoordinate('a', 1),
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'營戶': ChessCoordinate('c', 1),
'營戶': ChessCoordinate('d', 1),
'營戶': ChessCoordinate('e', 1),
...
'營戶上': ChessCoordinate('f', 7),
'營戶上': ChessCoordinate('g', 7),
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}
```



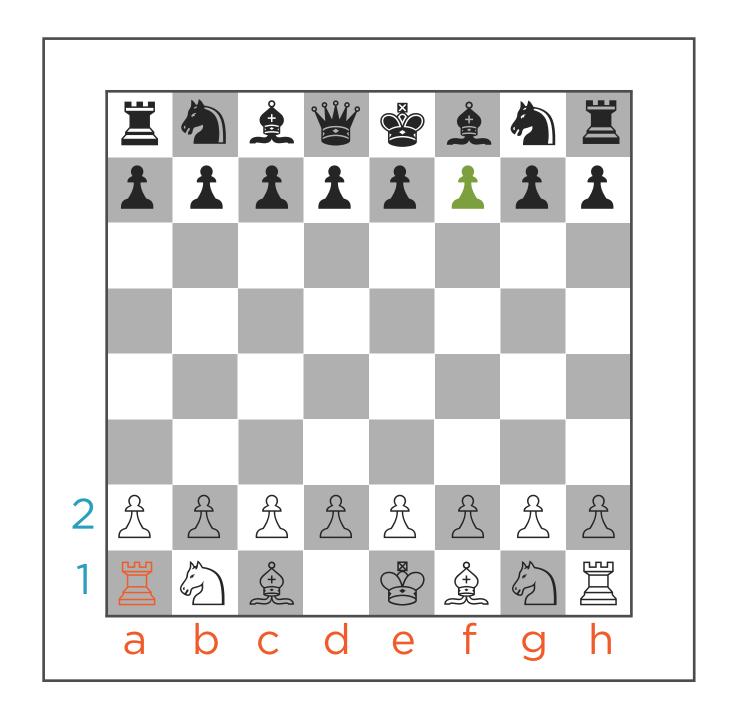
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'營園': ChessCoordinate('d', 1),
```

' 📽 👲 🖈 ': ChessCoordinate('f', 7),

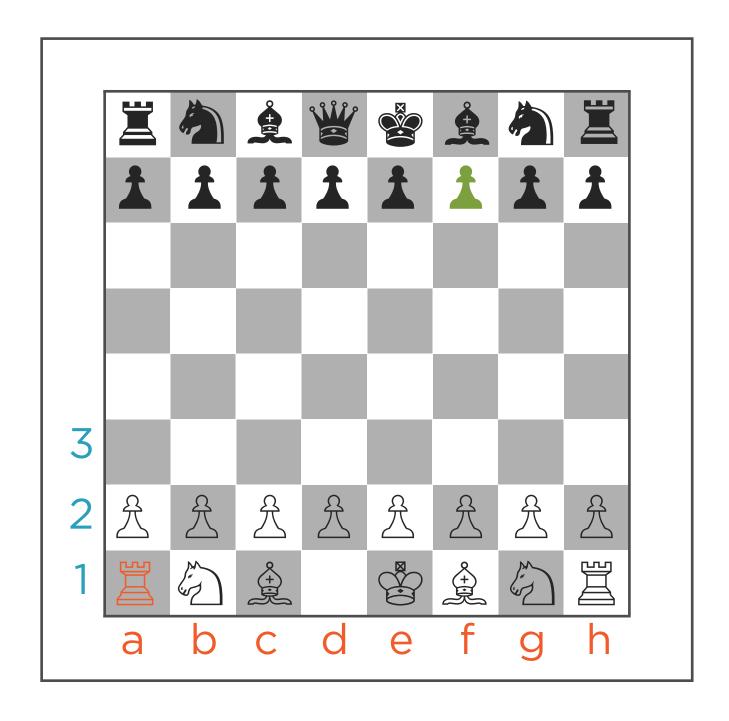
' \* ' : ChessCoordinate('g', 7),

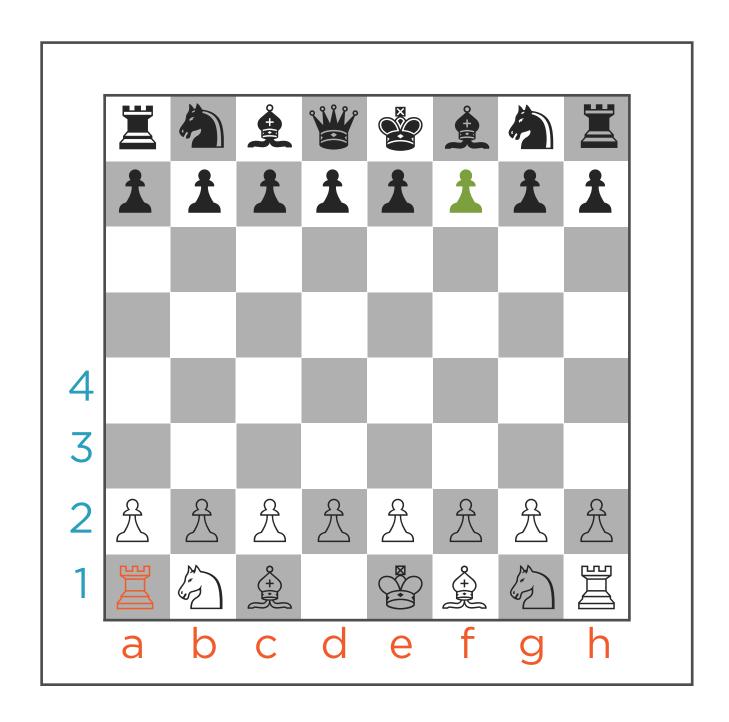
'♚≝i': ChessCoordinate('h', 7),





```
{'���': ChessCoordinate('a', 1),
'���': ChessCoordinate('b', 1),
'���': ChessCoordinate('c', 1),
'���': ChessCoordinate('d', 1),
'���': ChessCoordinate('e', 1),
...
'���': ChessCoordinate('f', 7),
'���': ChessCoordinate('f', 7),
'���': ChessCoordinate('g', 7),
'���': ChessCoordinate('h', 7),
}
```





```
3
    允
        允
      允
  光
          尤
```

```
'\\)': ChessCoordinate('b', 1),
'፟፟፟፟፟፟፟፟፟፟፟፟፟ ': ChessCoordinate('e', 1),
' 👺 👲 🖈 ': ChessCoordinate('f', 7),
' * ' : ChessCoordinate('g', 7),
'♚≝i': ChessCoordinate('h', 7),
```

```
6
3
     允
         允
      允
   允
           允
```

```
6
3
    允
        允

      尤
```

```
'\\)': ChessCoordinate('b', 1),
'፟፟፟፟፟፟፟፟፟፟፟፟፟ ': ChessCoordinate('e', 1),
' 👺 👲 🖈 ': ChessCoordinate('f', 7),
'♚��1': ChessCoordinate('g', 7),
'♚≝i': ChessCoordinate('h', 7),
```

```
6
3
    允
        允

      尤
```

```
6
3
   允
      允

     尤
        允
```

### Chess Board Memory Usage

17.1 MB

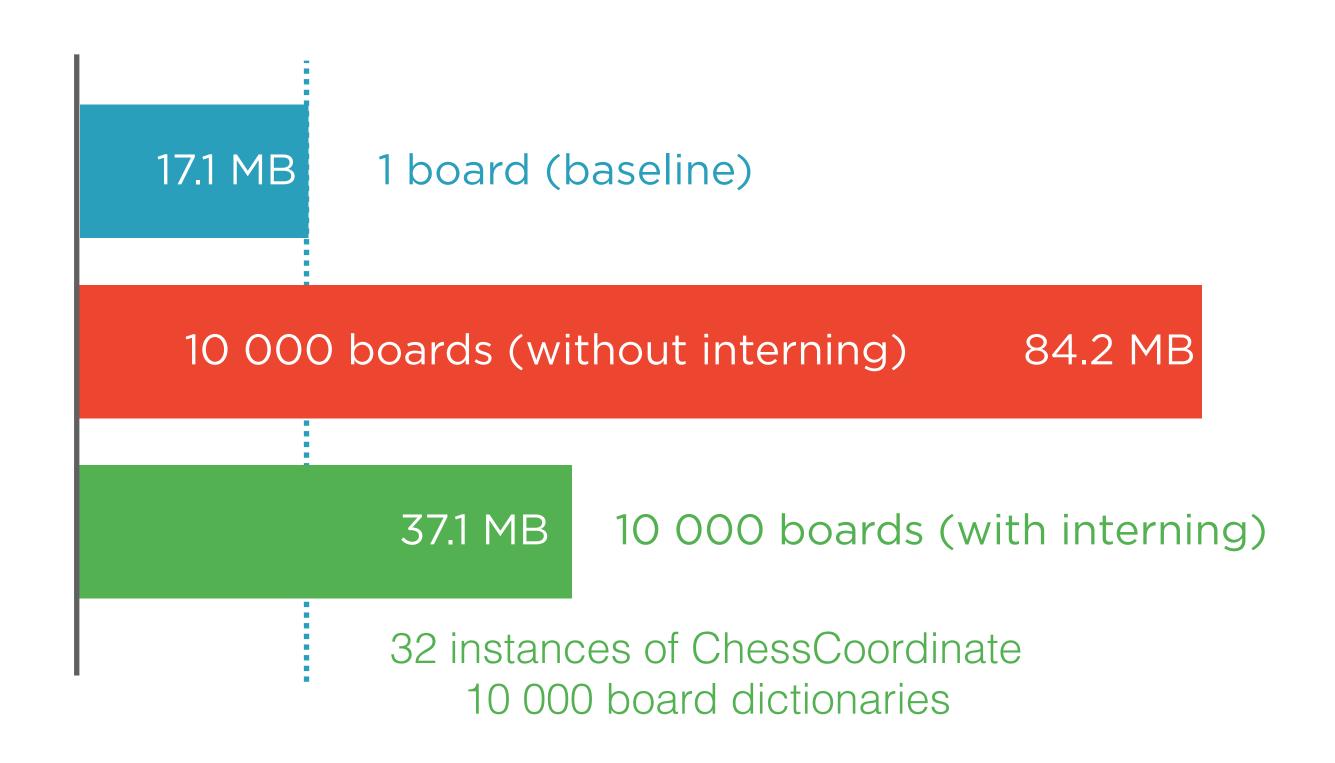
1 board (baseline)

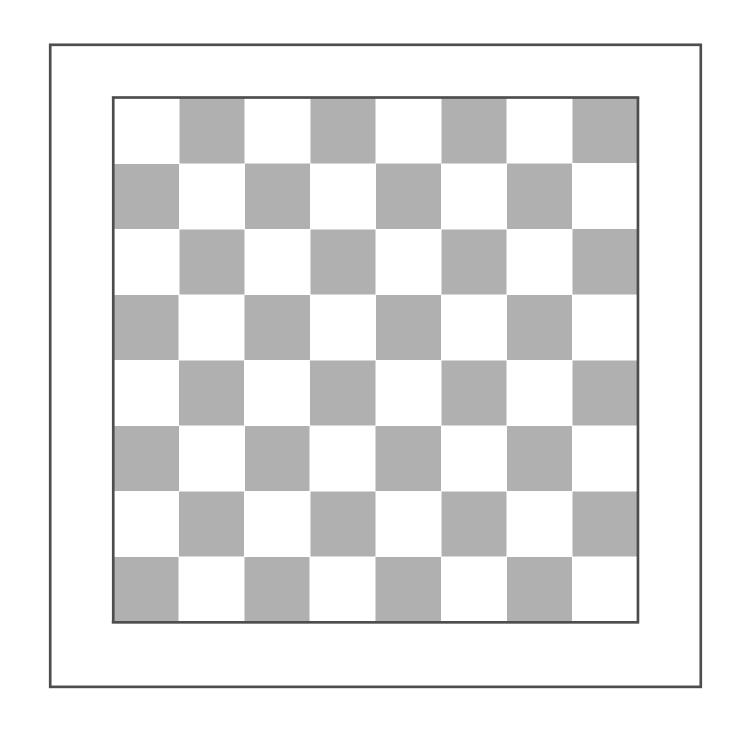
10 000 boards (without interning)

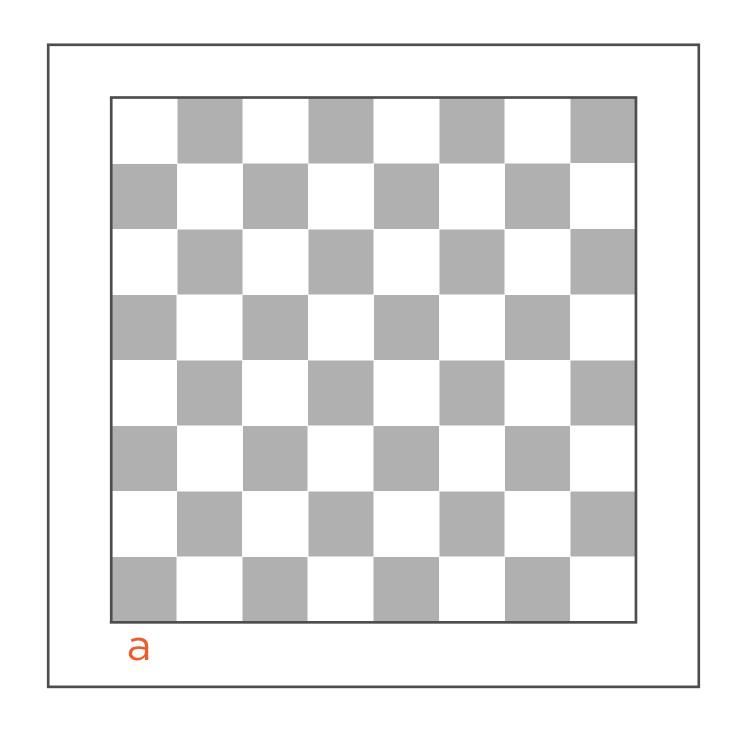
84.2 MB

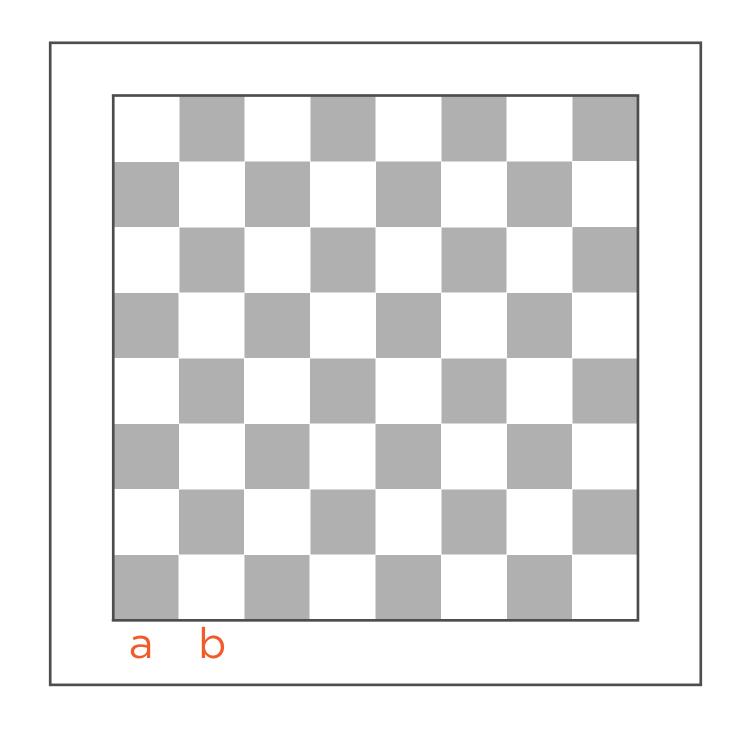
320 000 instances of ChessCoordinate 10 000 board dictionaries

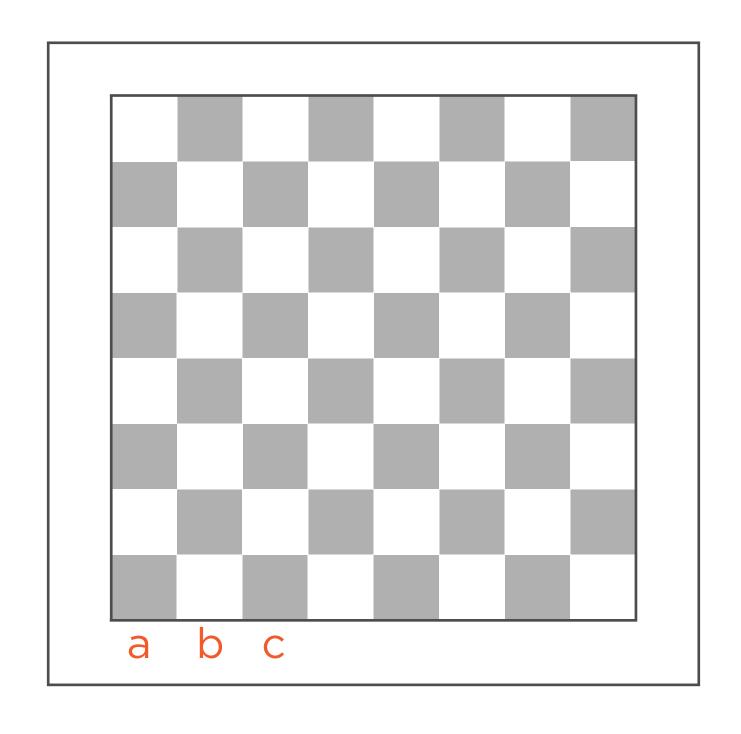
#### Chess Board Memory Usage

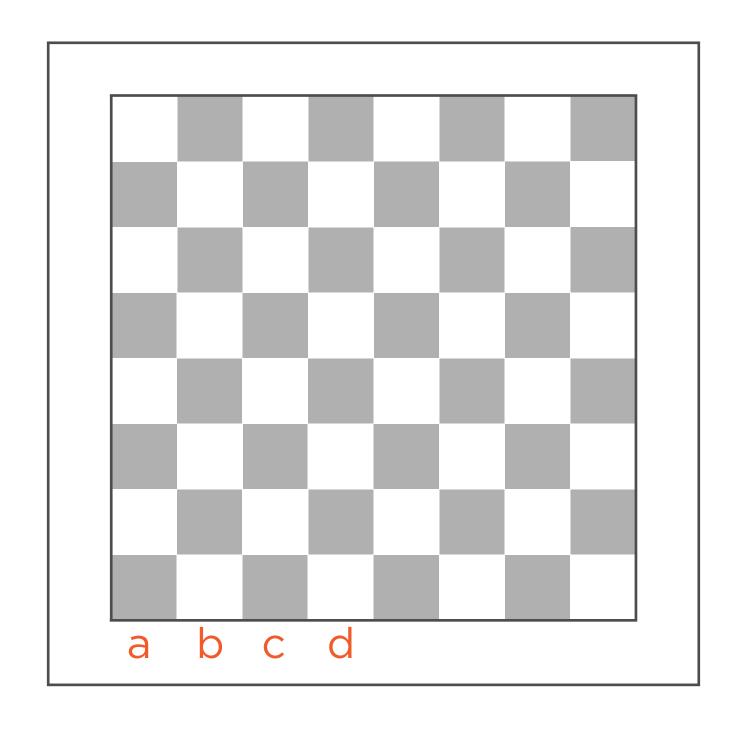


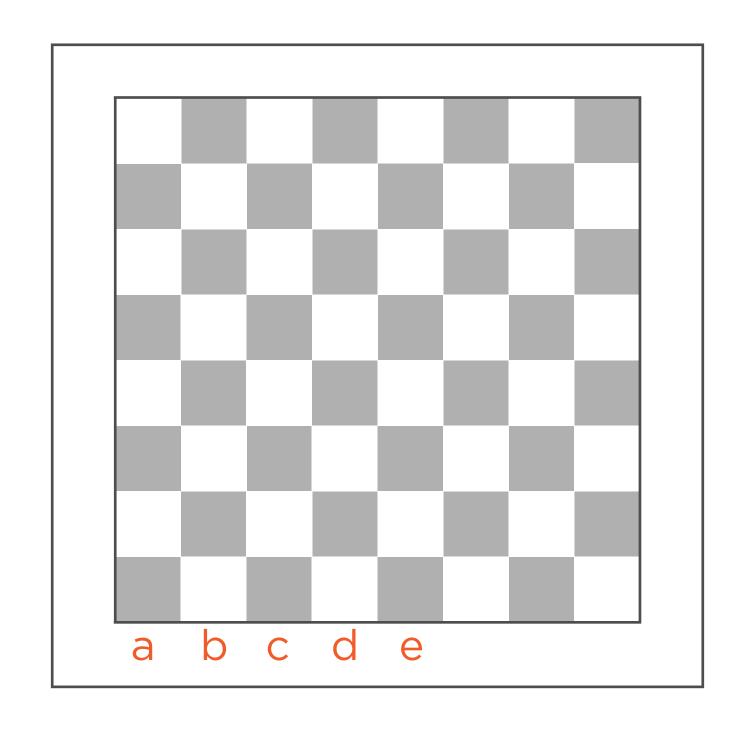


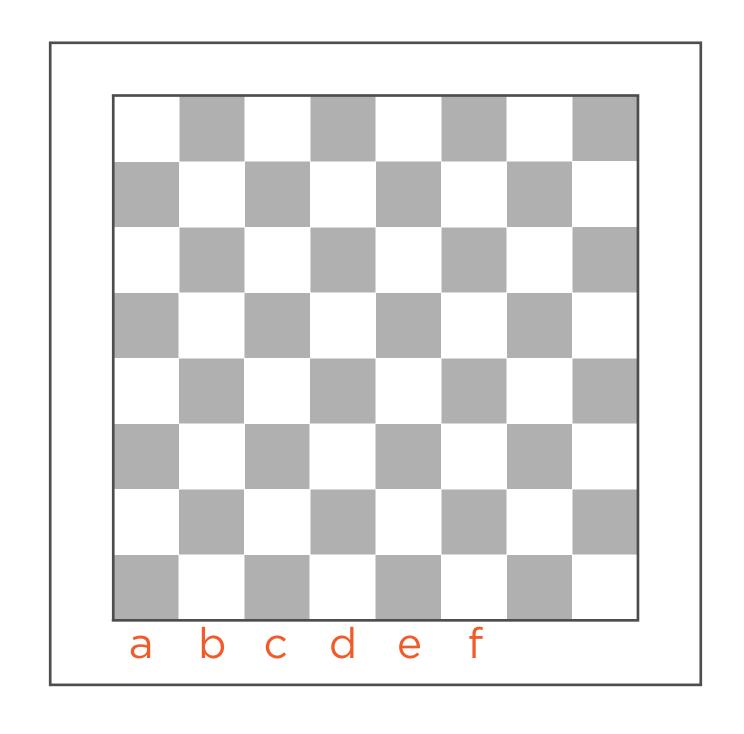


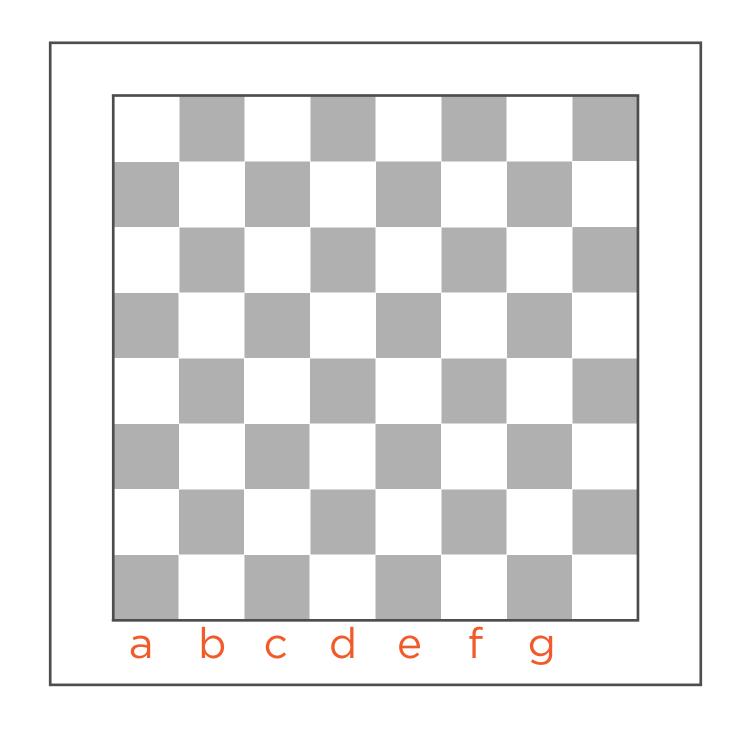


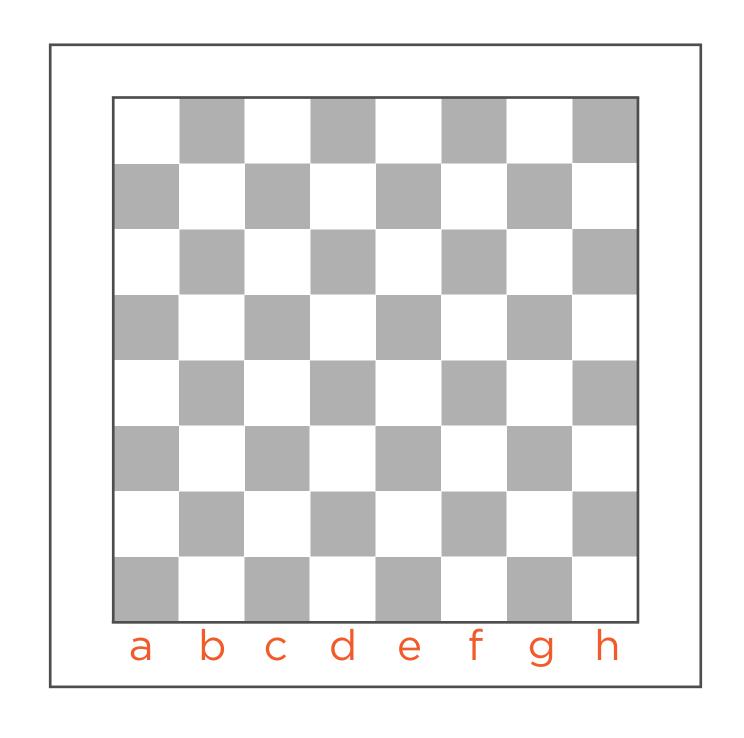


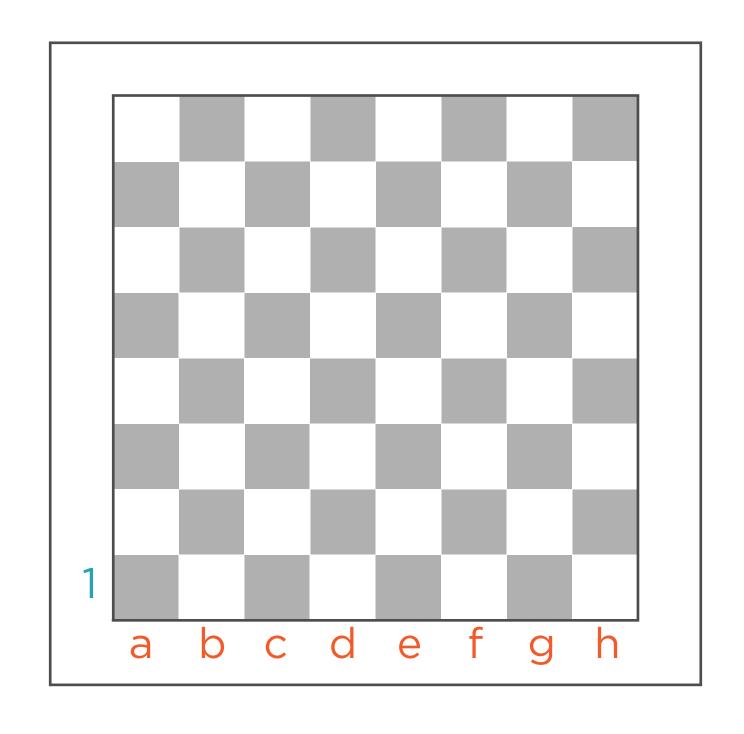


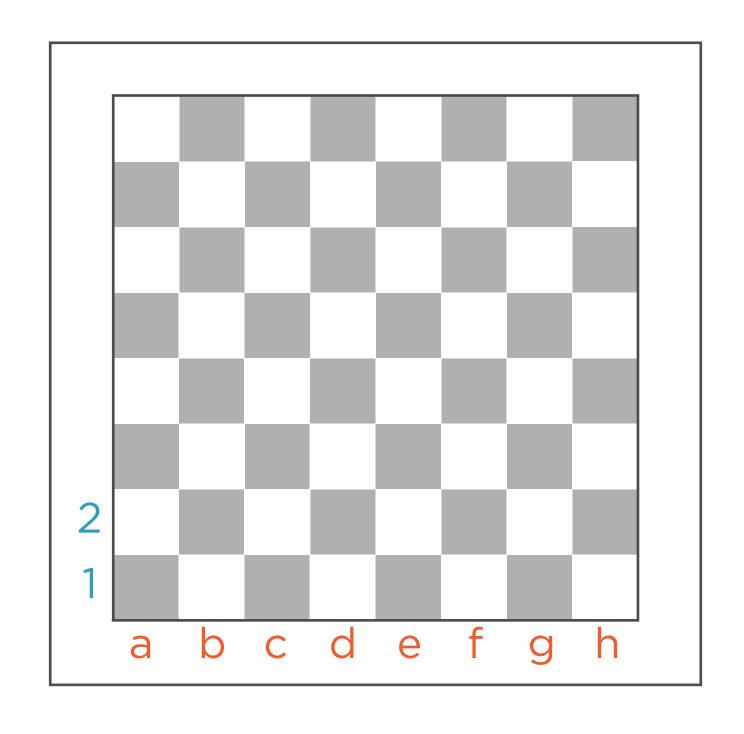


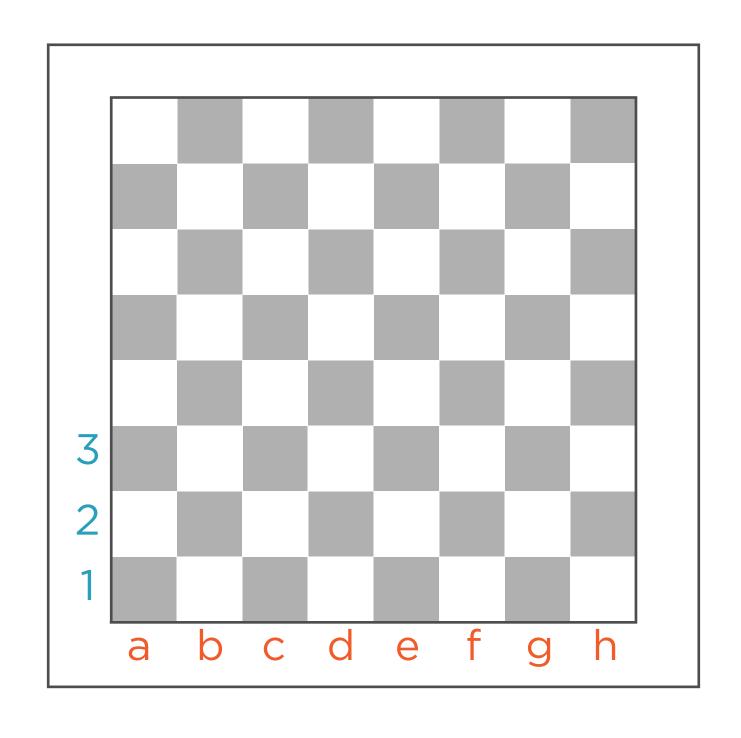


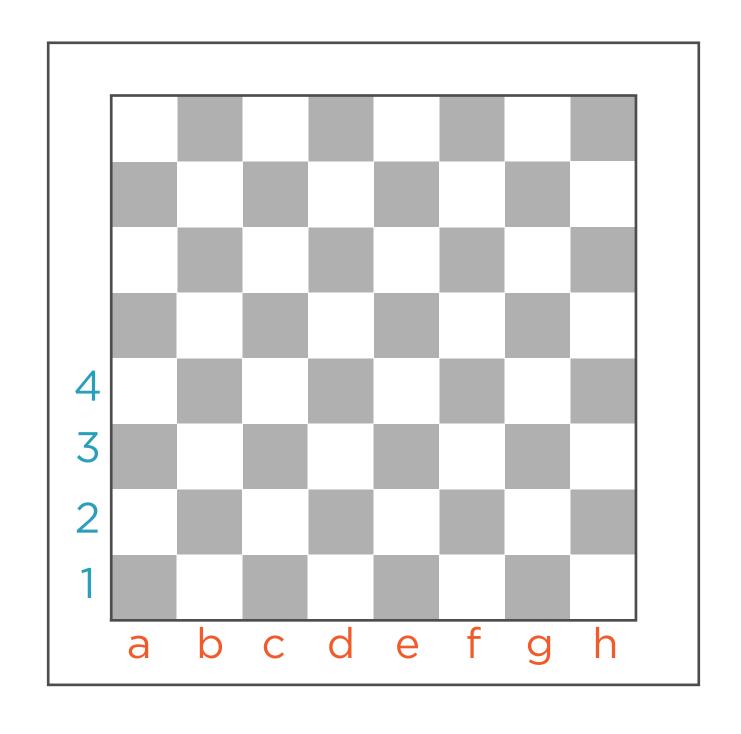


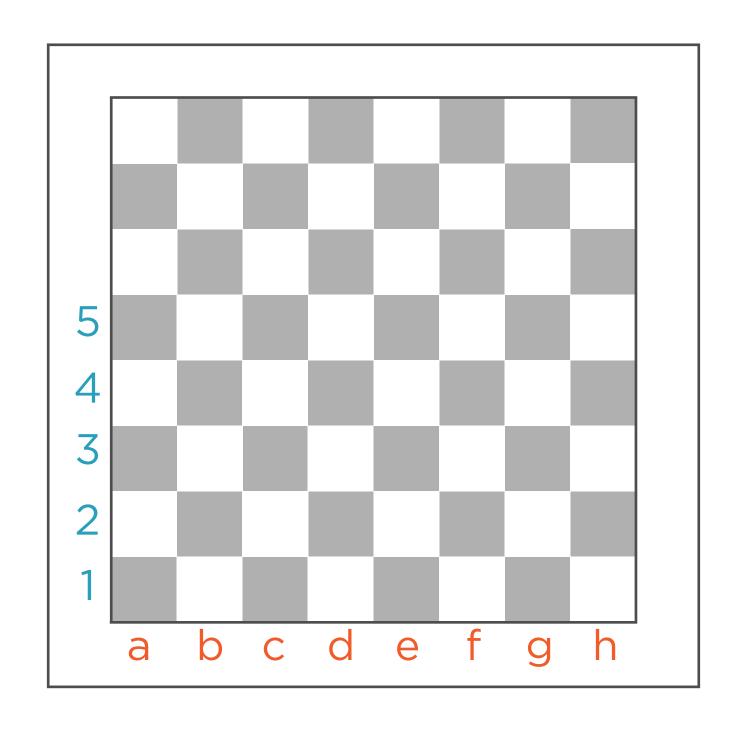


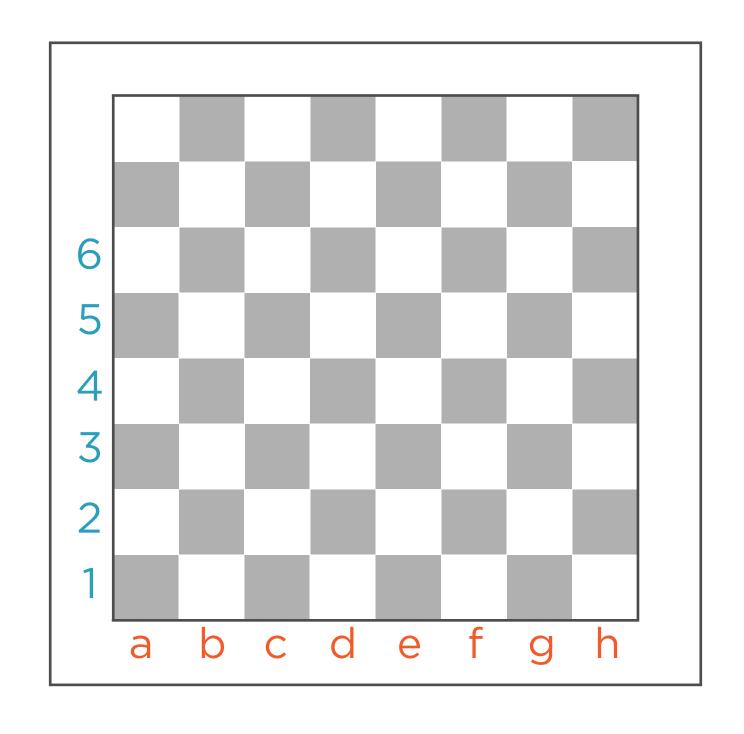


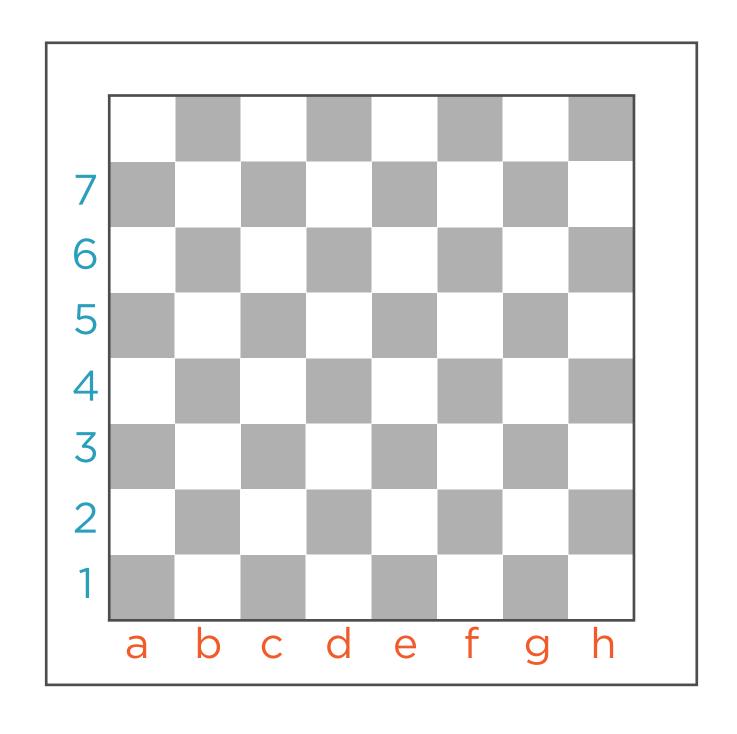


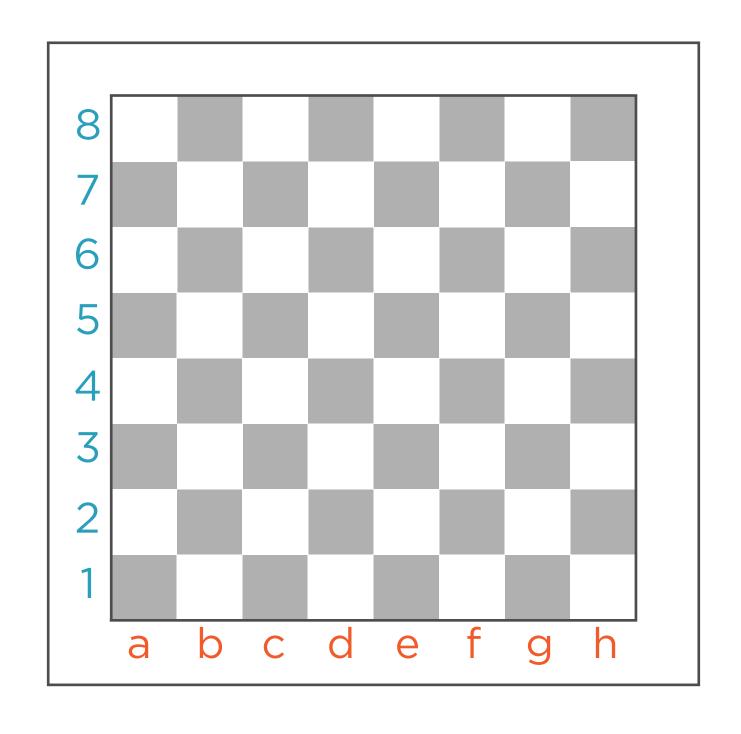


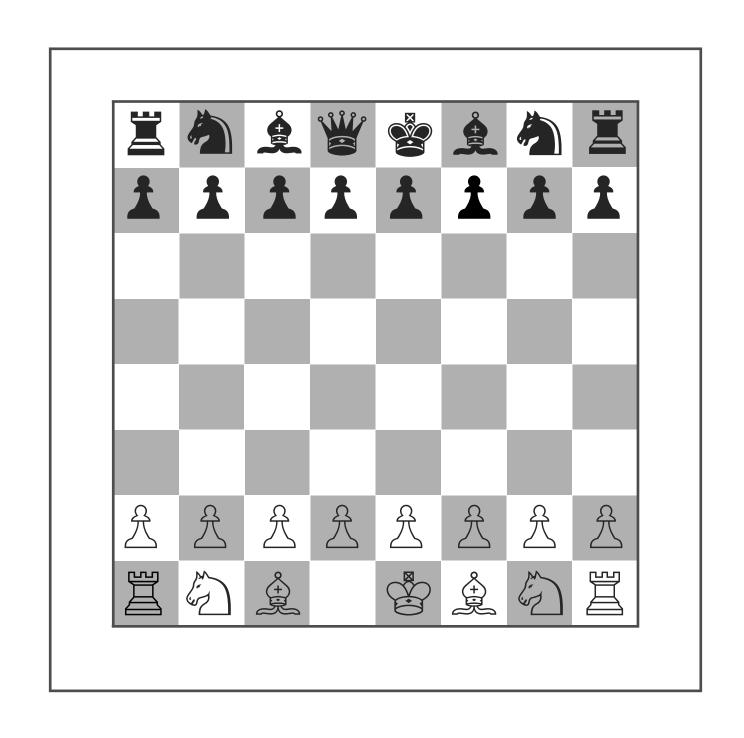


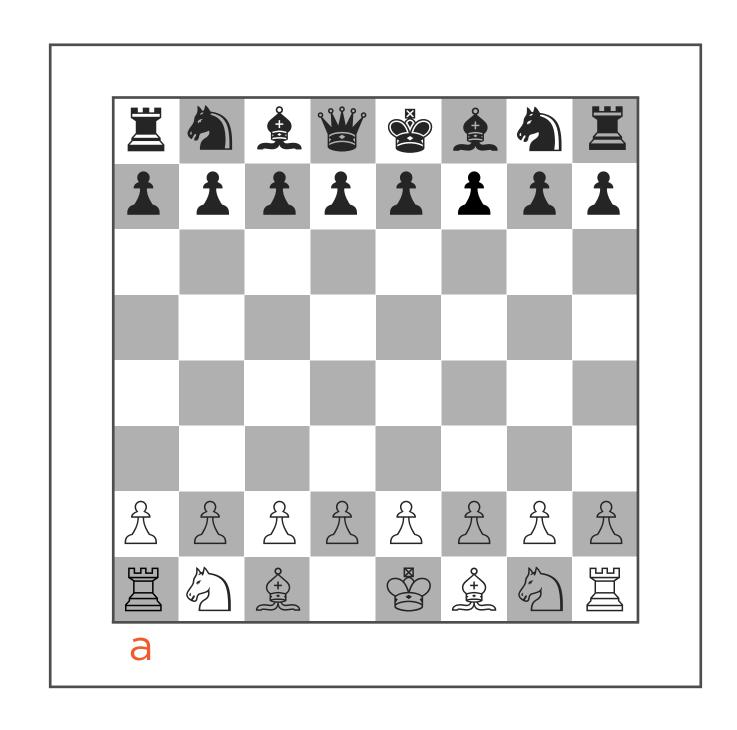


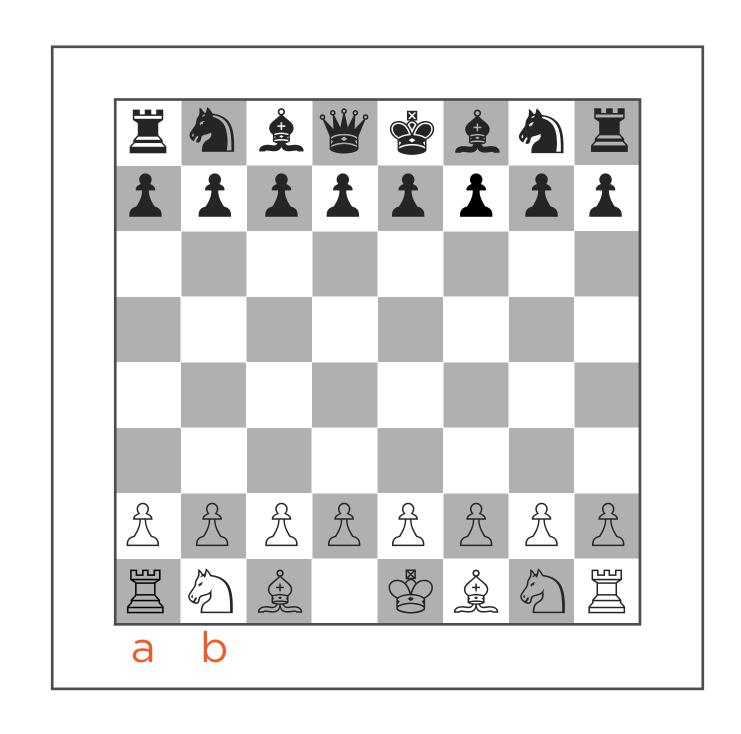


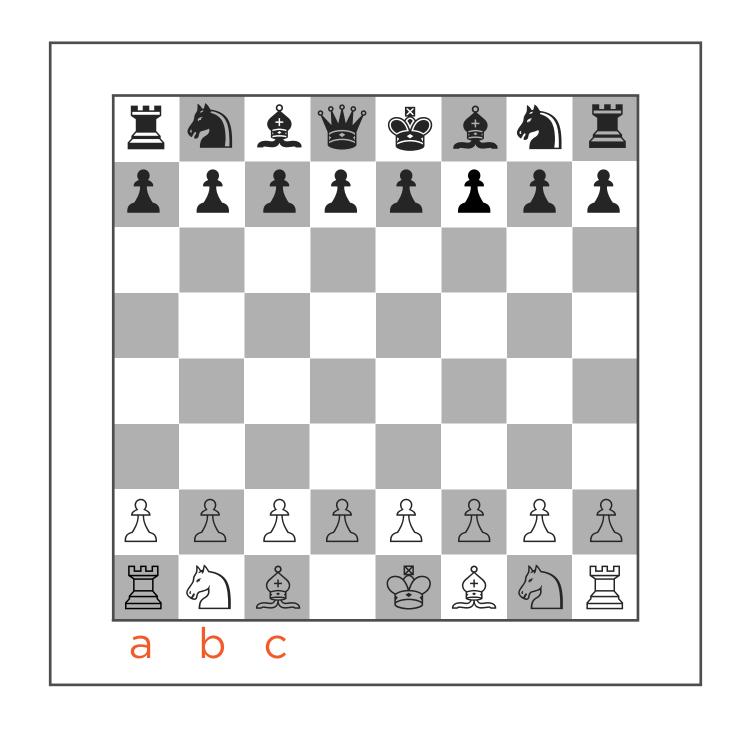


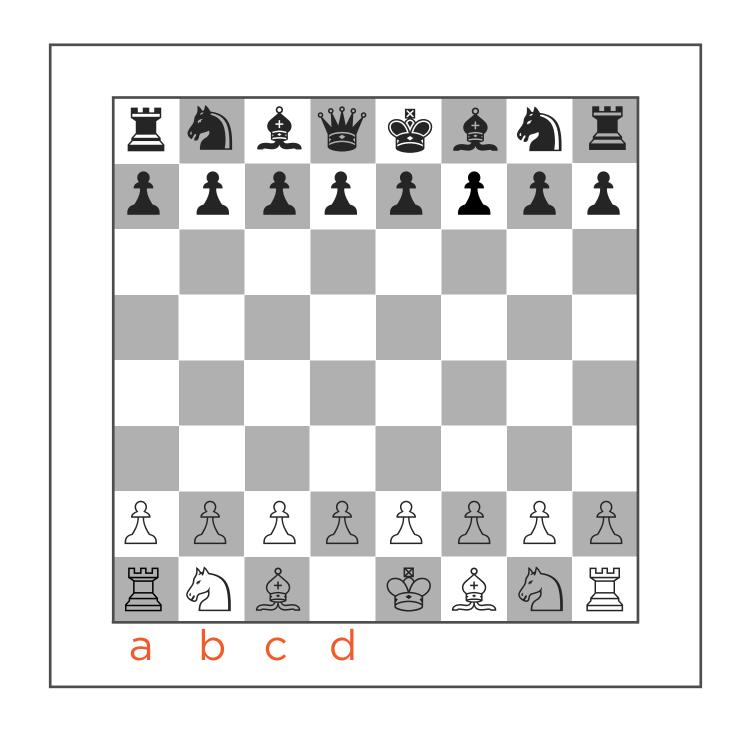


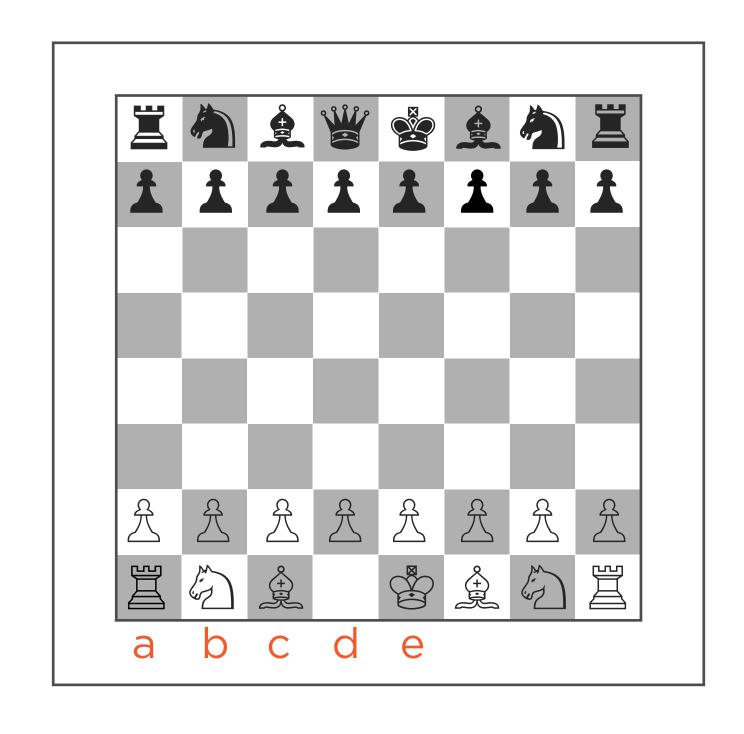


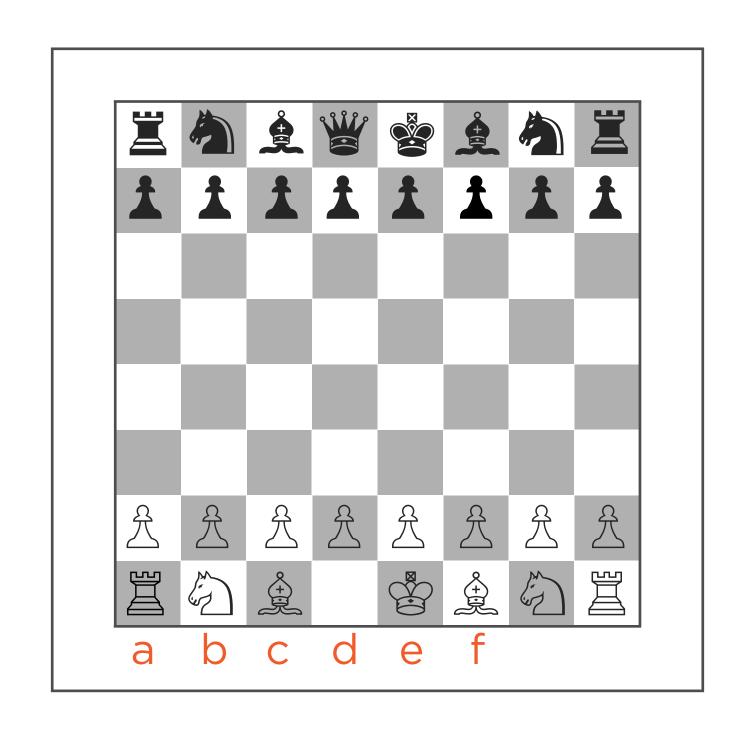


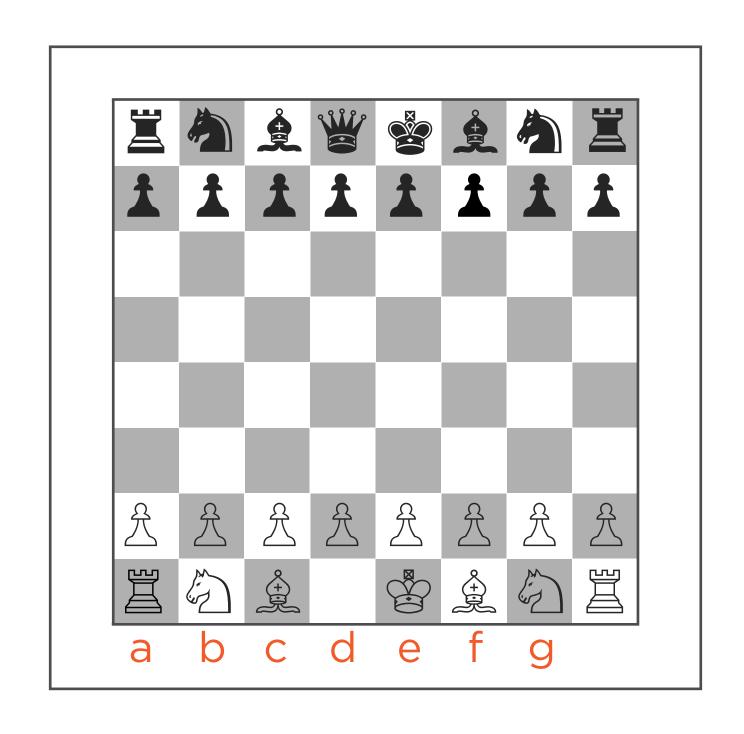


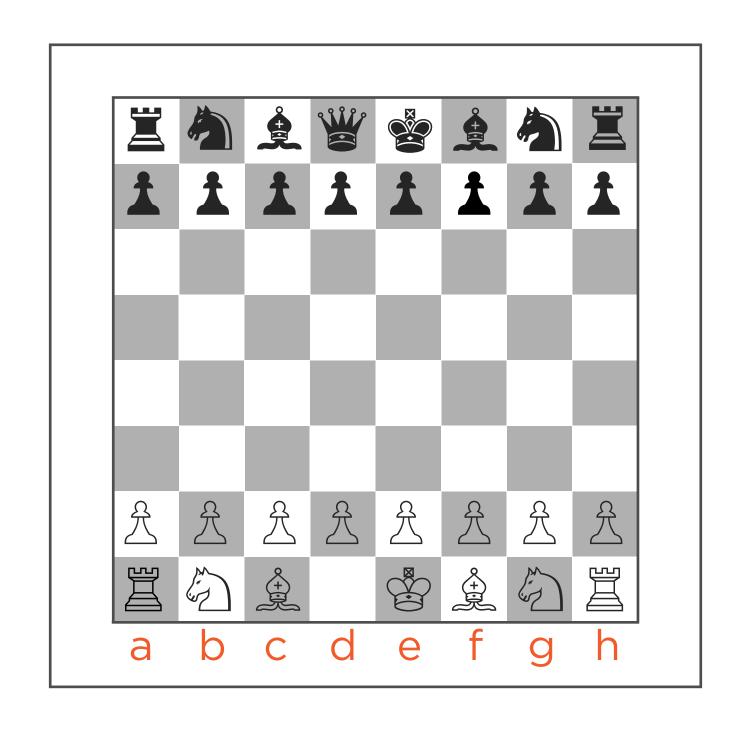


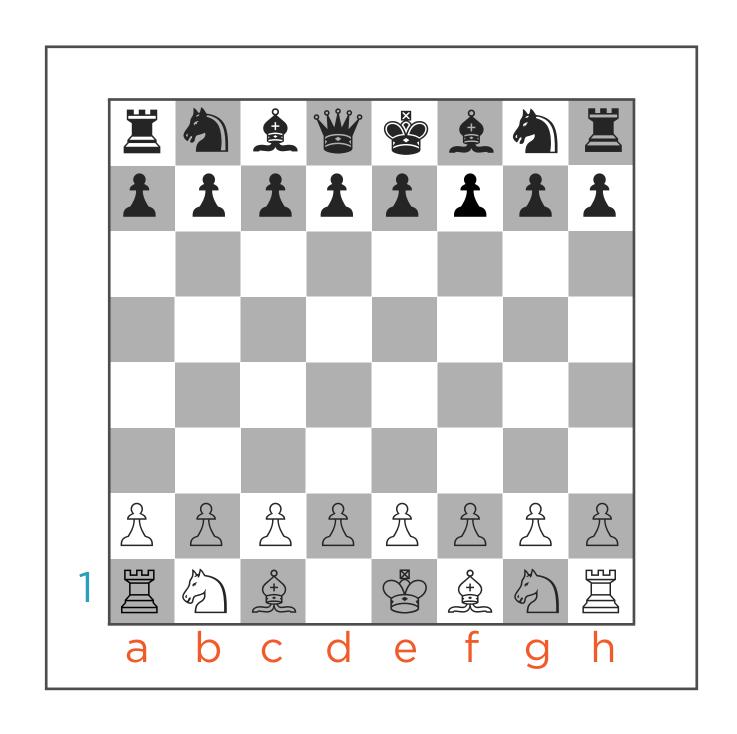


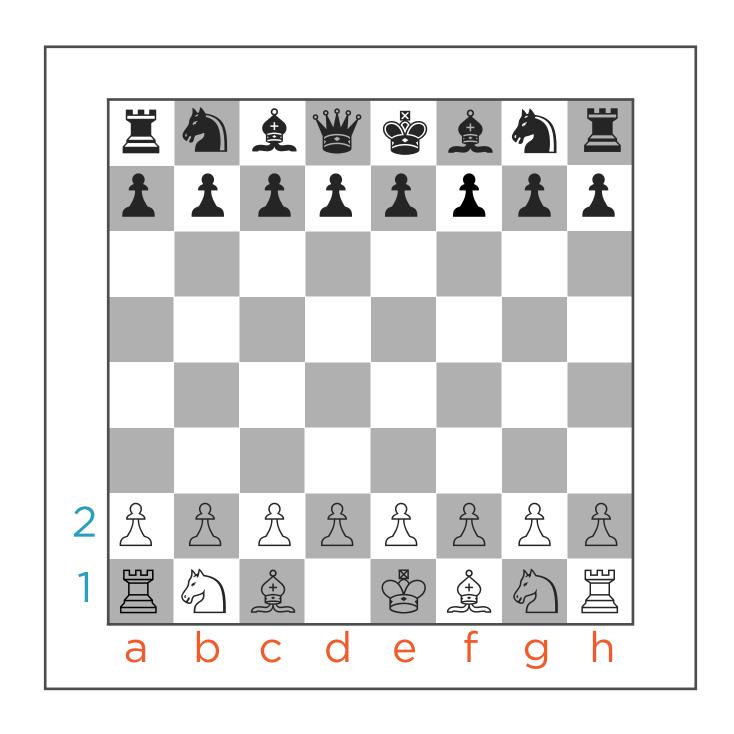


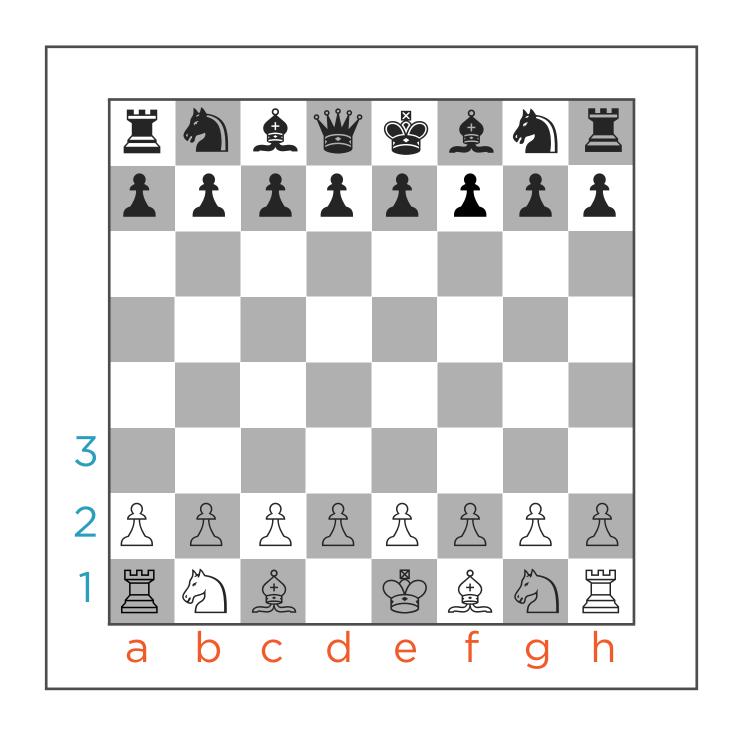


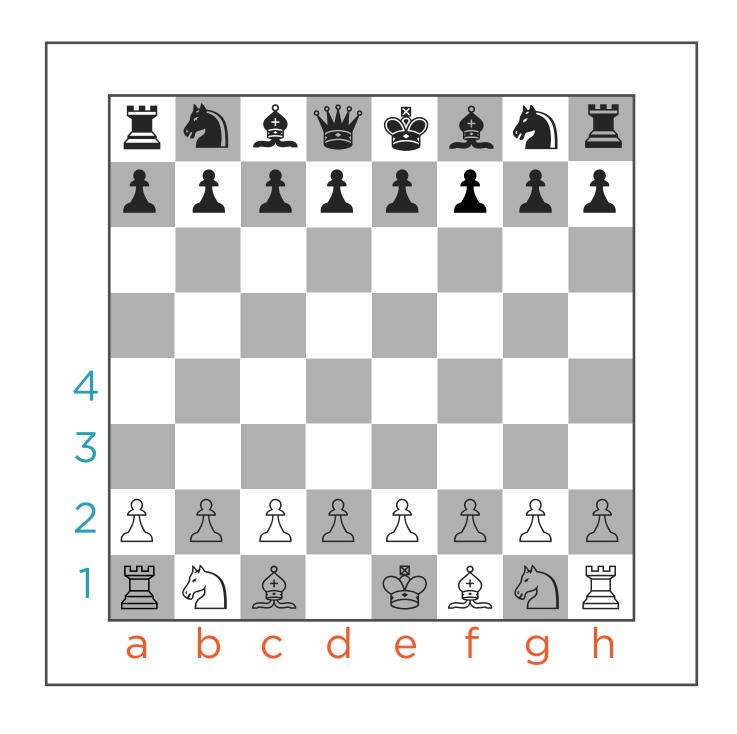


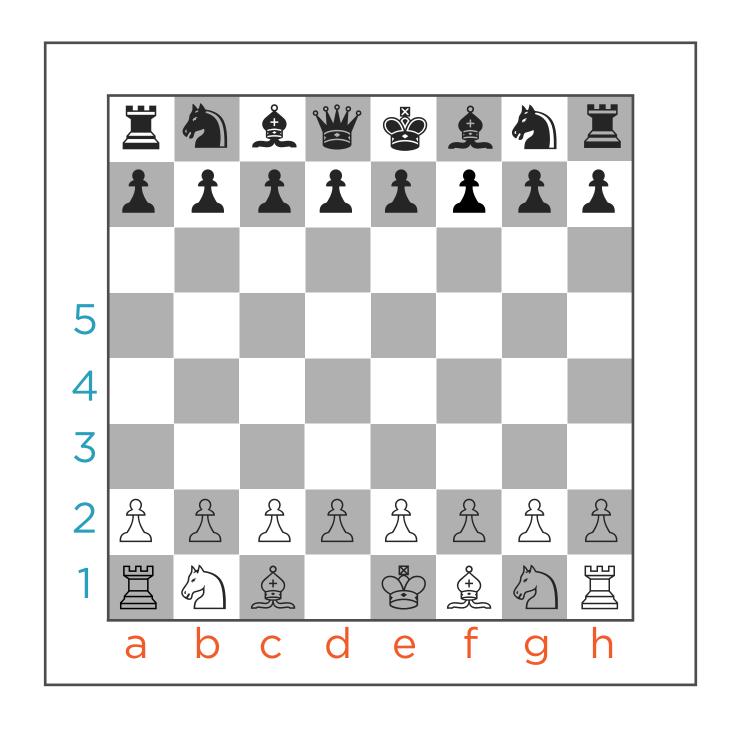


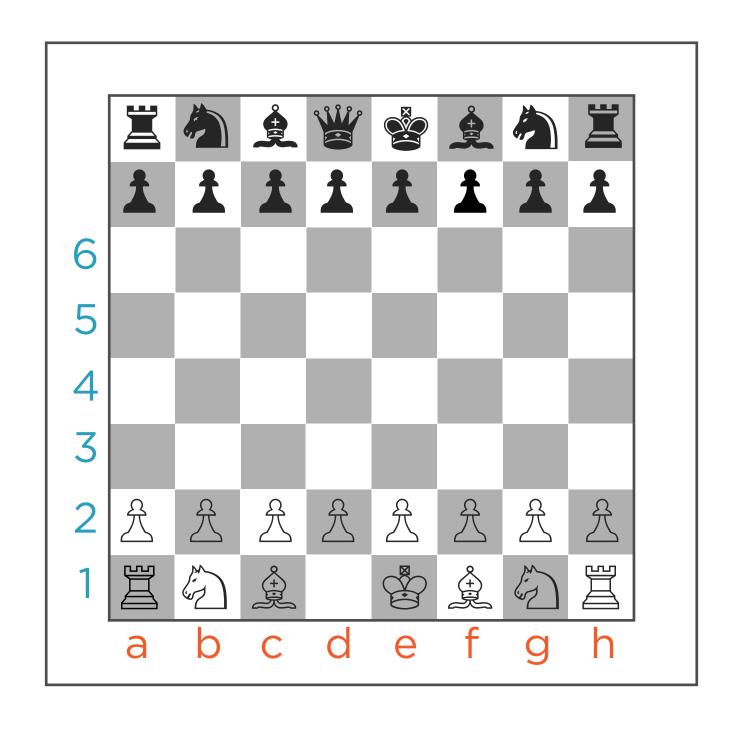


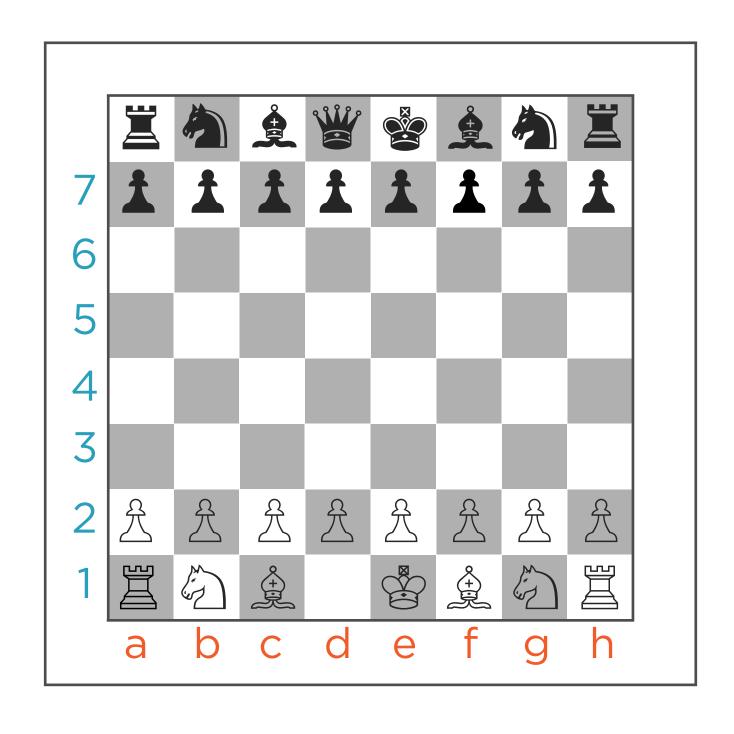


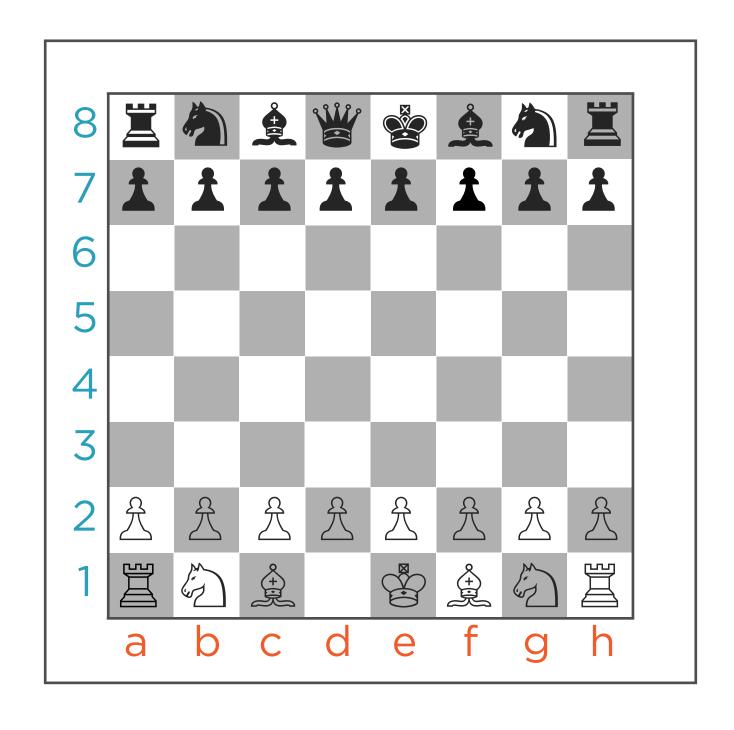


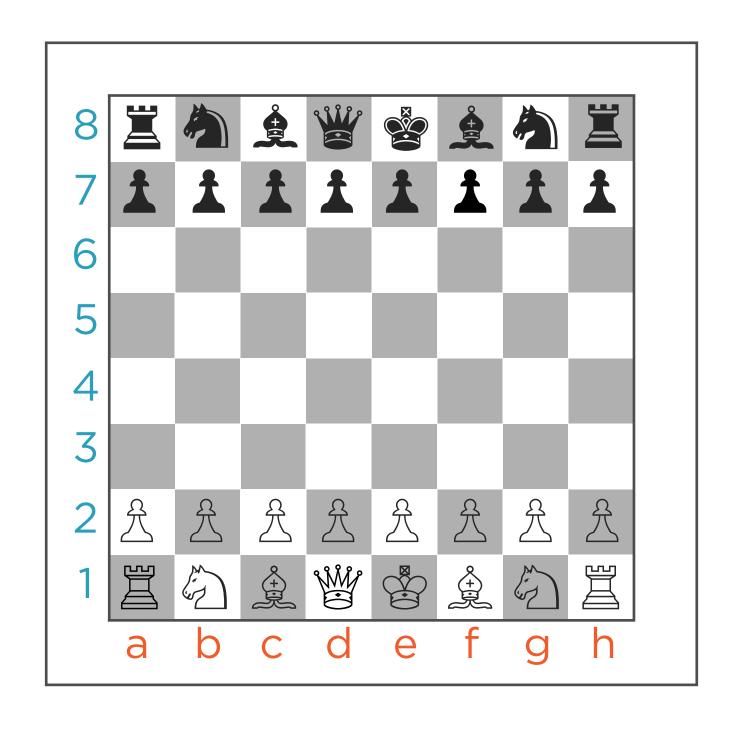












## Interning

# Only use for **immutable** value types

Static method \_\_new\_\_() allocates new instances

Static method \_\_new\_\_() allocates new instances

\_\_new\_\_() is implicitly a class-method

```
Static method __new__() allocates new instances
```

```
__new__() is implicitly a class-method
```

object.\_\_new\_\_() is the ultimate allocator