

# Instance Creation

---



**Robert Smallshire**

COFOUNDER - SIXTY NORTH

@robsmallshire rob@sixty-north.com

# Summary

# Summary

# Summary

## **Allocation versus initialisation**

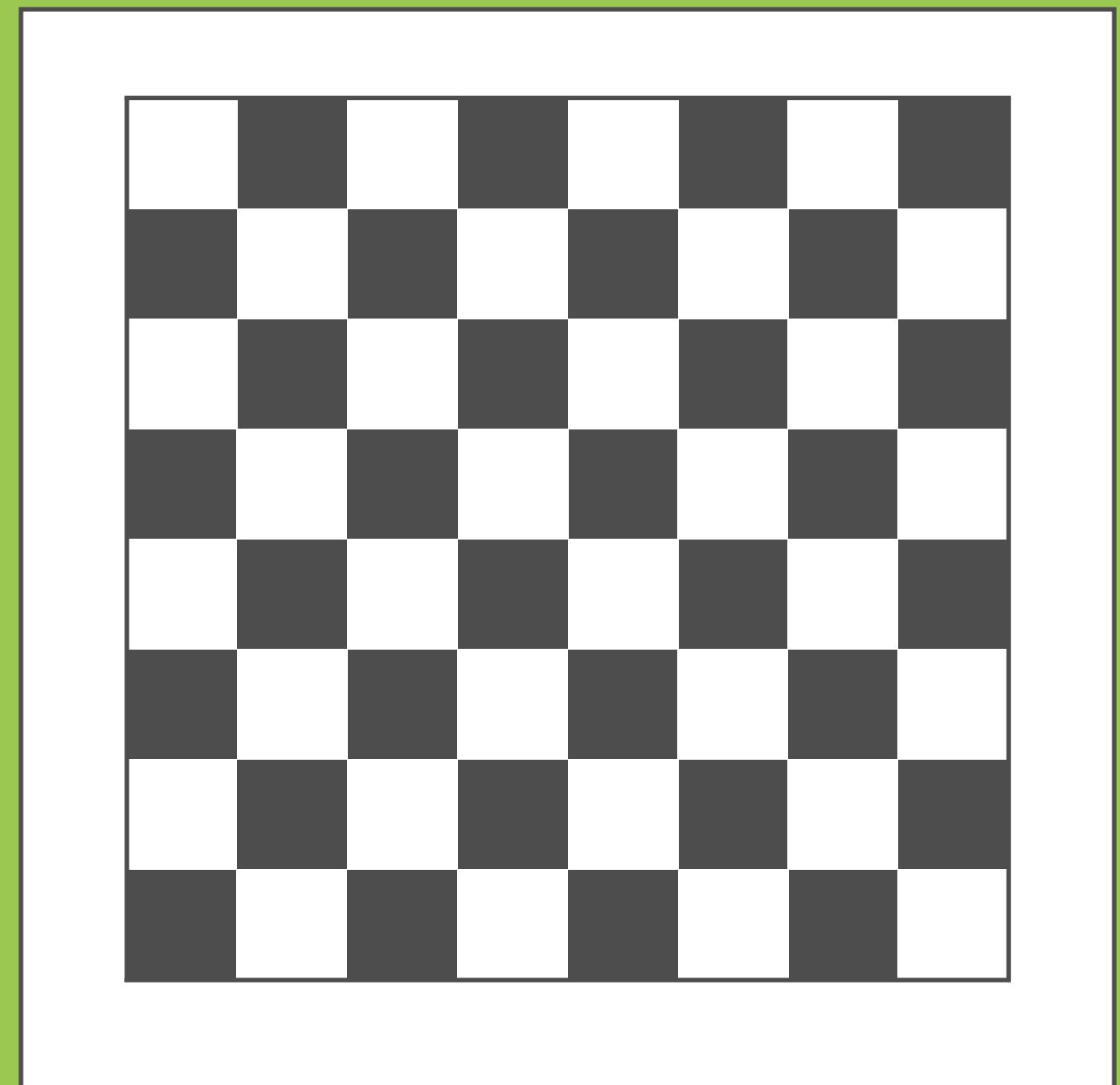
# Summary

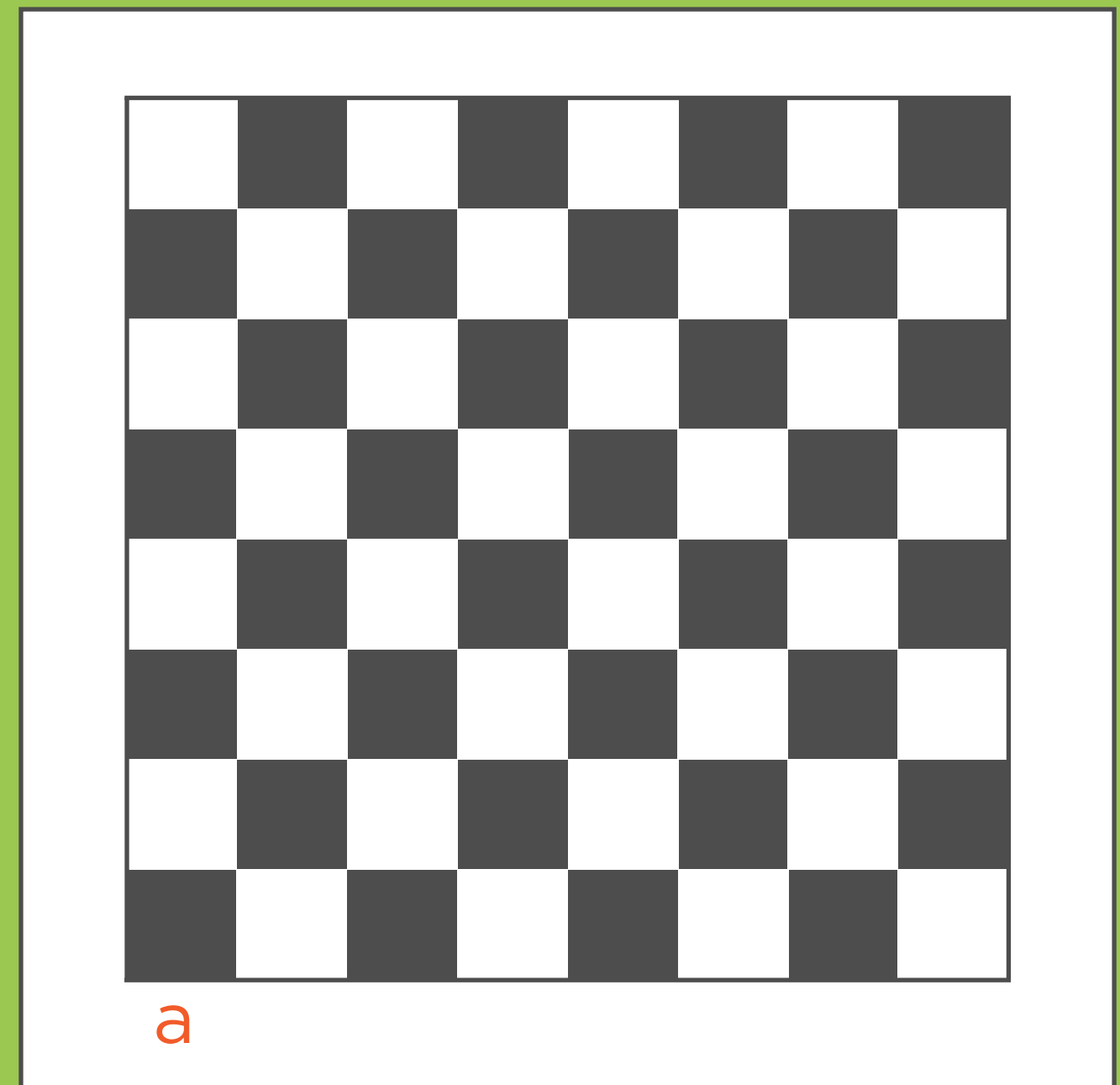
Allocation versus initialisation

**The role and signature of `__new__()`**

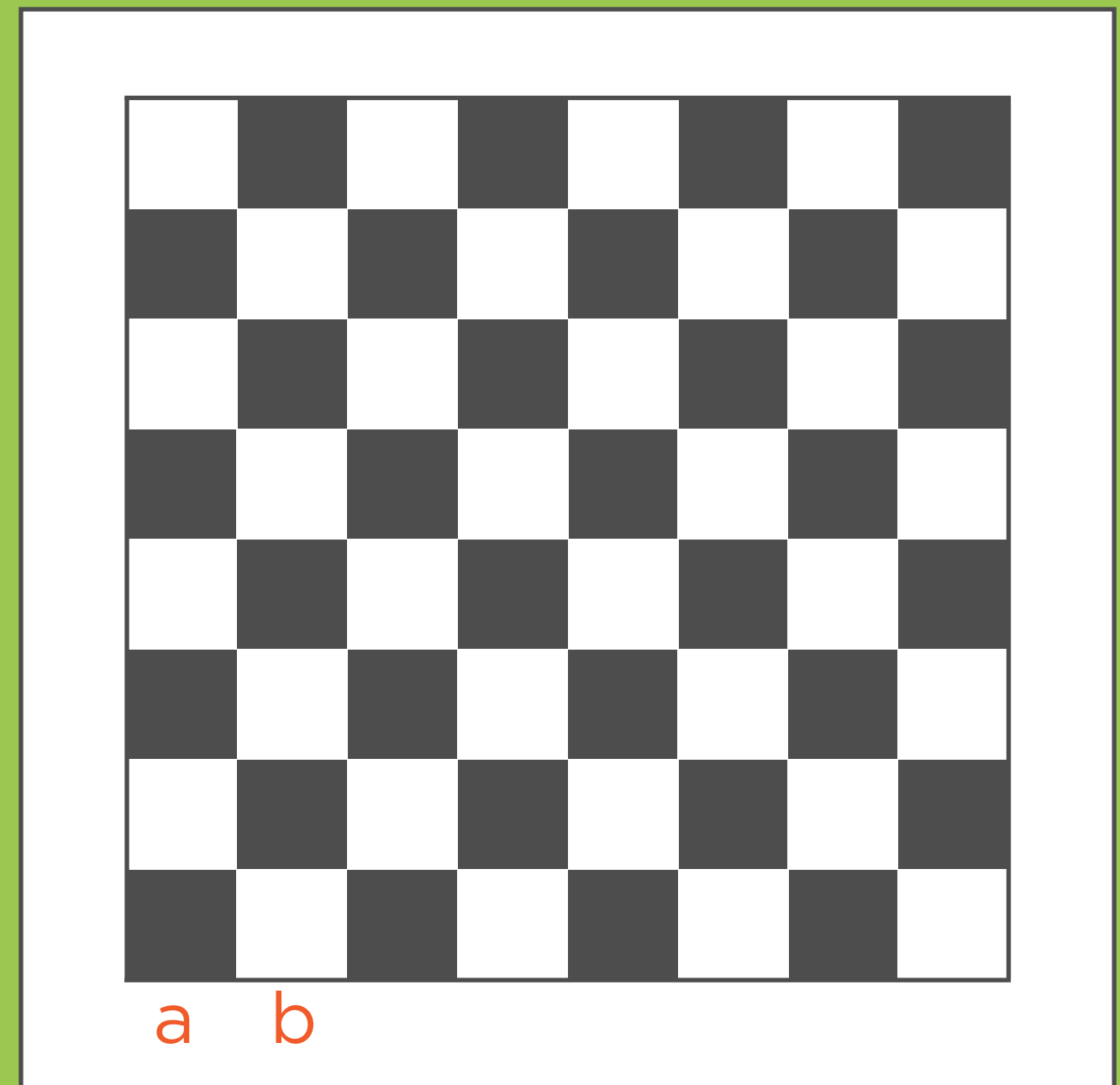
# Allocation Versus Initialisation

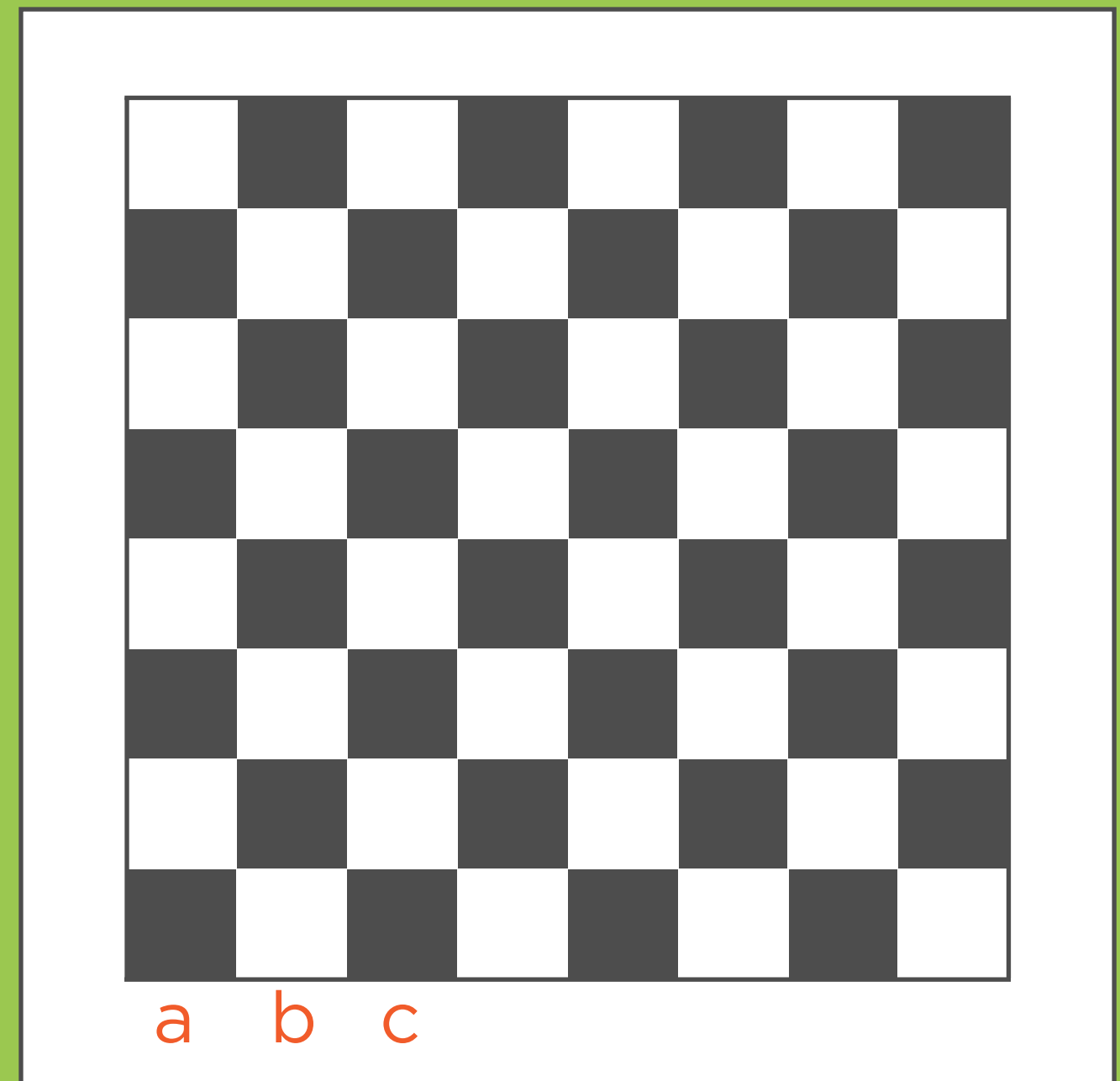
---

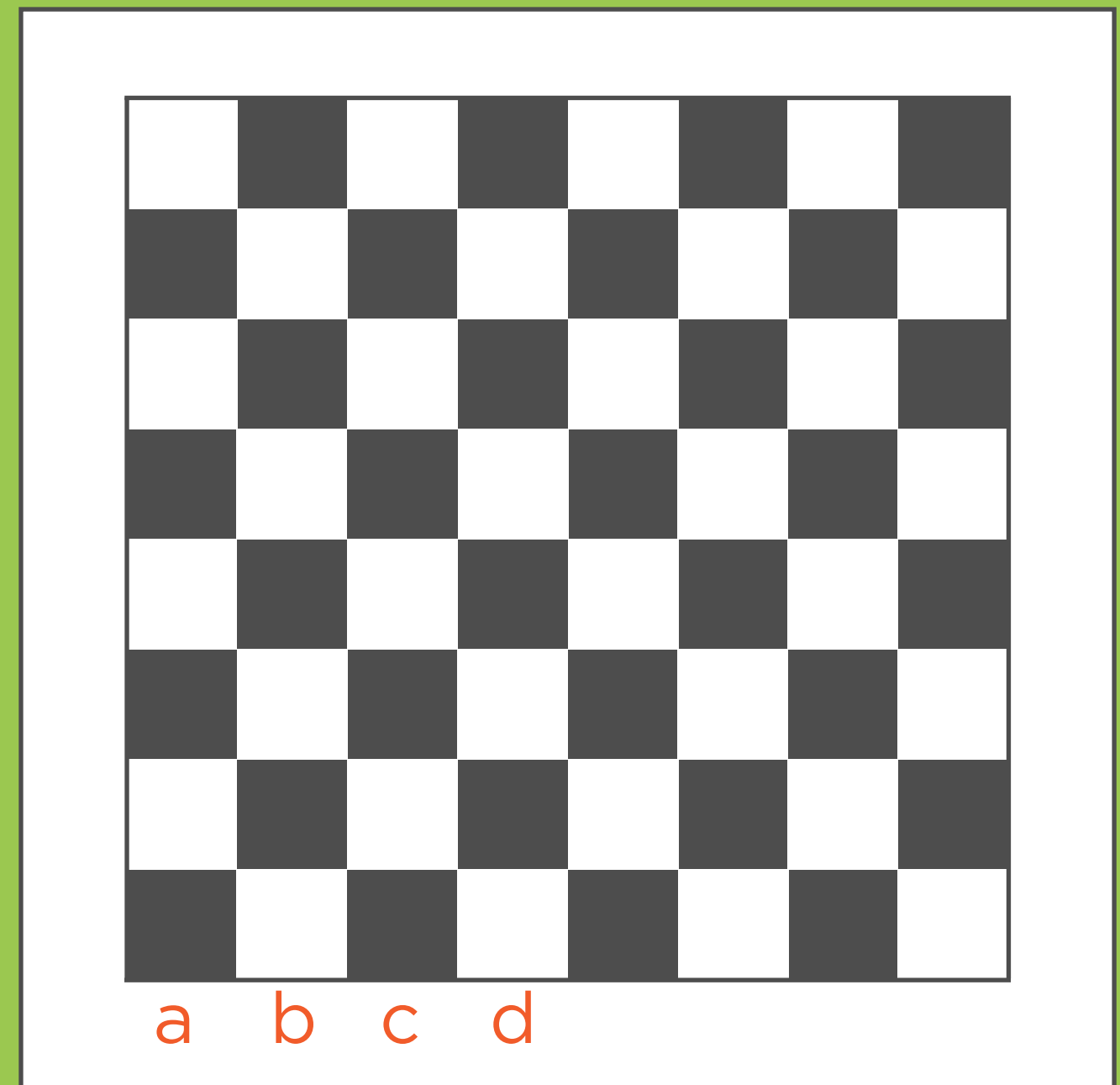


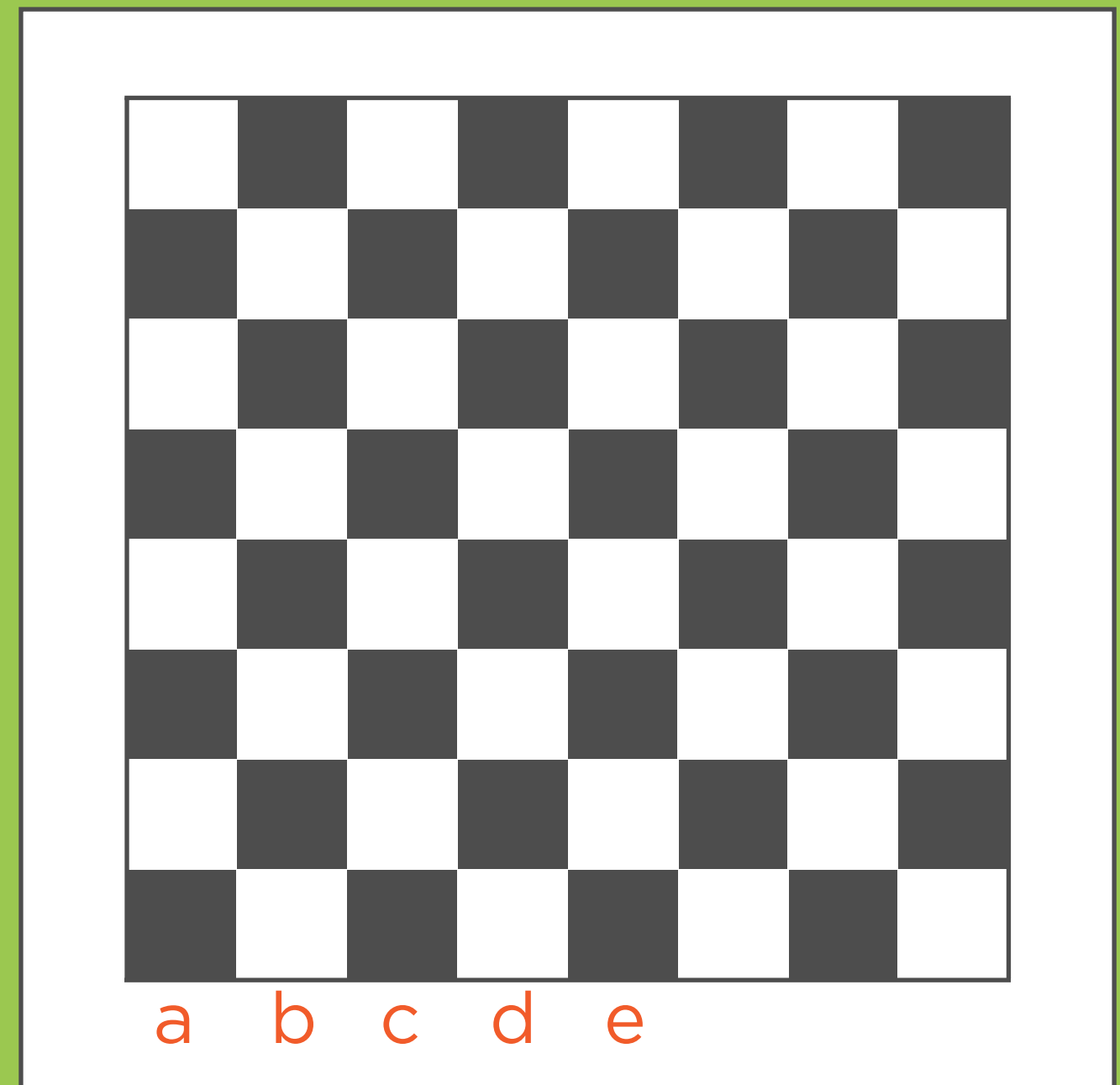


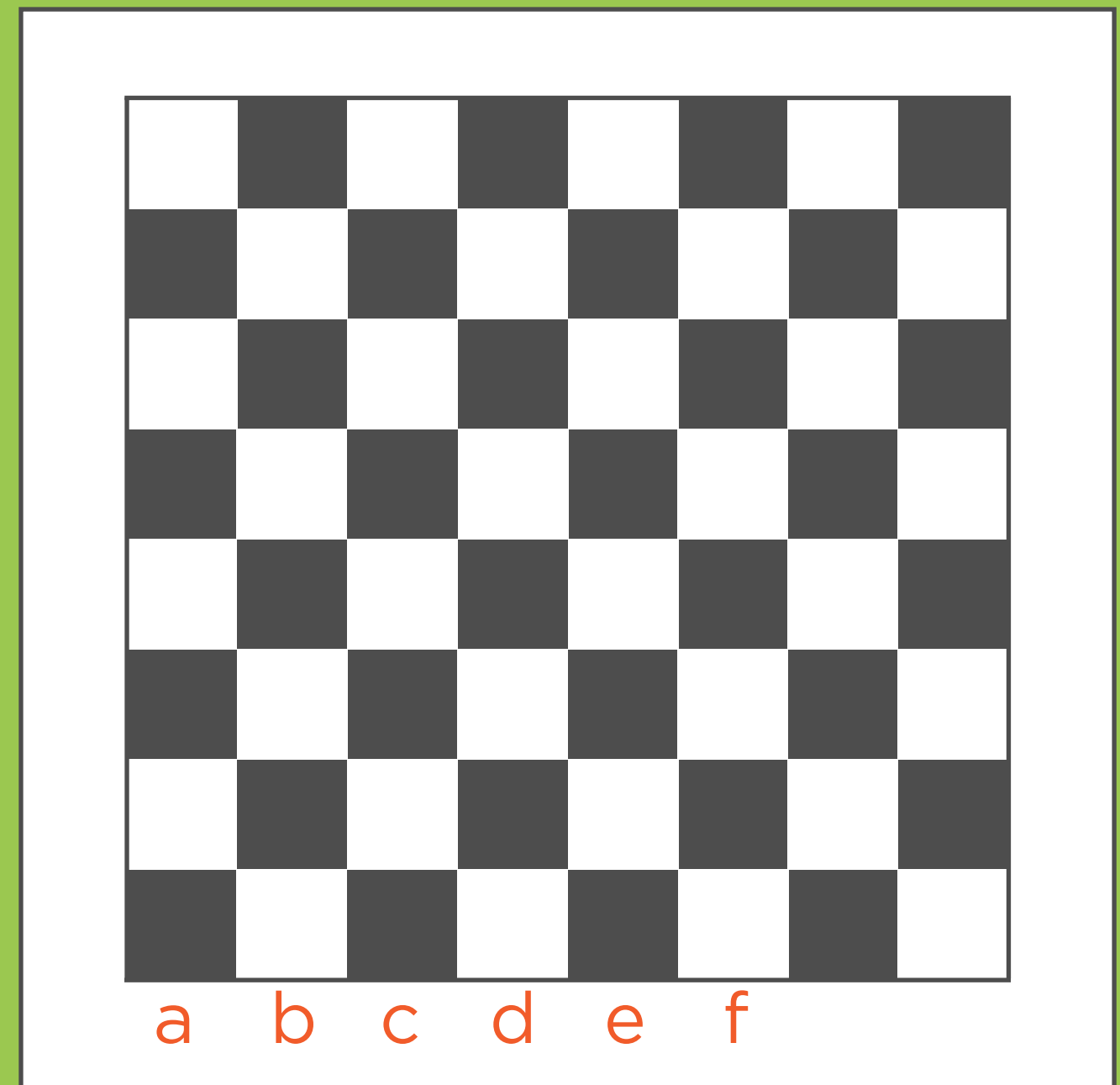


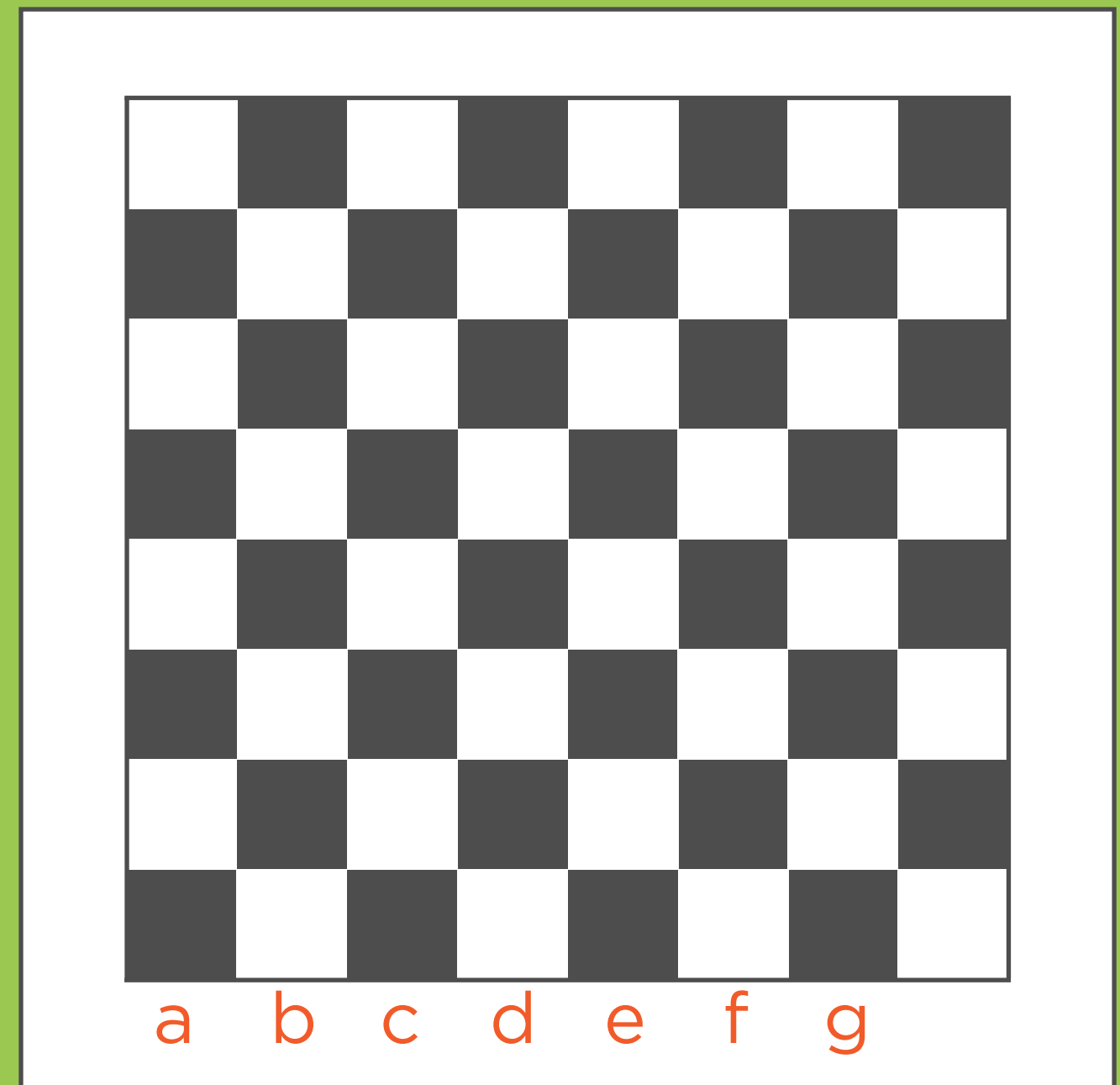


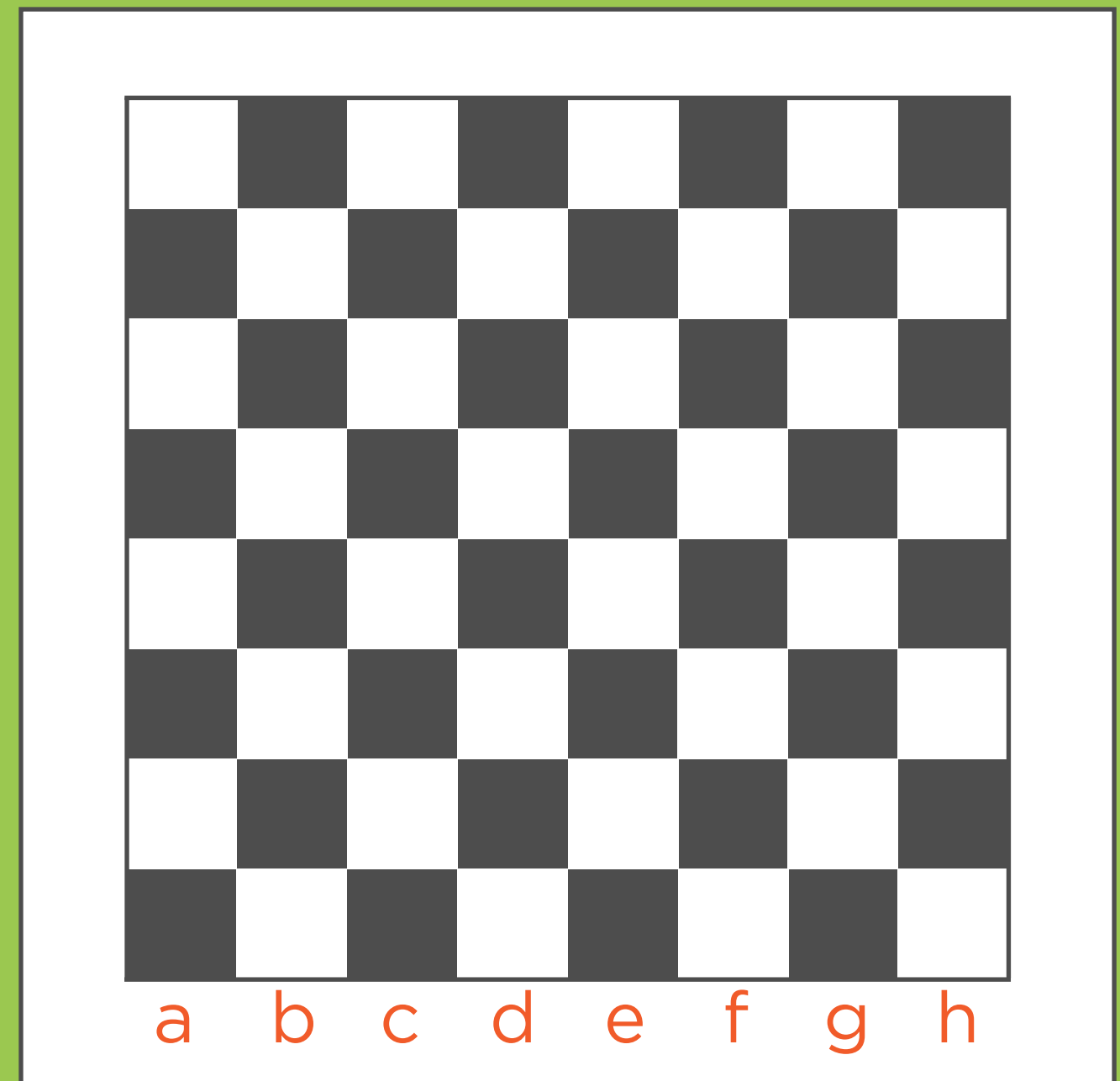


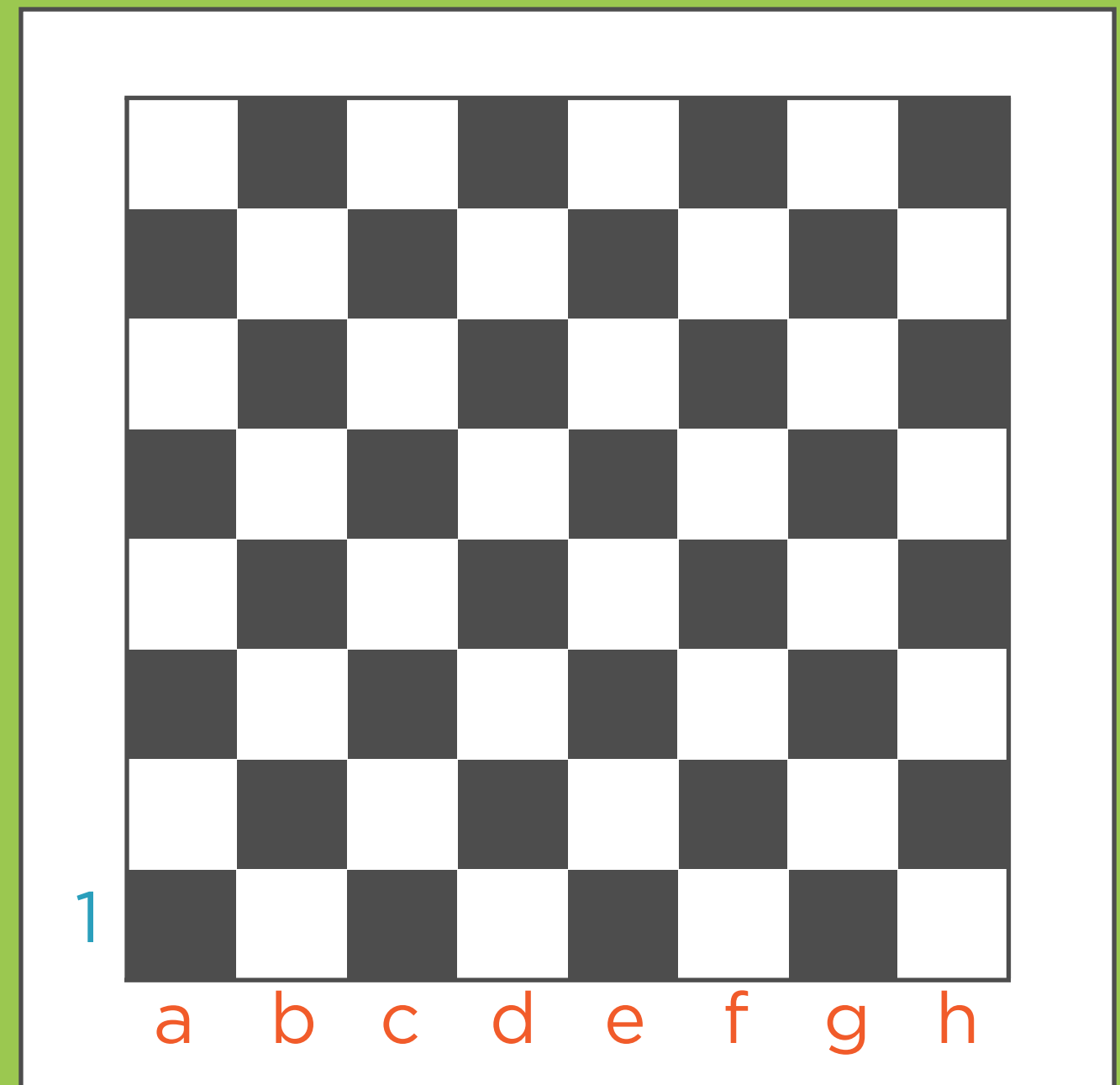




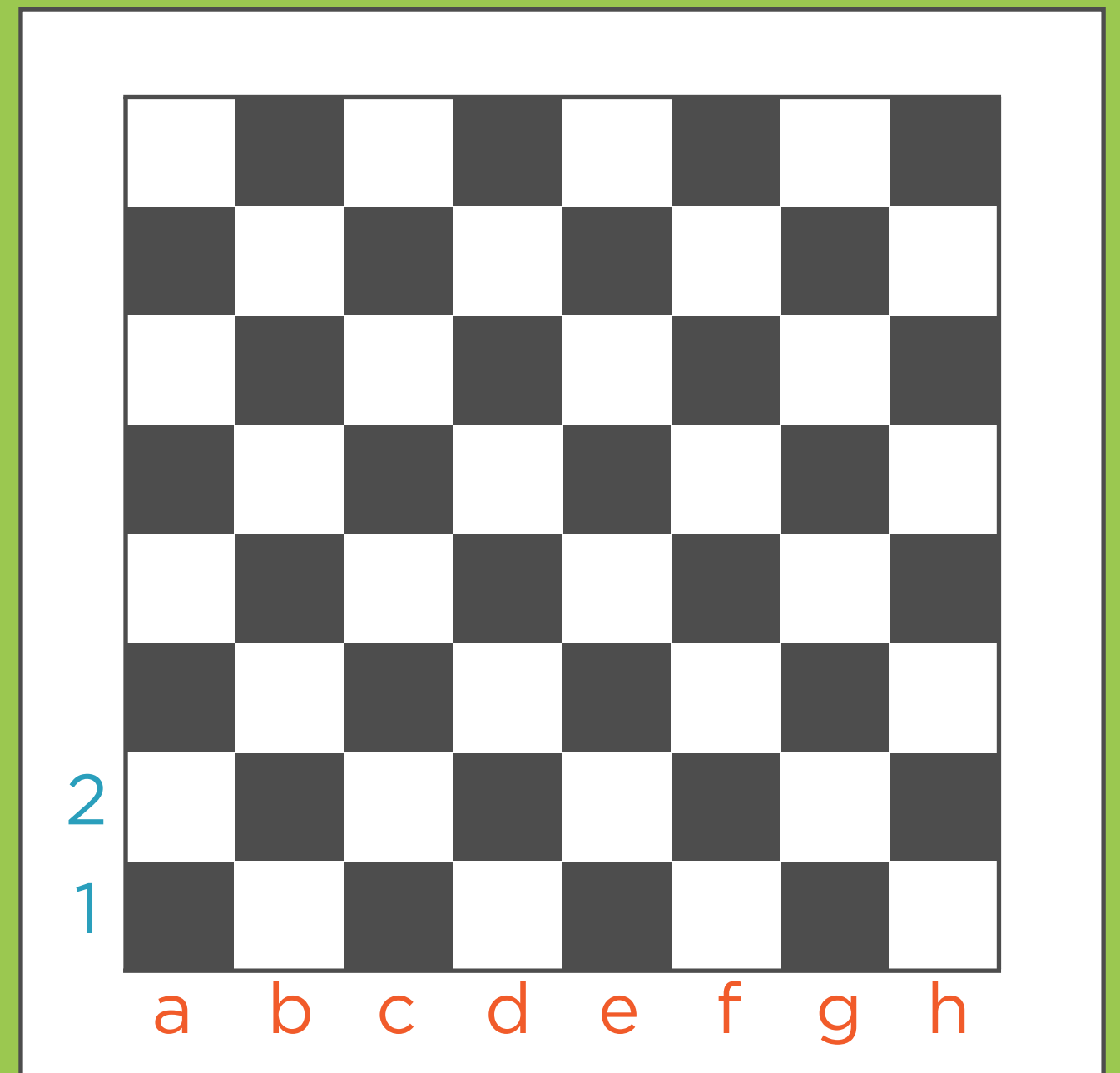


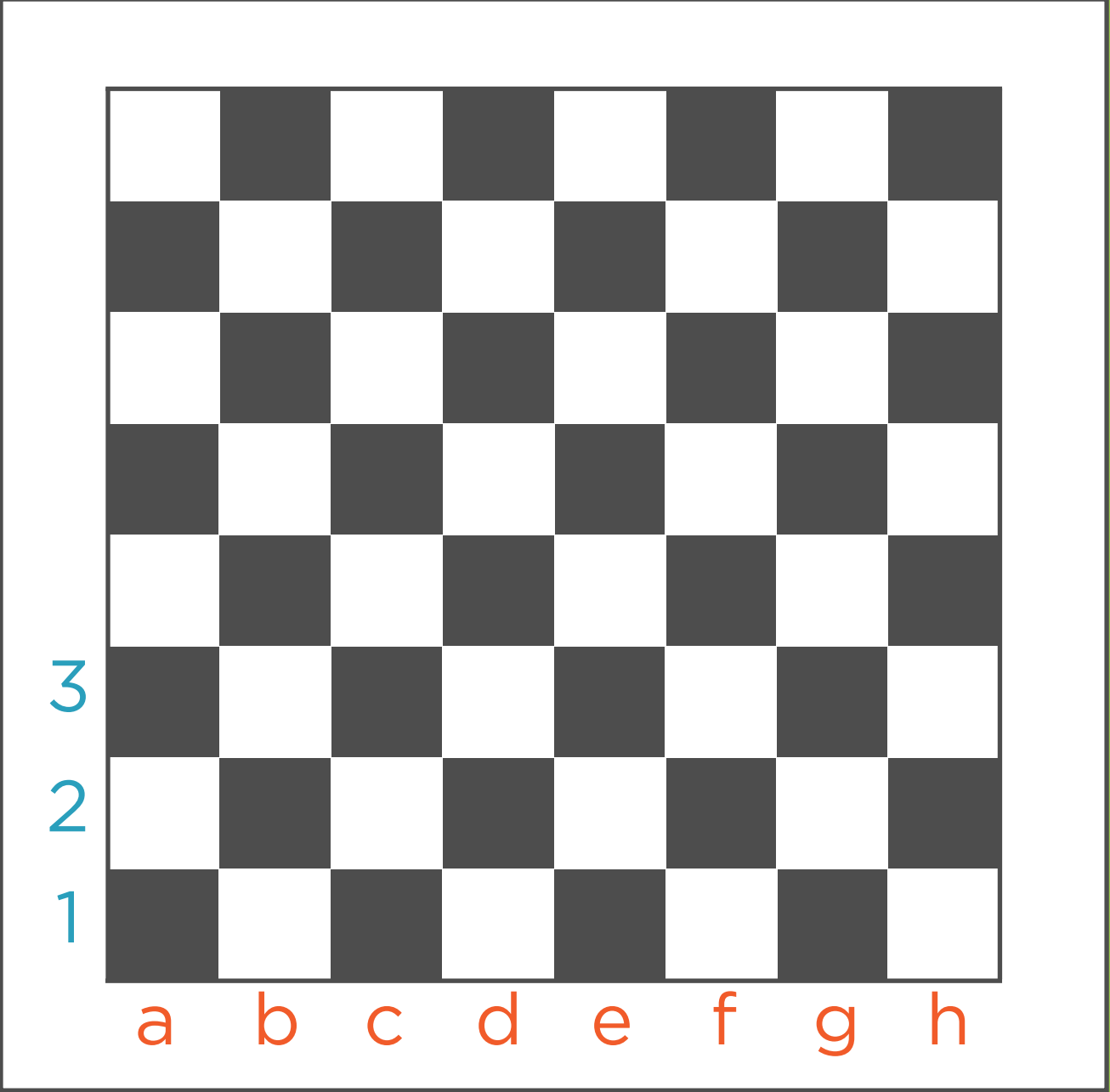


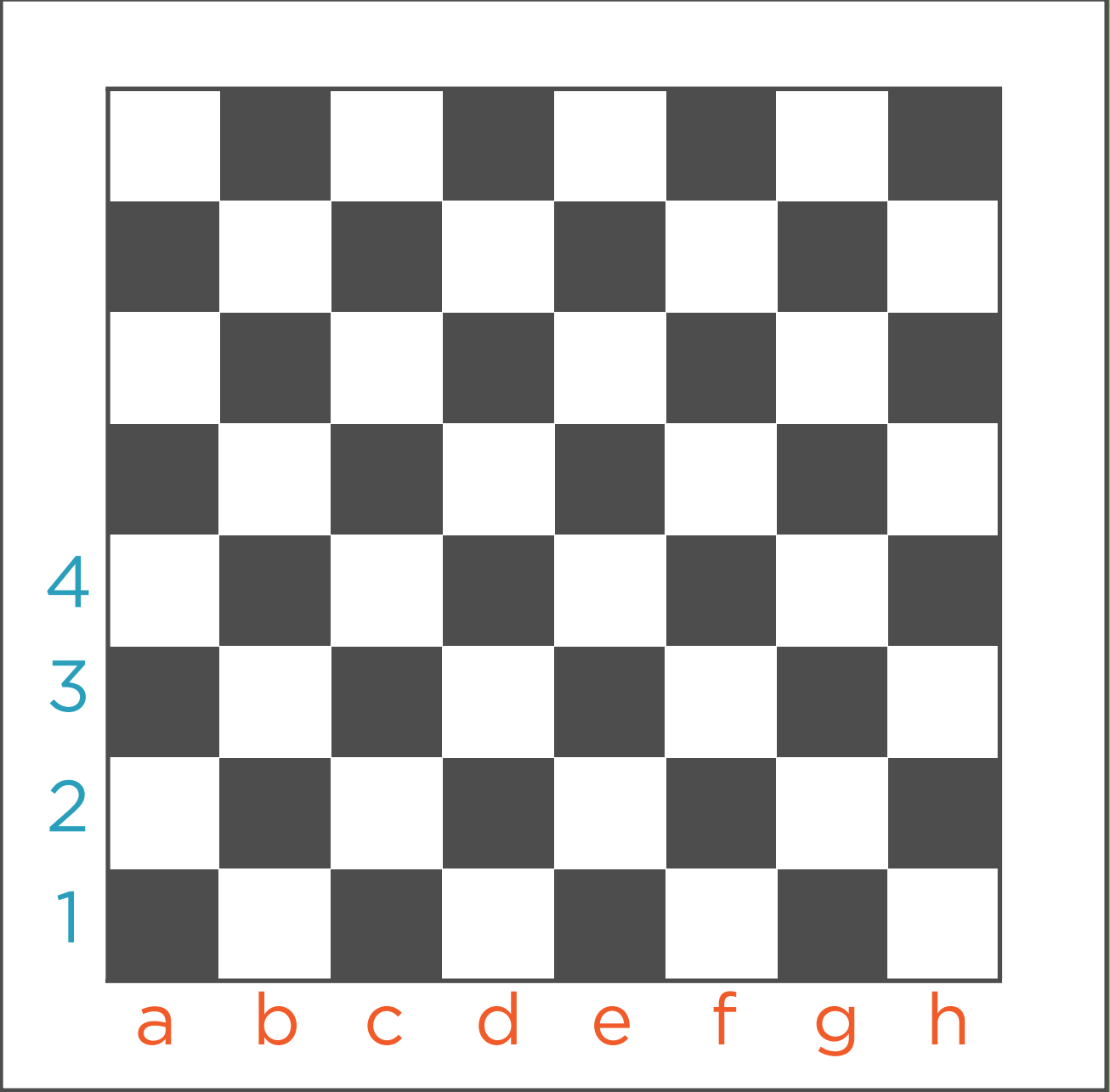


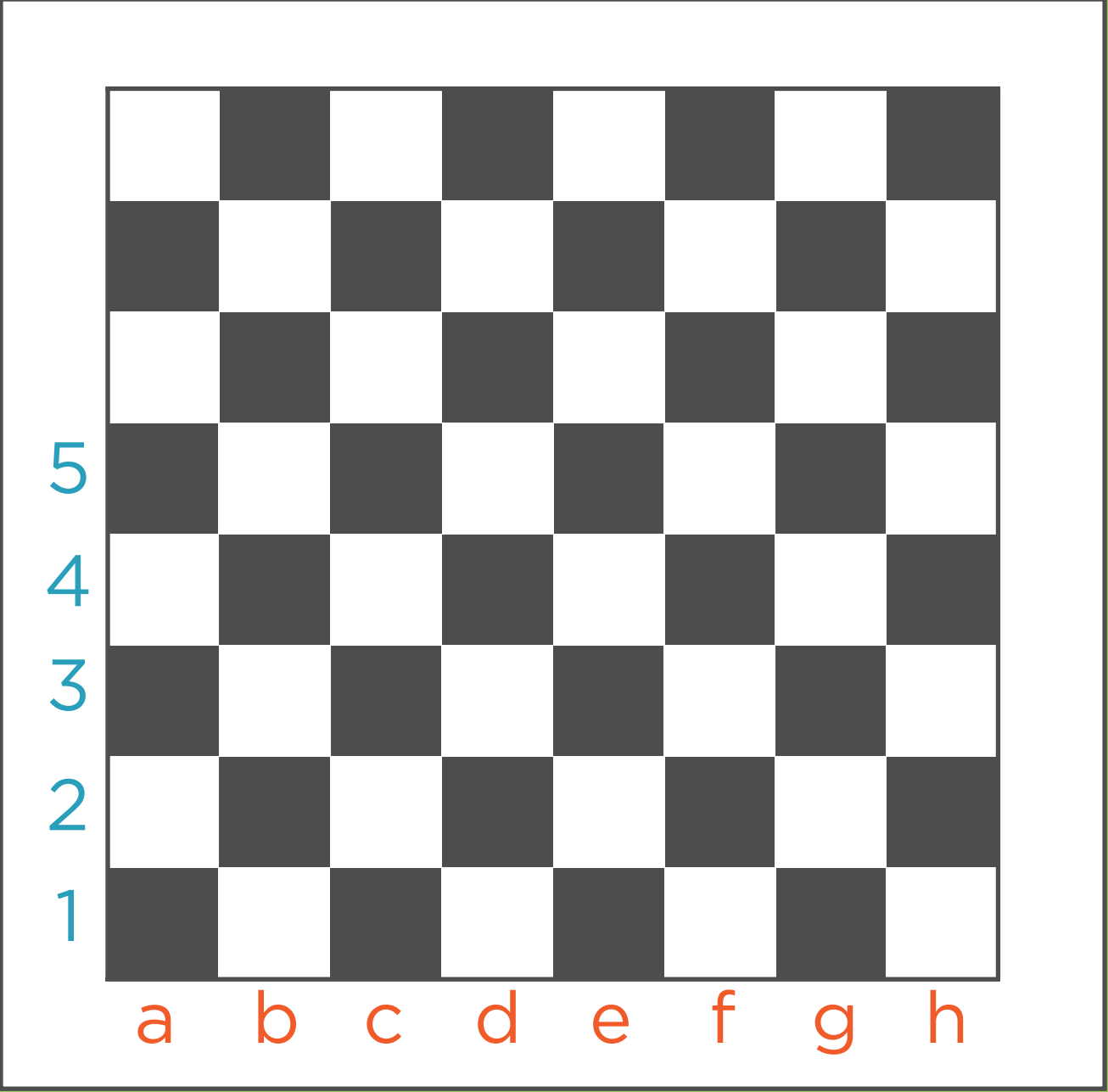


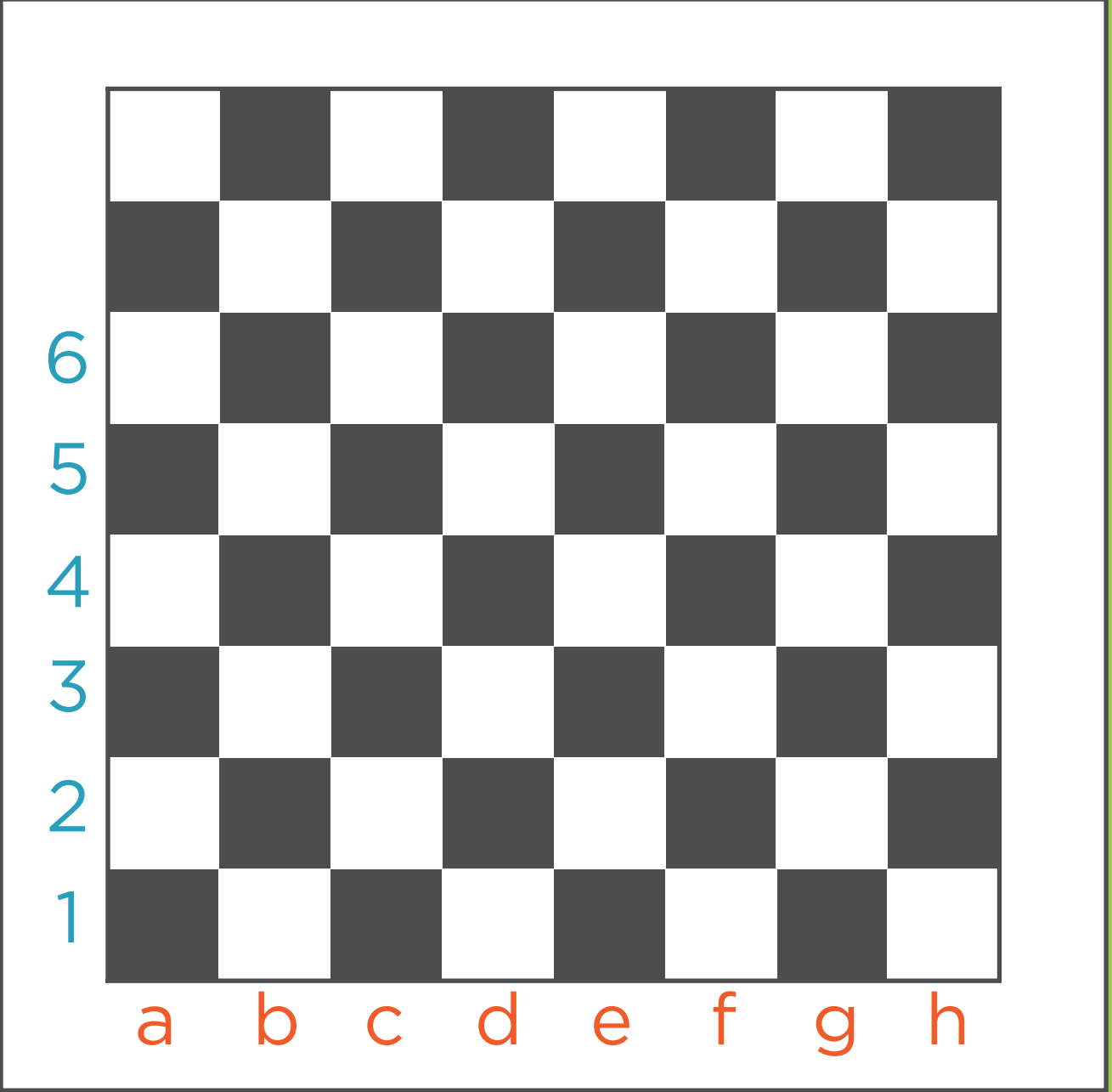


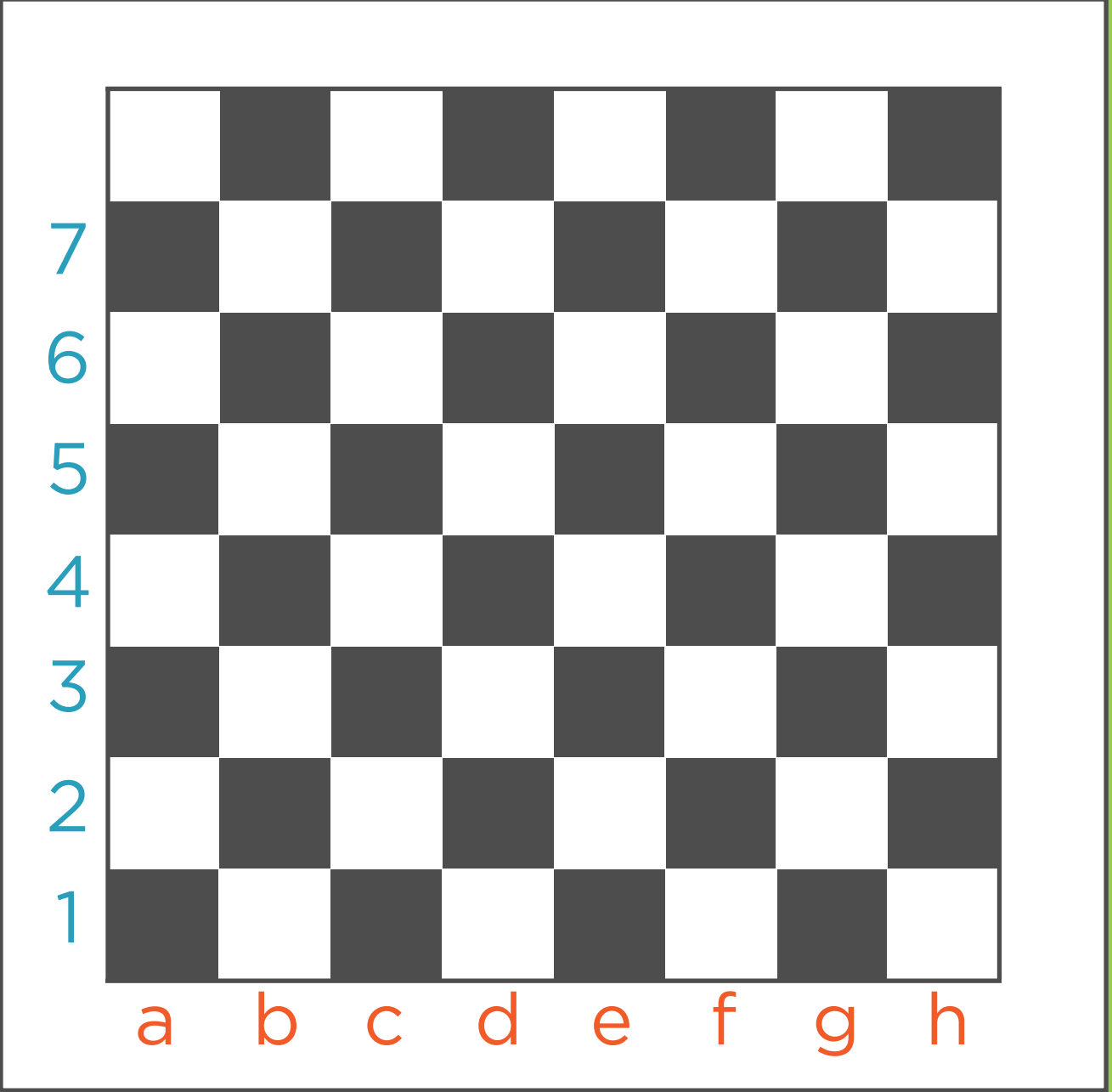


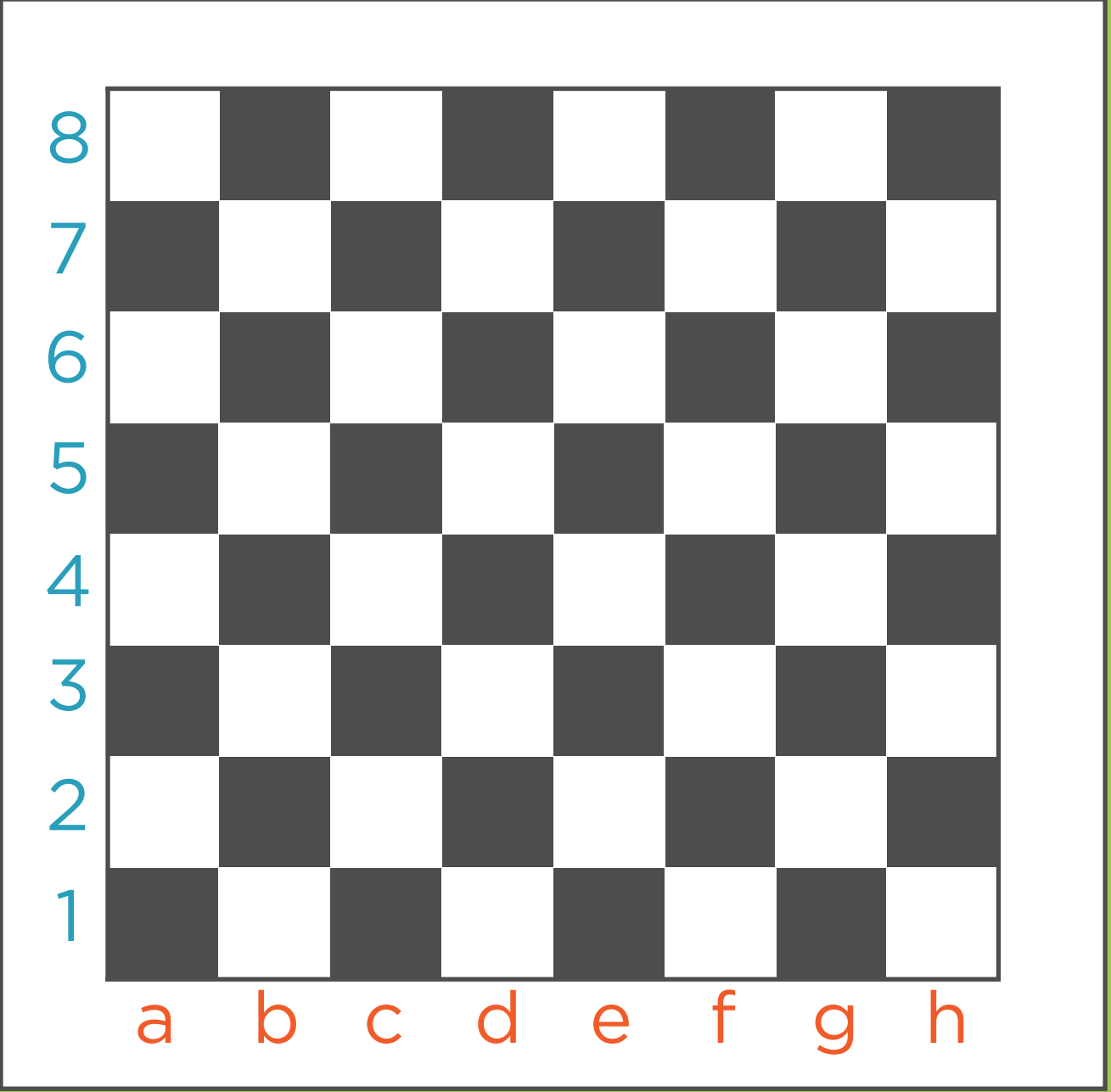


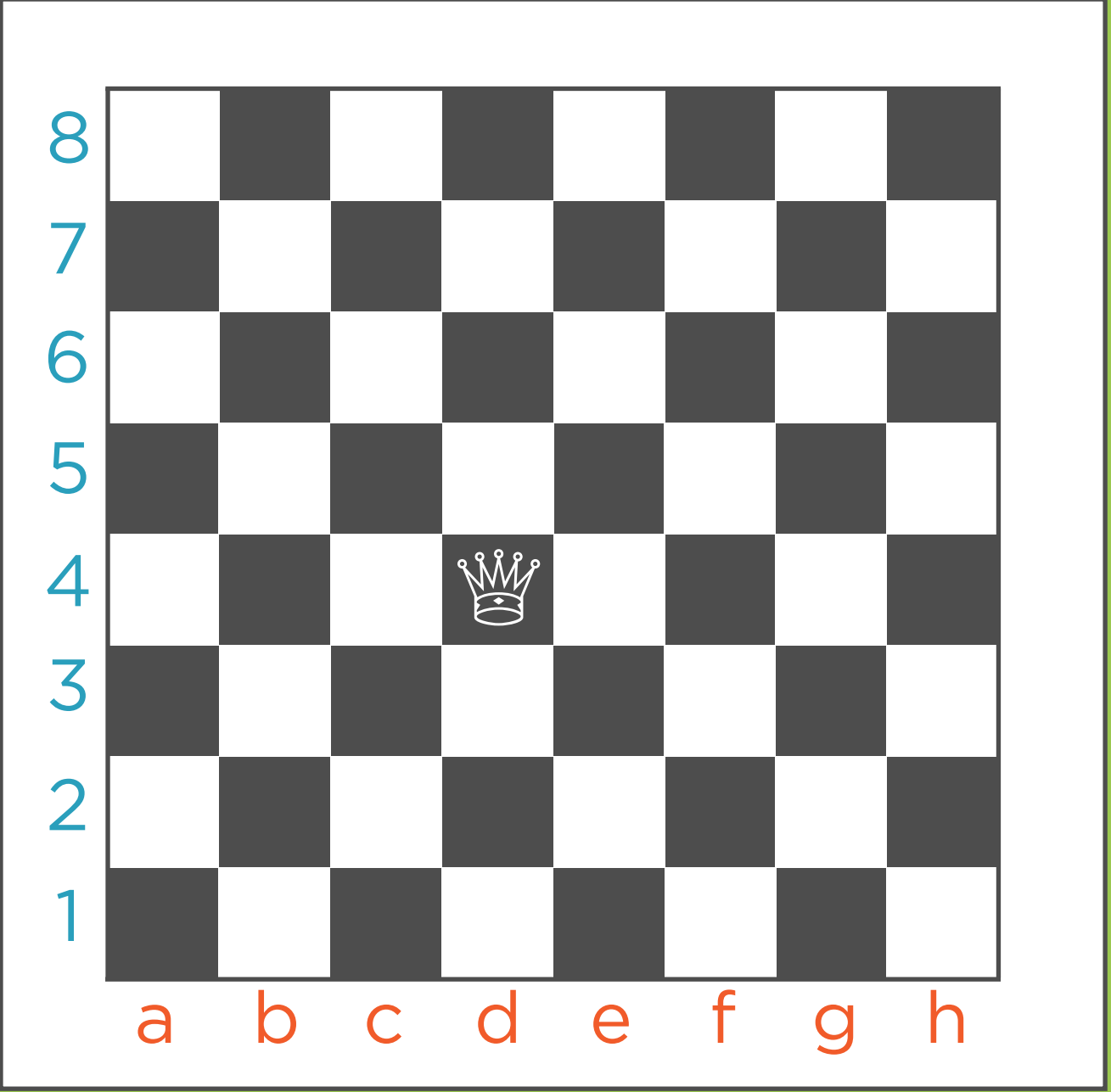














# Allocation With `__new__()`

---

# Customising Allocation

---

# Customising Allocation

MyClass
<code>__init__(self, ...)</code>

# Customising Allocation

MyClass
<code>__new__(cls, ...)</code> <code>__init__(self, ...)</code>

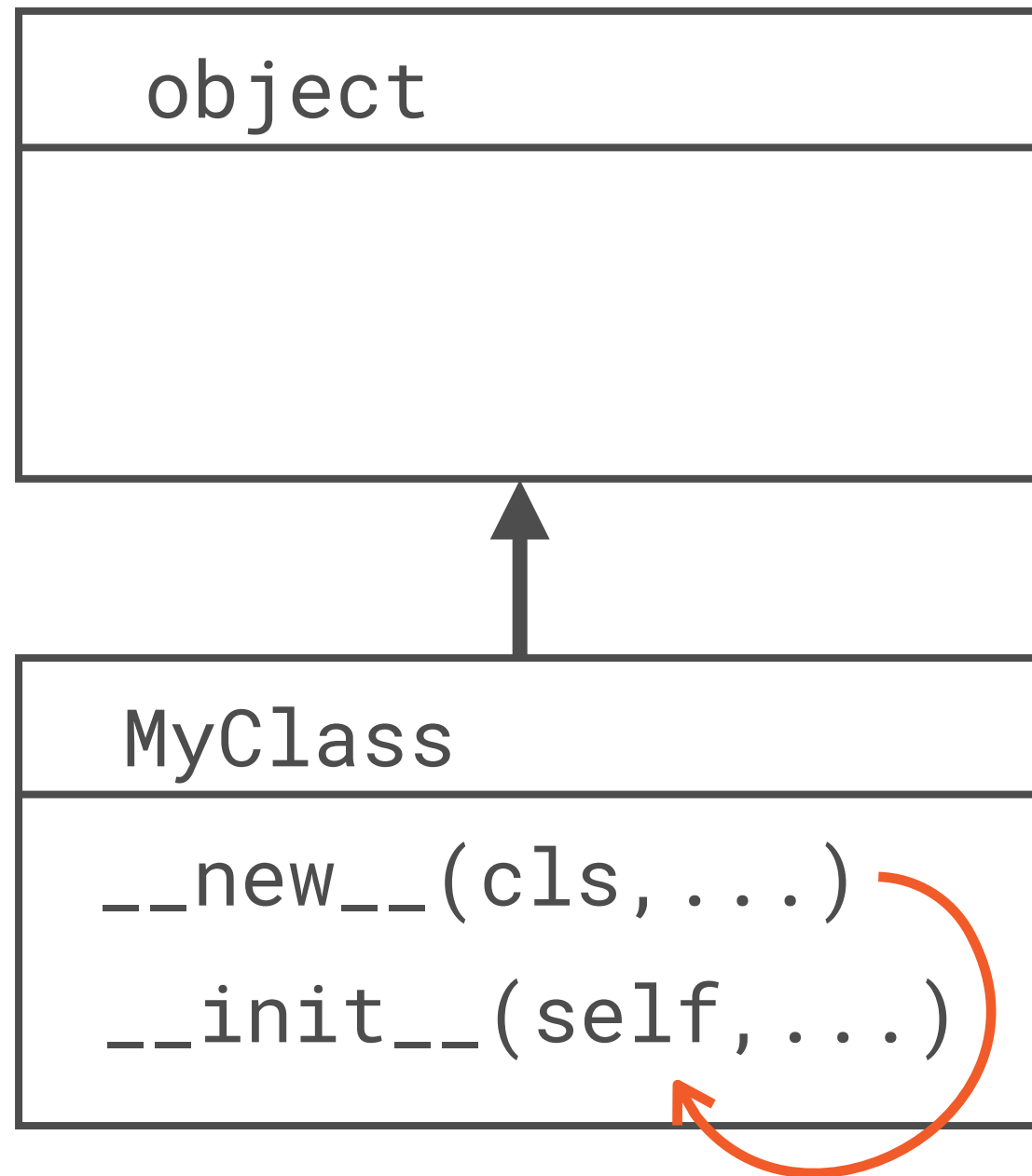
# Customising Allocation

MyClass
<pre>__new__(cls, ...) __init__(self, ...)</pre>

return value passed as self

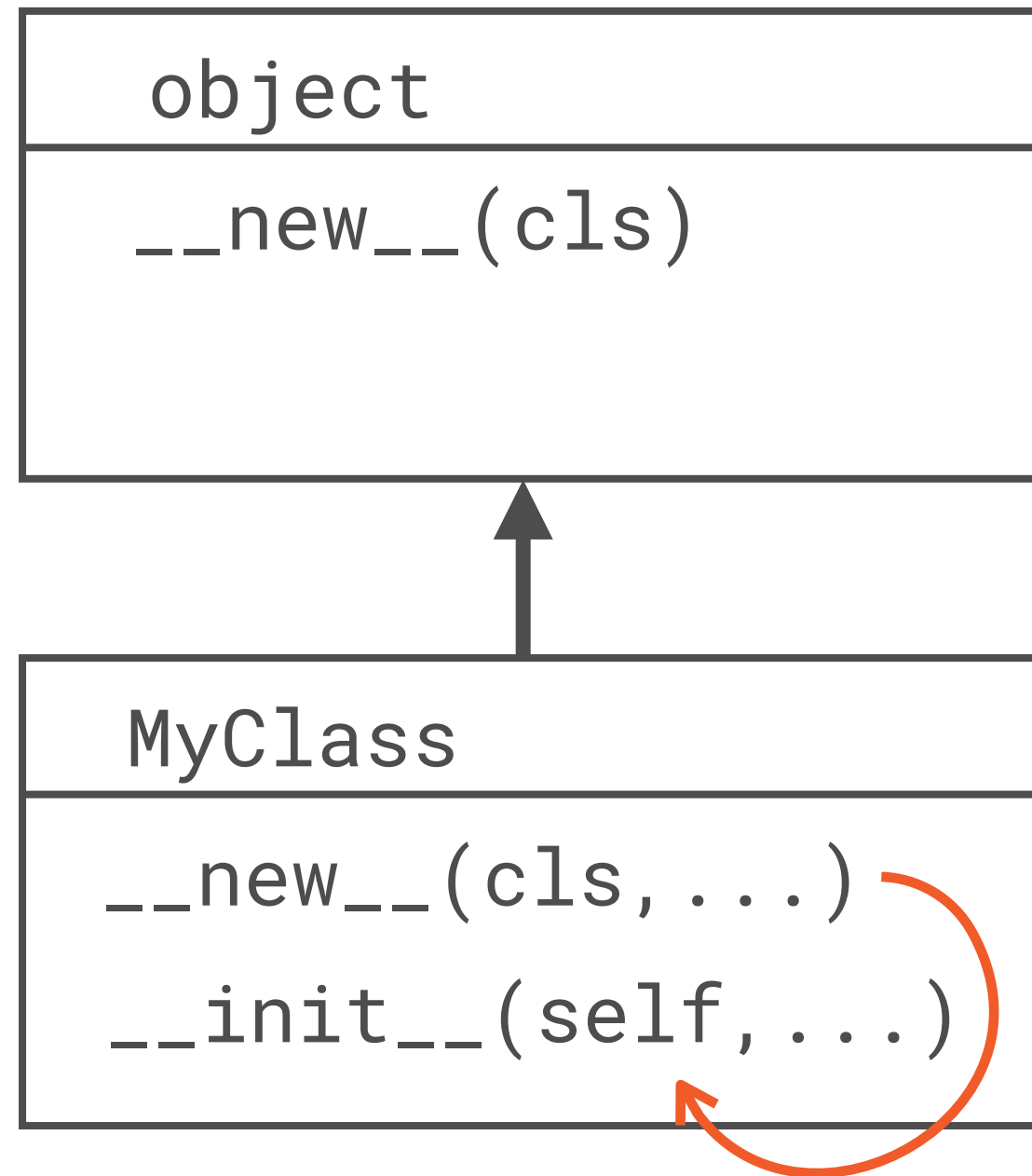


# Customising Allocation



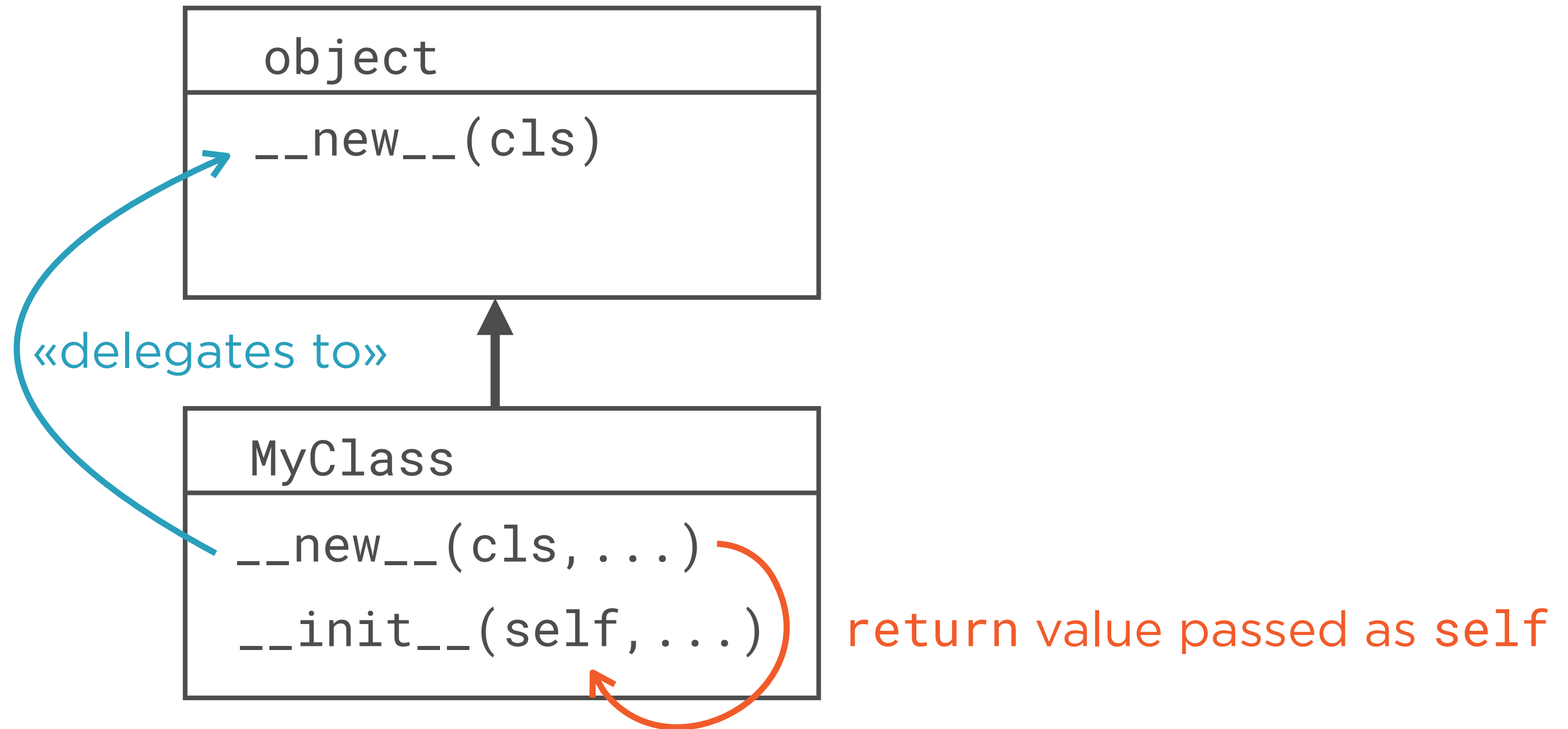
return value passed as self

# Customising Allocation



return value passed as self

# Customising Allocation



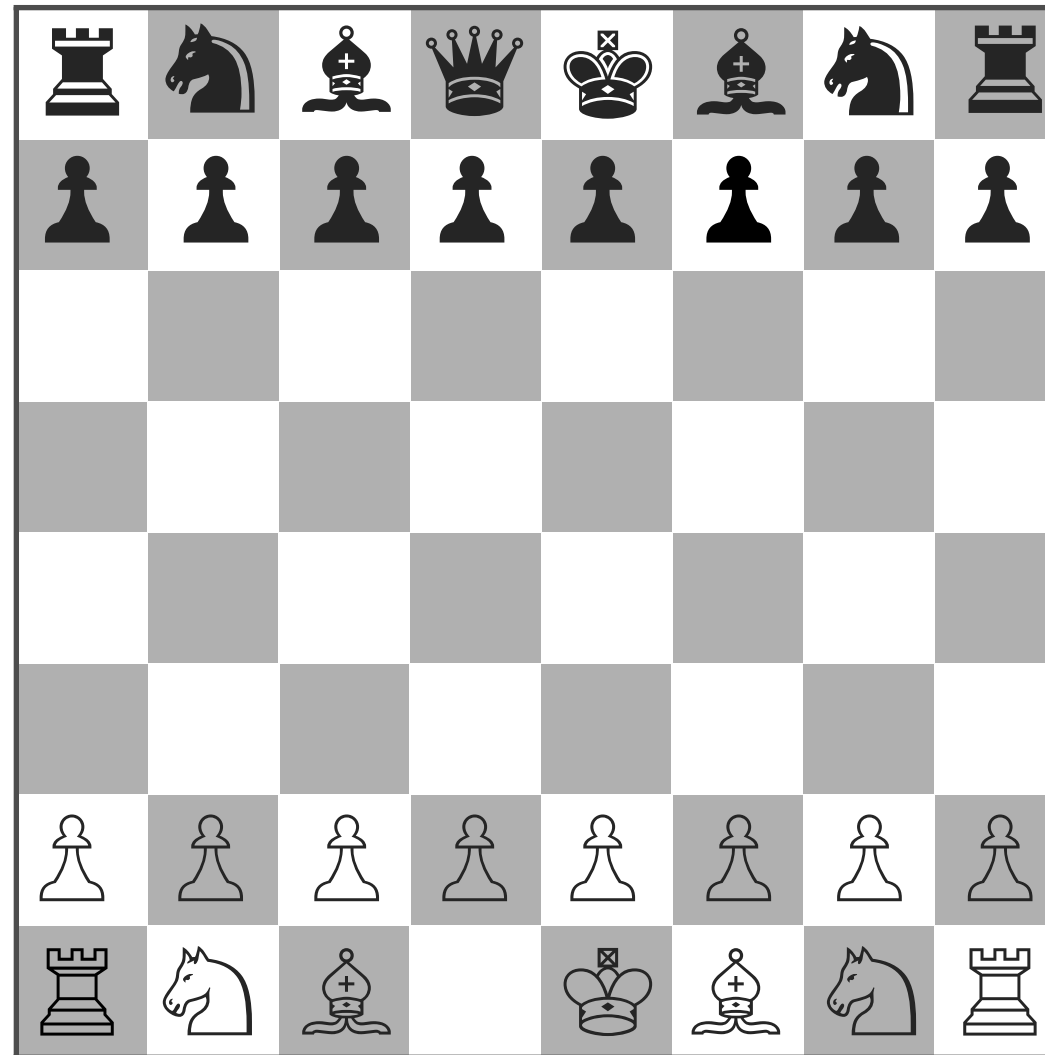


# Interning

Storing only one copy of  
each distinct value

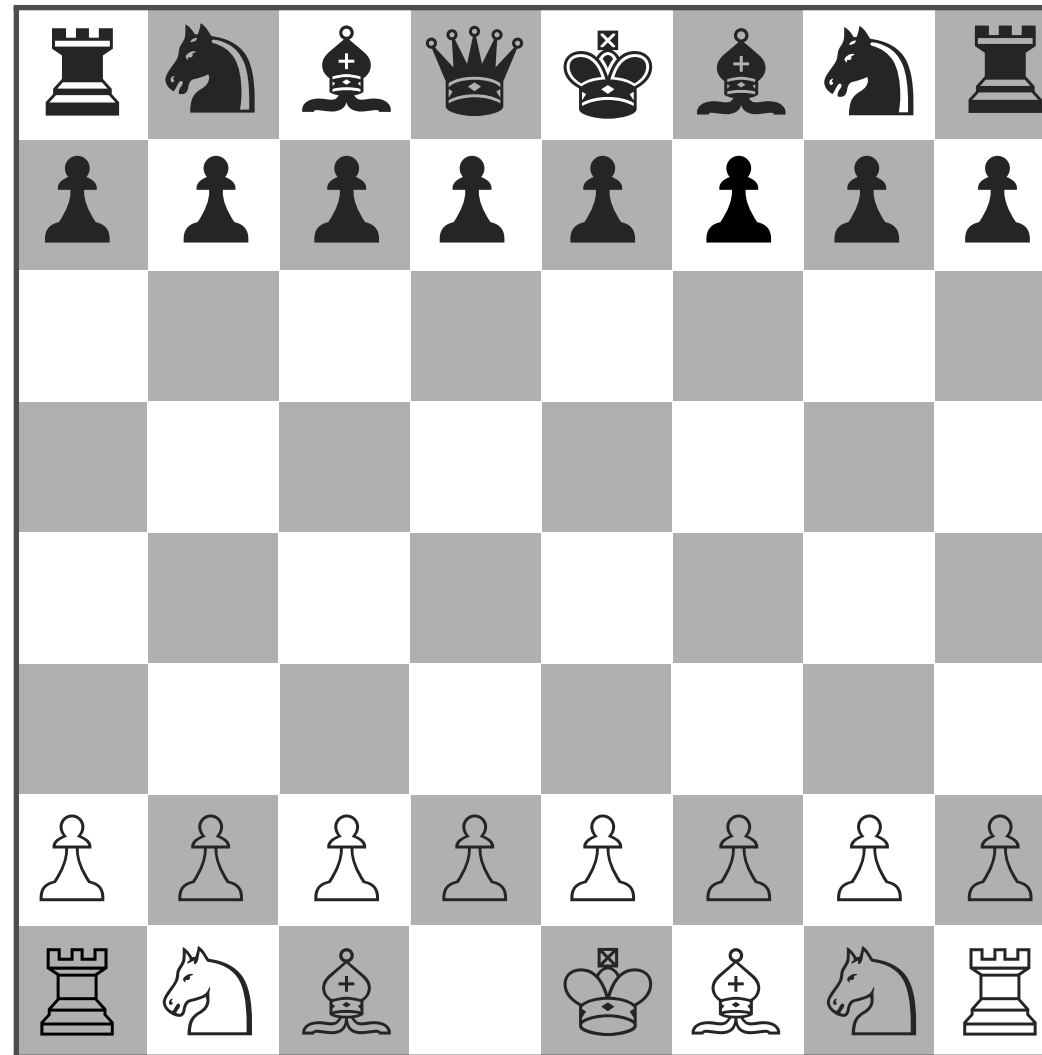
# Chess Piece Encoding

```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding

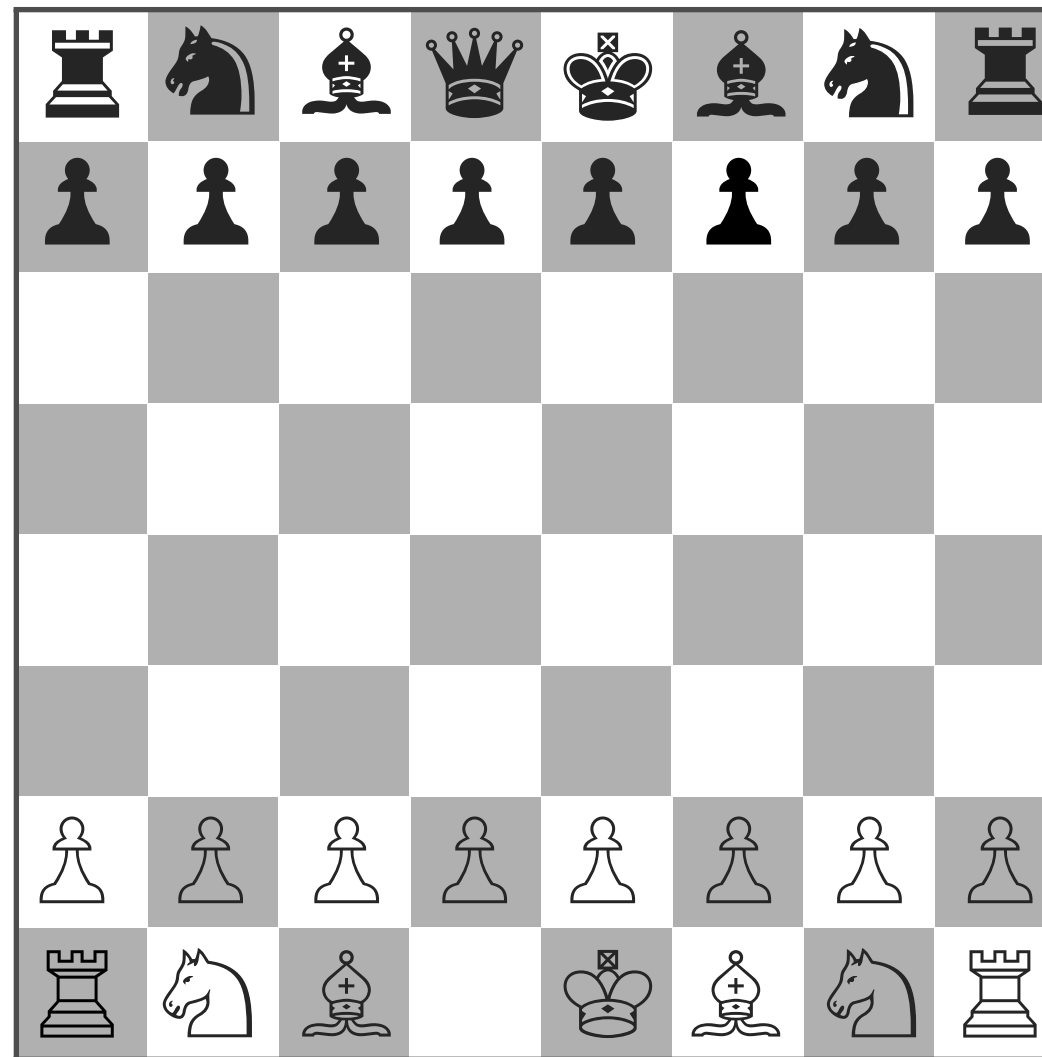
```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



a

# Chess Piece Encoding

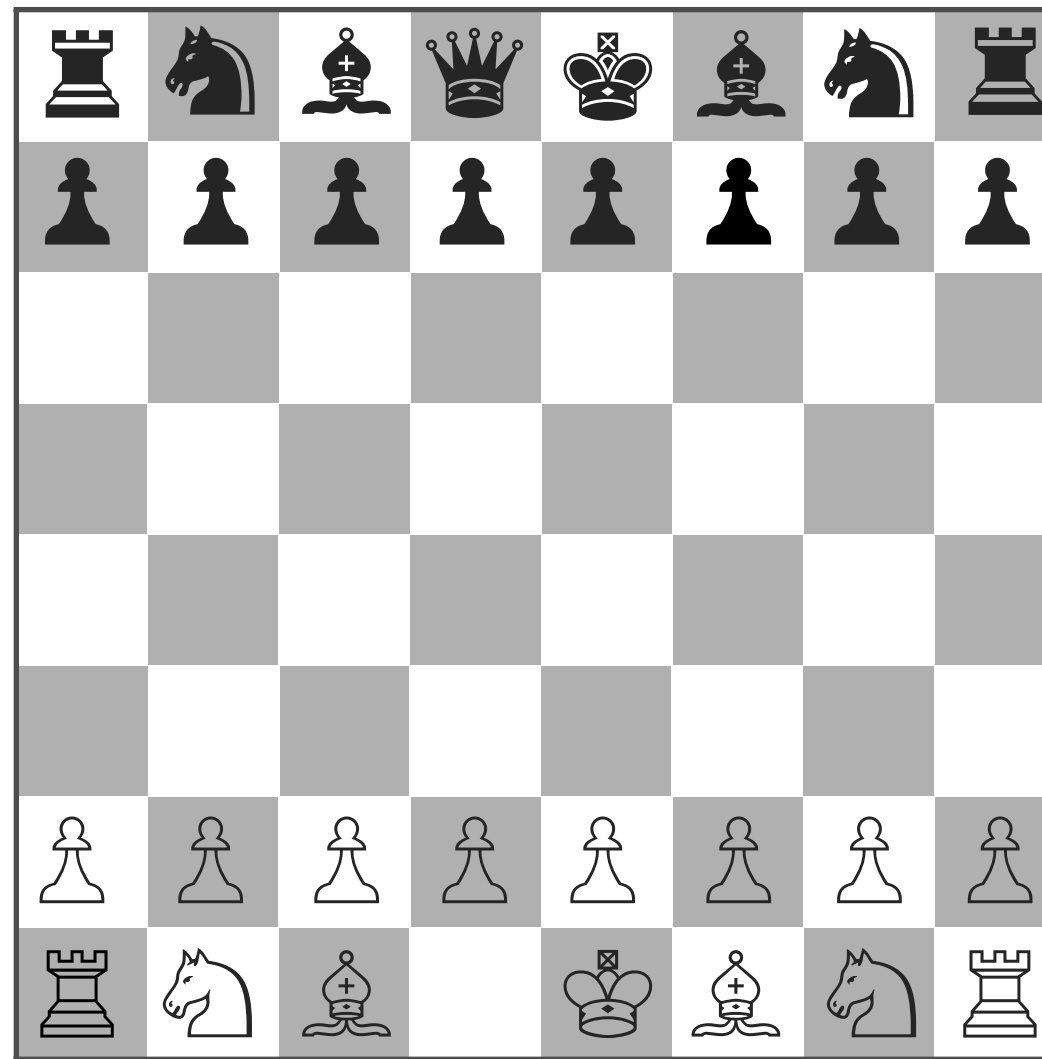
```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



a b

# Chess Piece Encoding

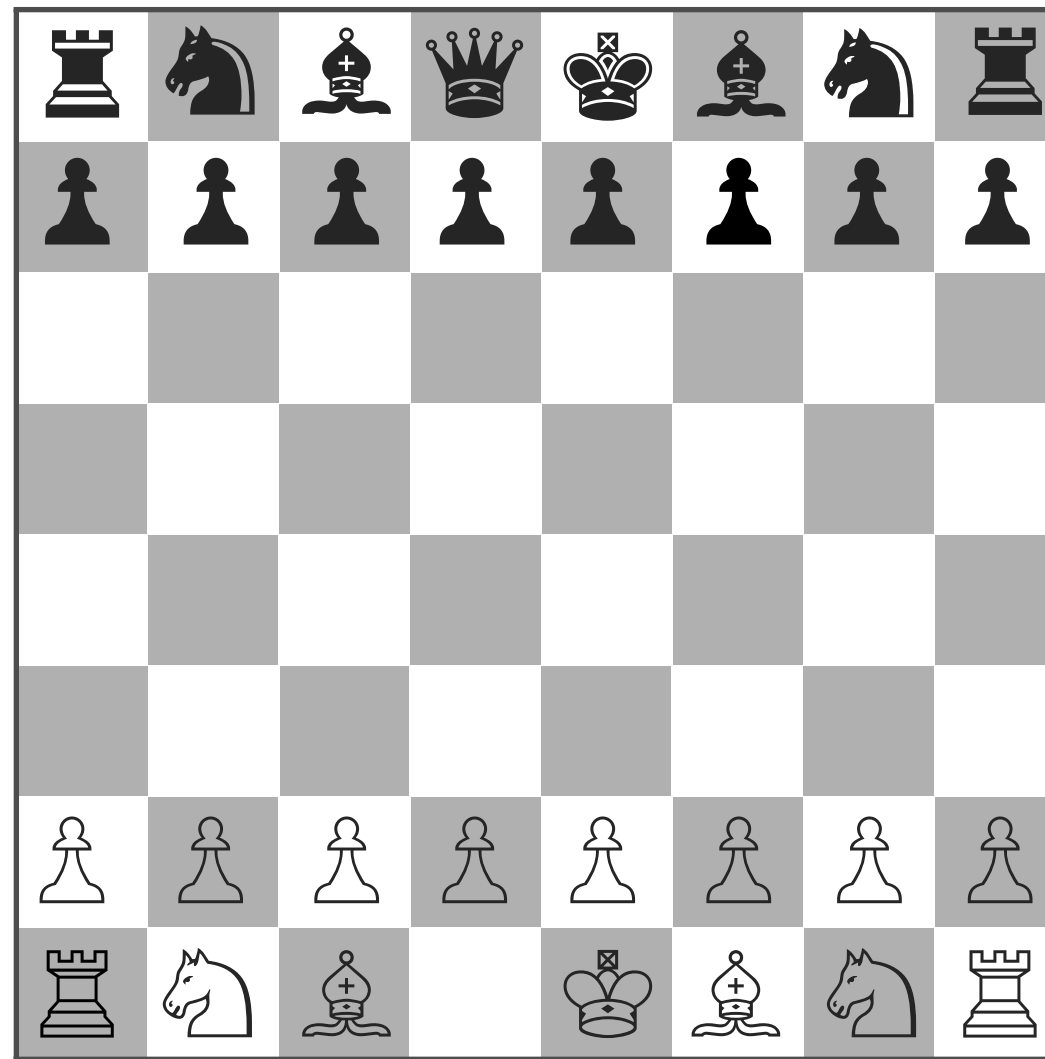
```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



a b c

# Chess Piece Encoding

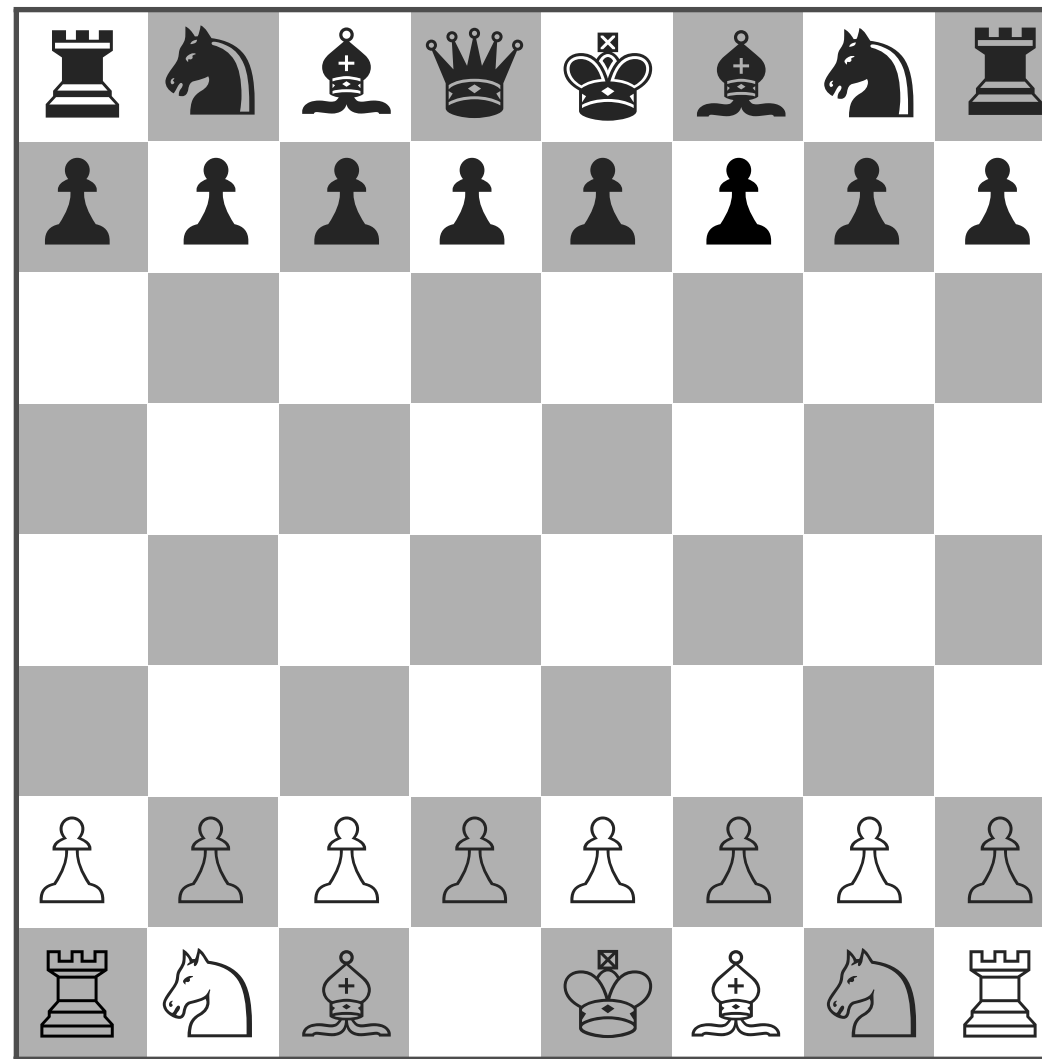
```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



a b c d

# Chess Piece Encoding

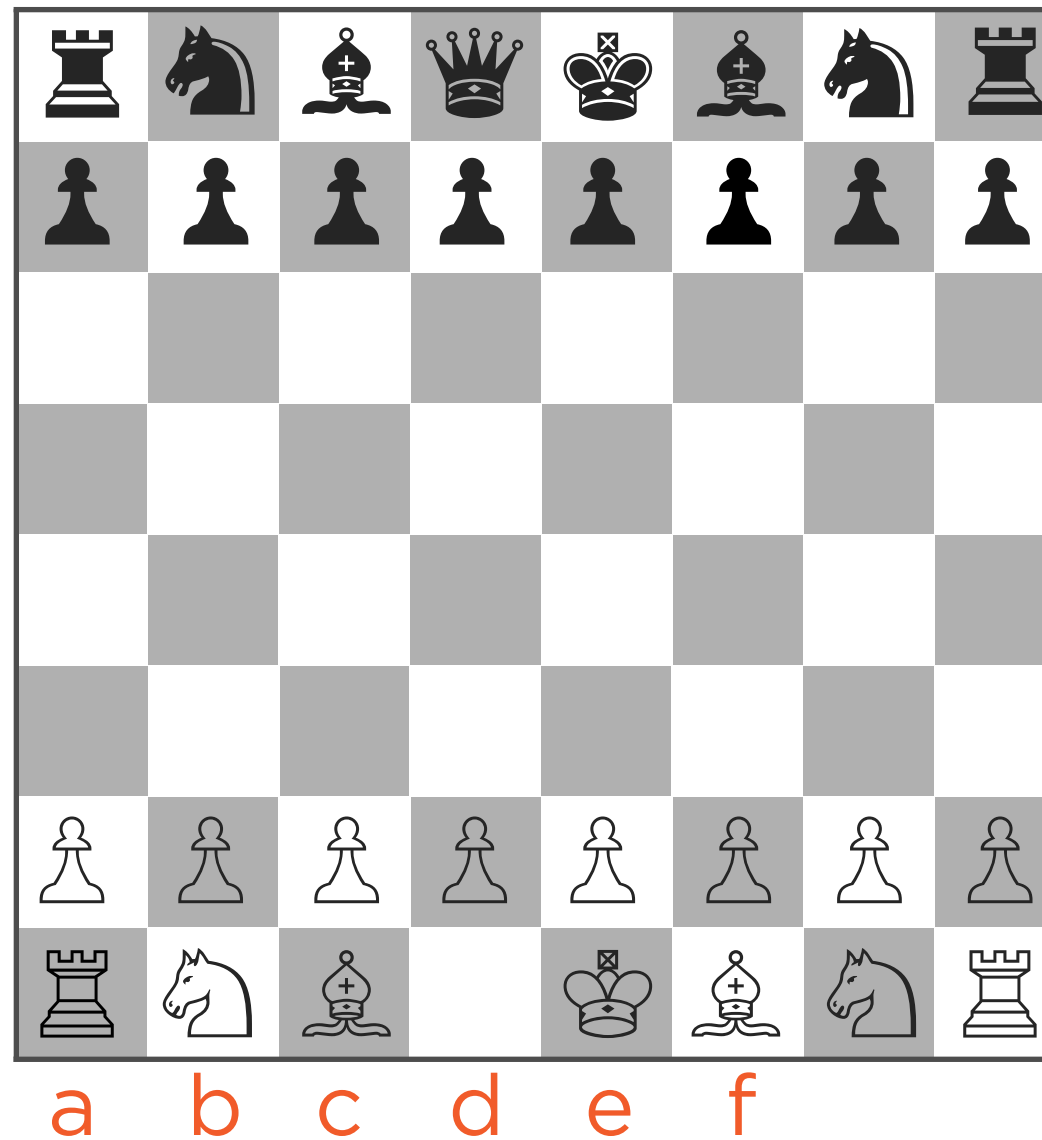
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♙': ChessCoordinate('c', 1),  
  '♔♚': ChessCoordinate('d', 1),  
  '♔♛': ChessCoordinate('e', 1),  
  ...  
  '♚♙♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



a b c d e

# Chess Piece Encoding

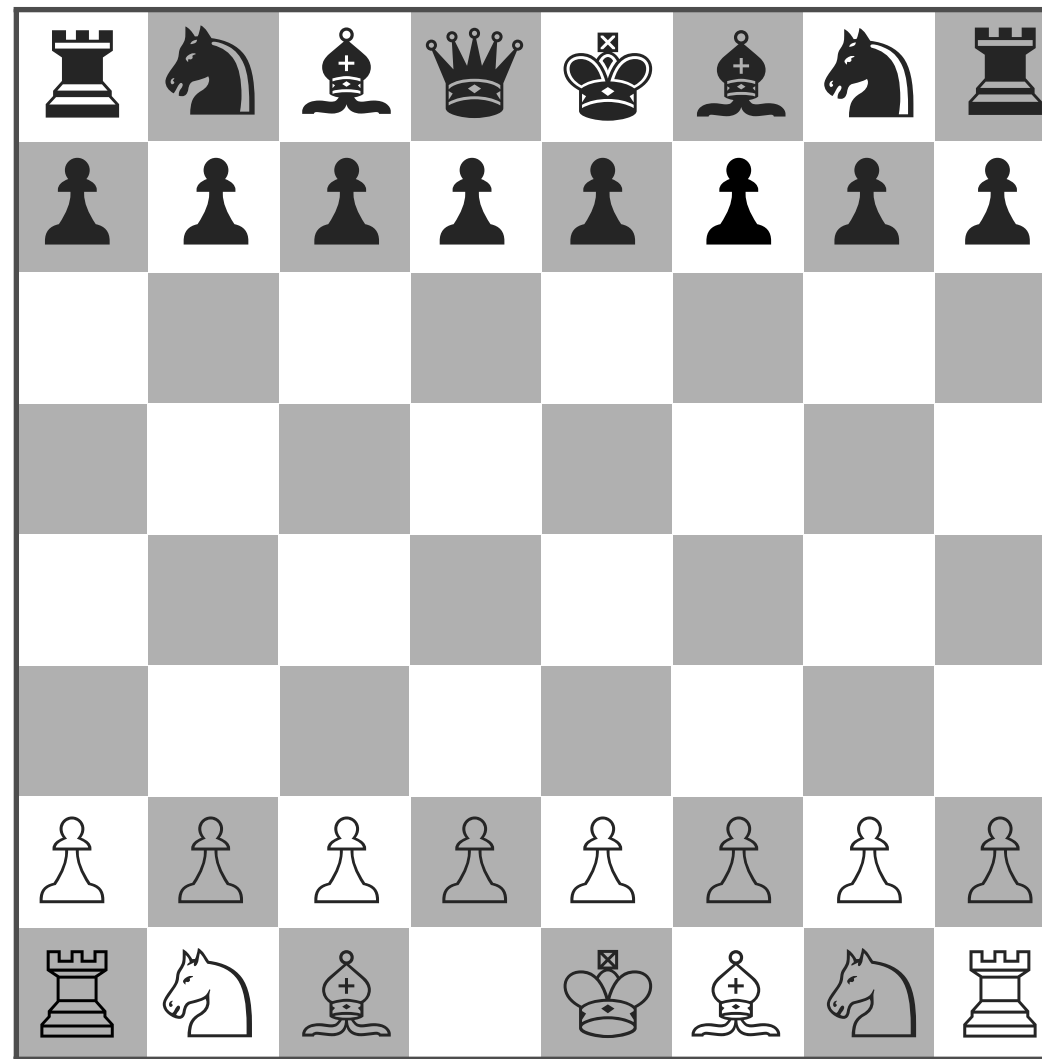
```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♚' : ChessCoordinate('d', 1),  
  '♔♗' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```





# Chess Piece Encoding

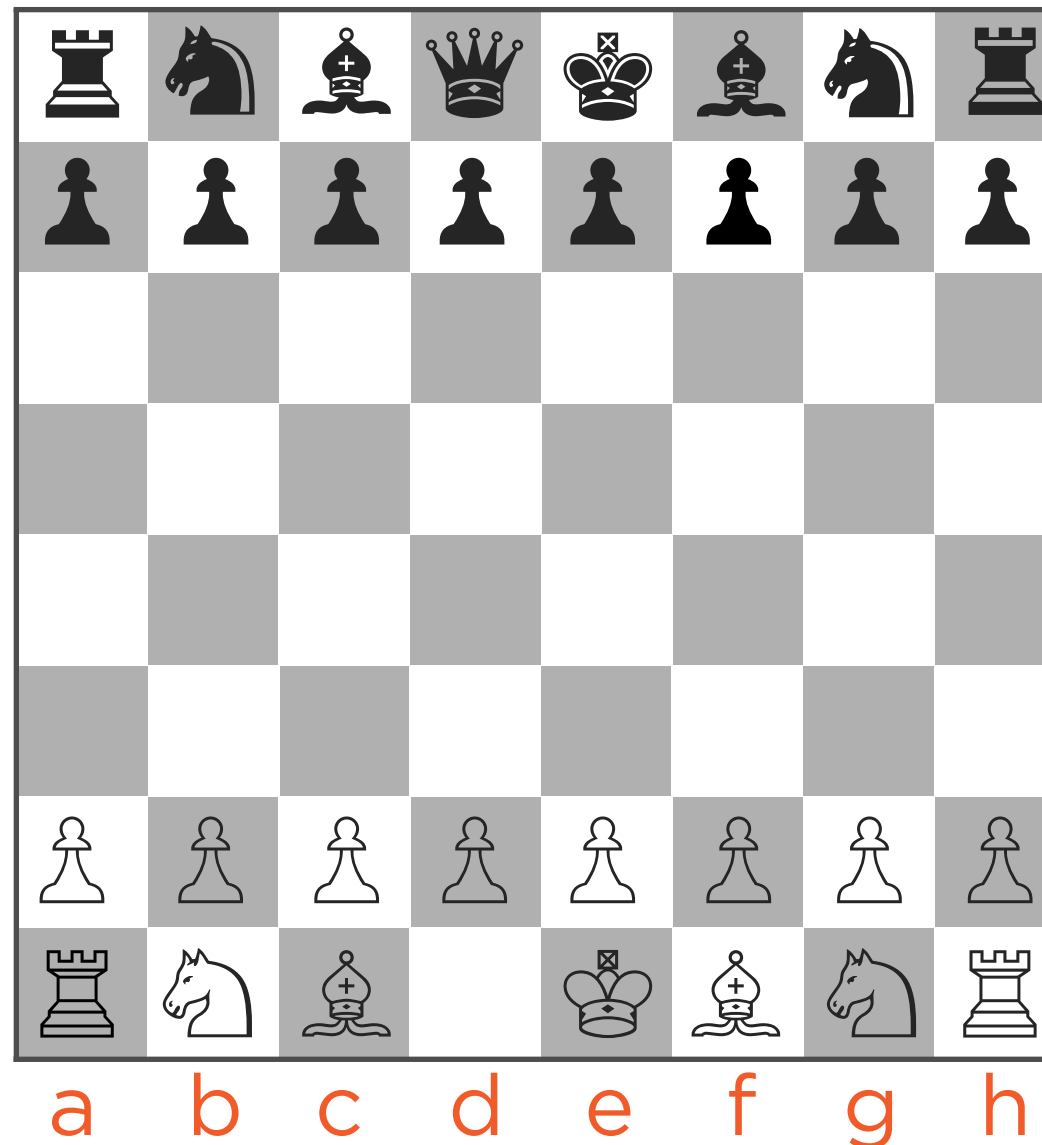
```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



a b c d e f g

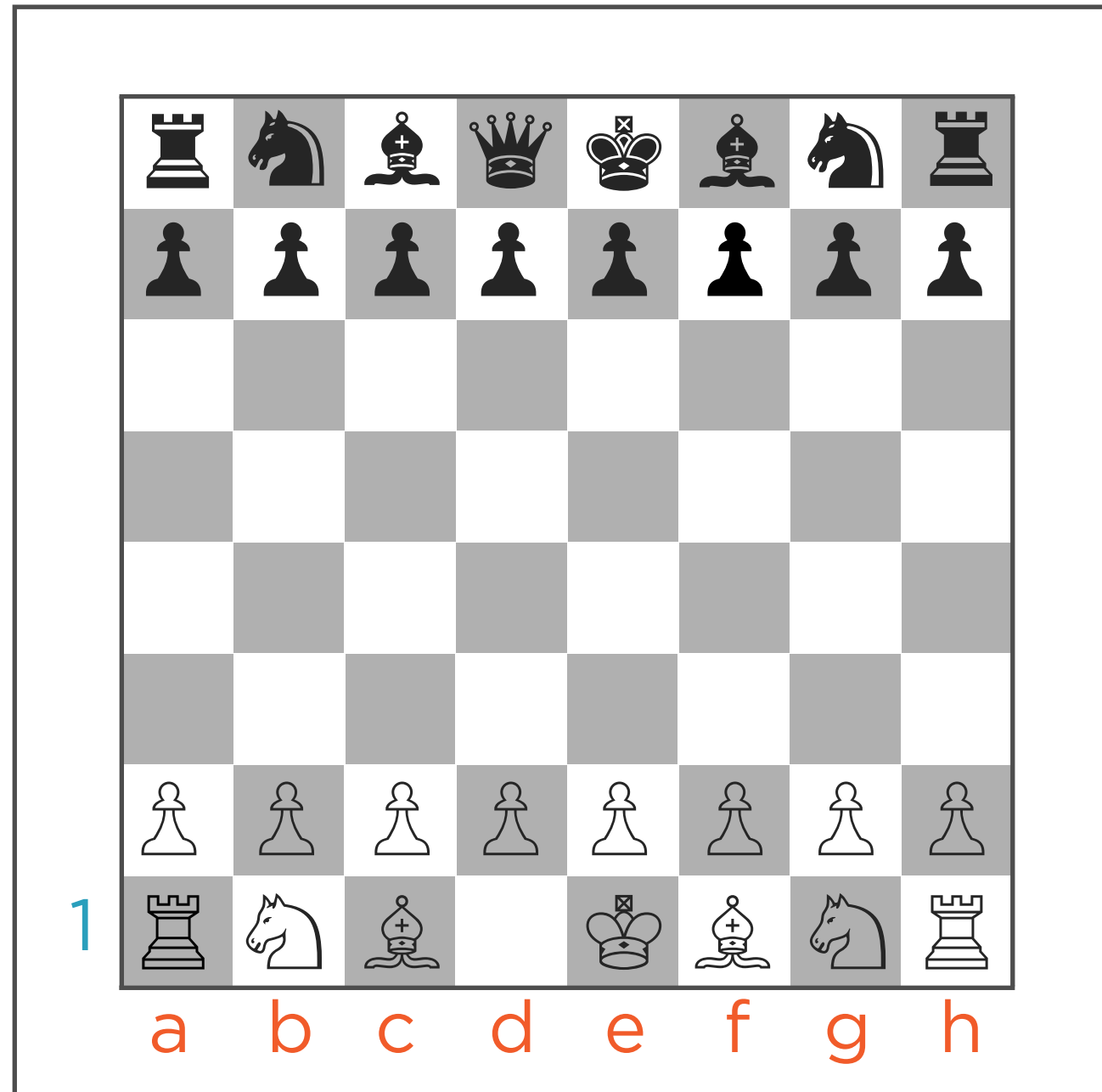
# Chess Piece Encoding

```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♚': ChessCoordinate('d', 1),  
  '♔♗': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



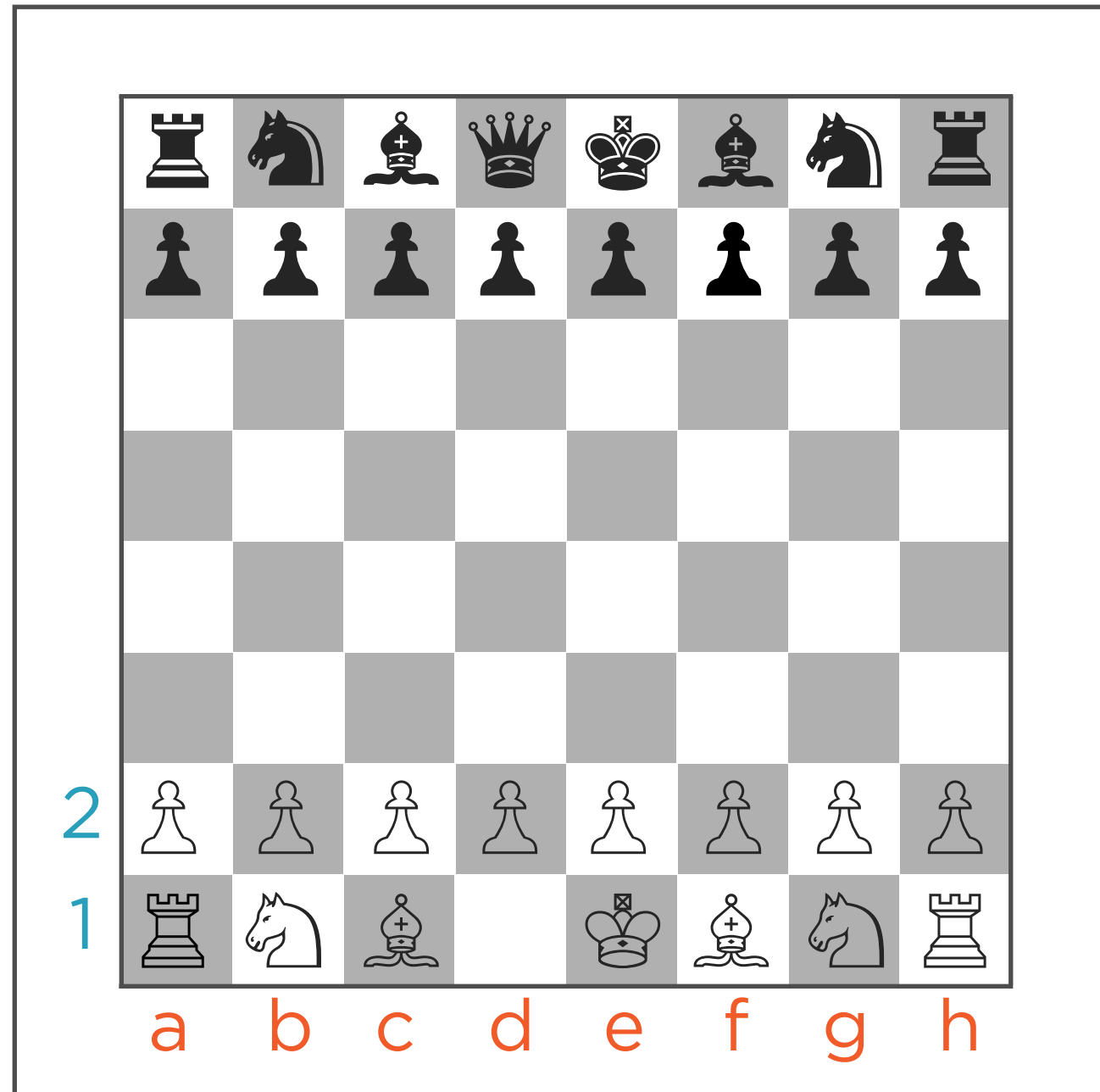
# Chess Piece Encoding

```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



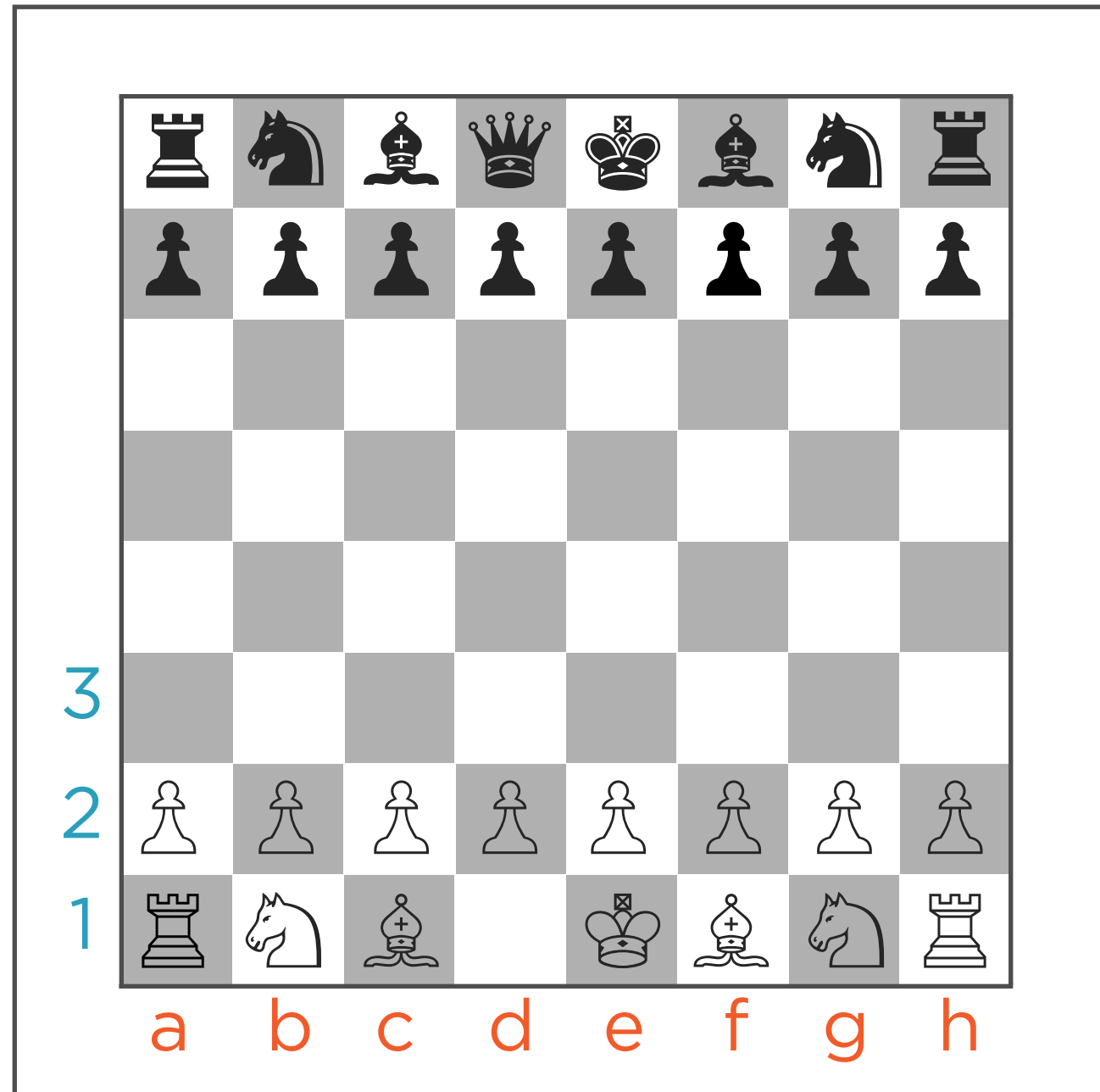
# Chess Piece Encoding

```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



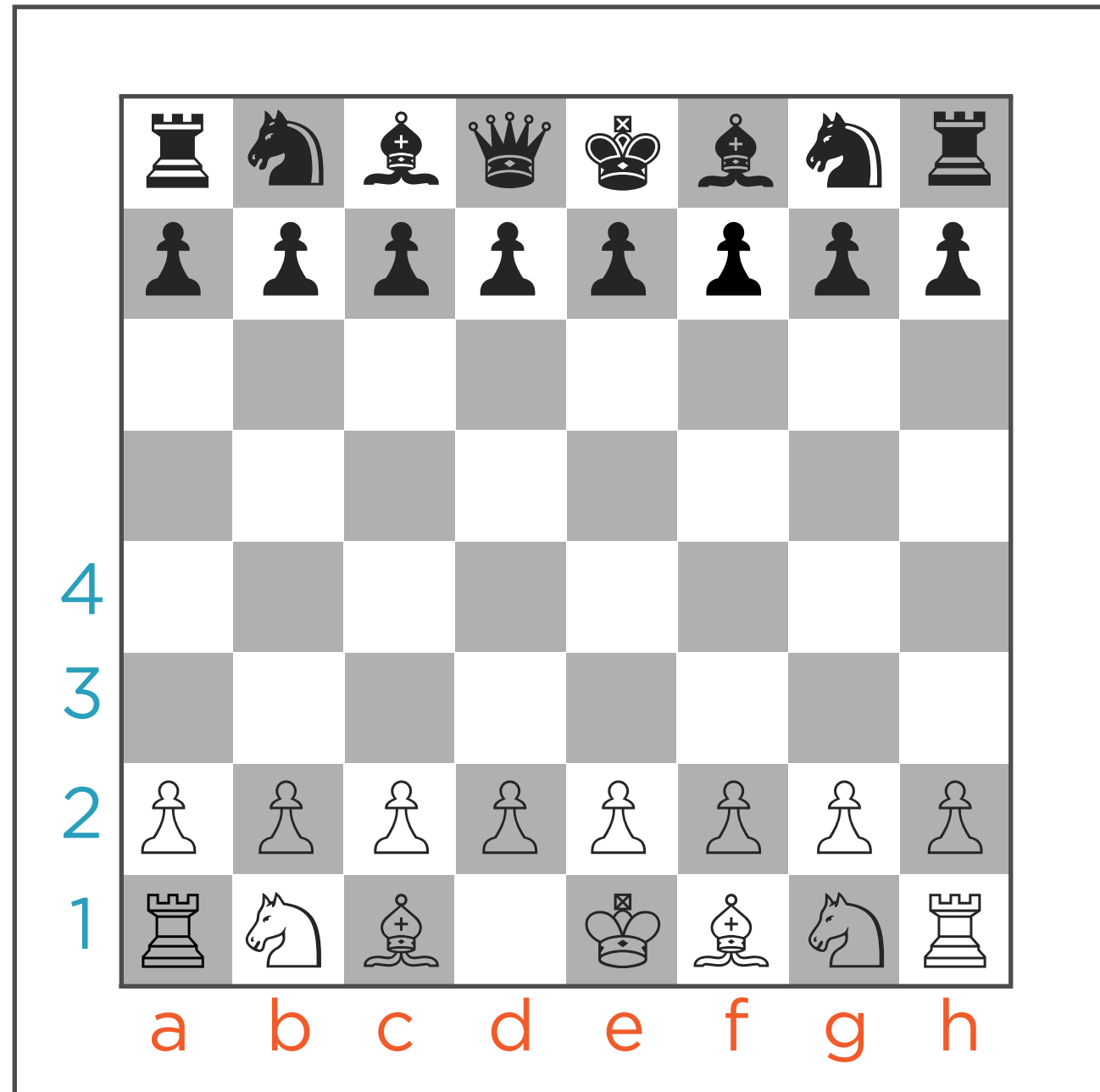
# Chess Piece Encoding

```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



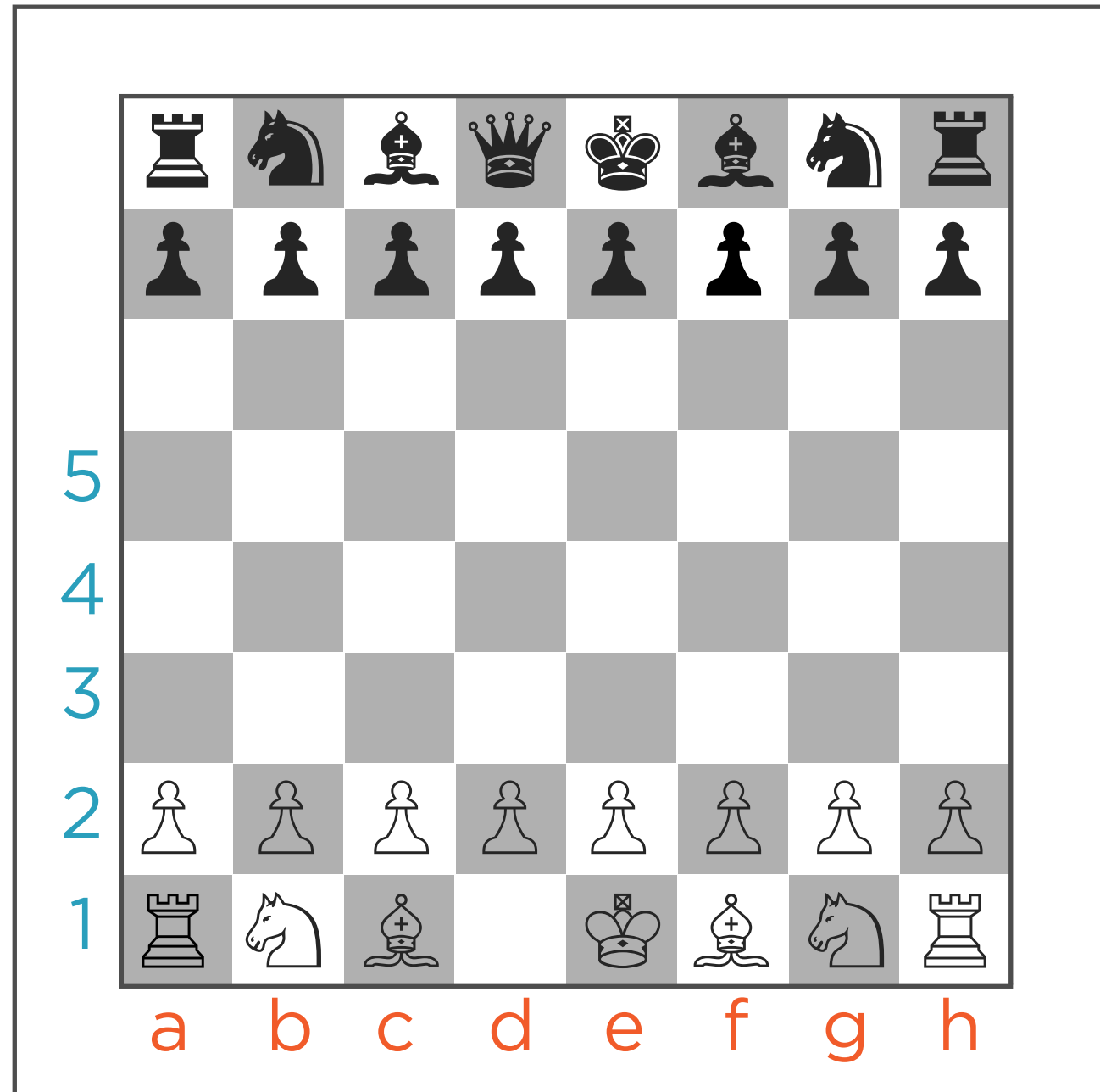
# Chess Piece Encoding

```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



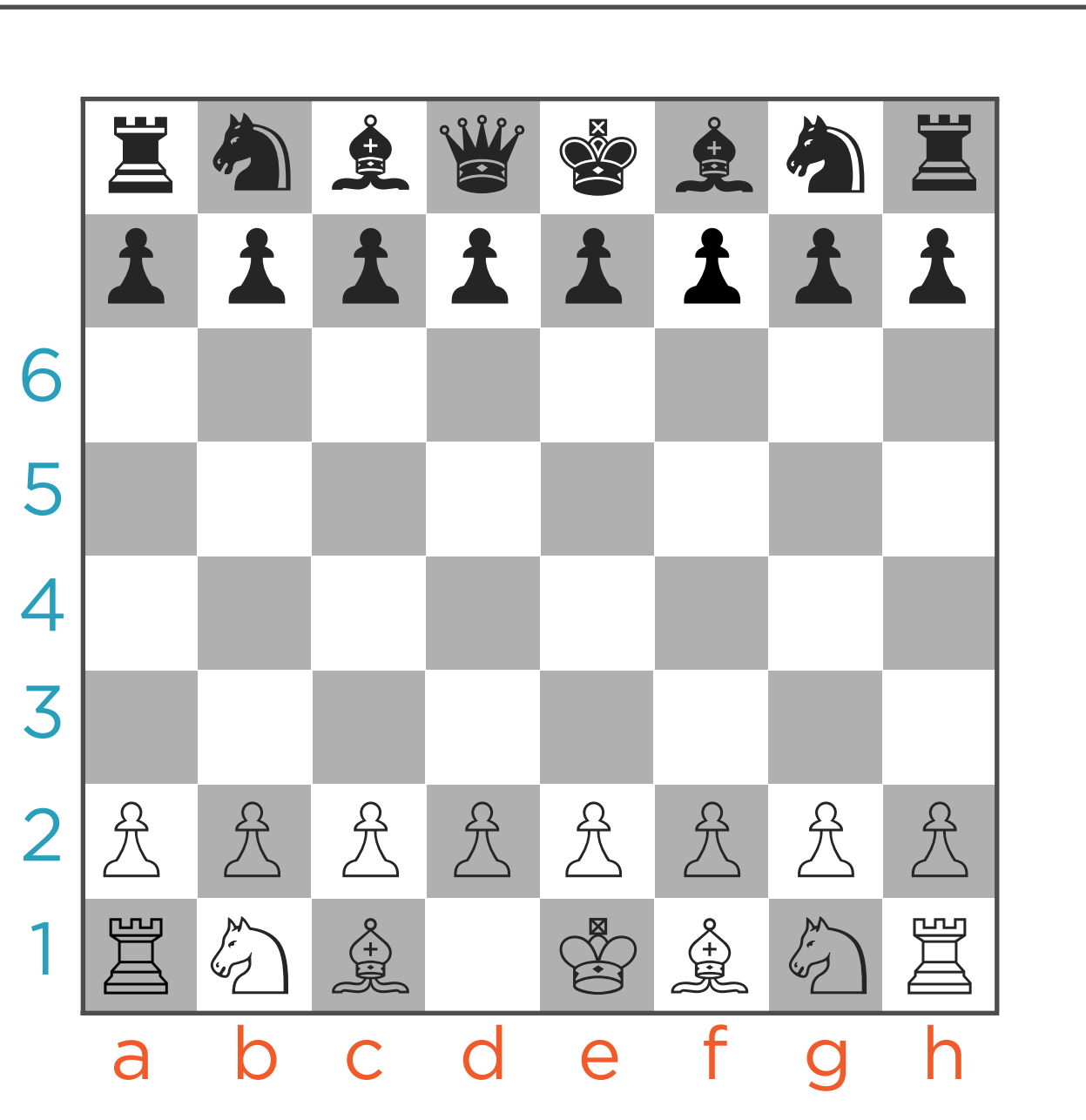
# Chess Piece Encoding

```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding

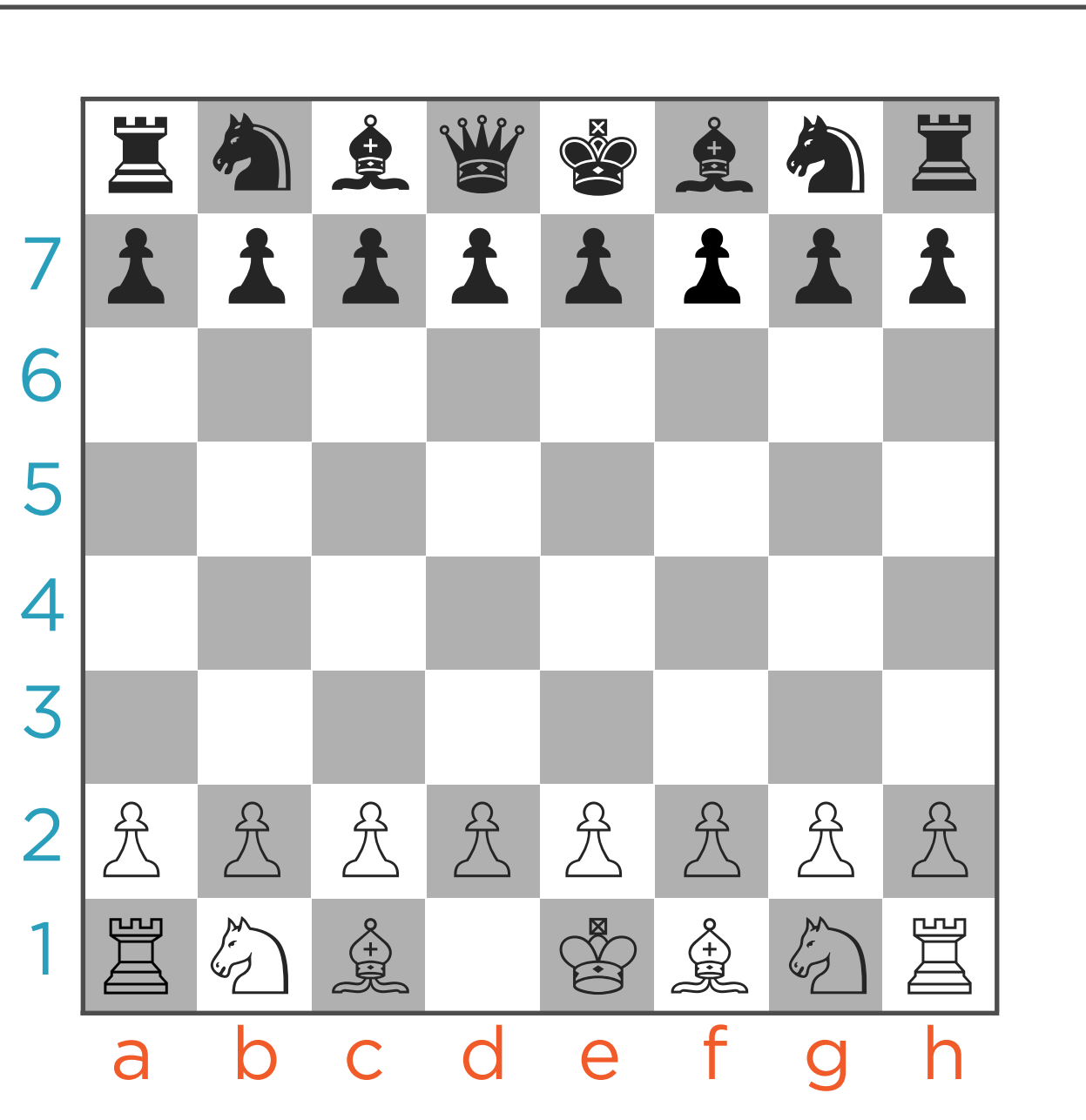
```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♖' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```





# Chess Piece Encoding

```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



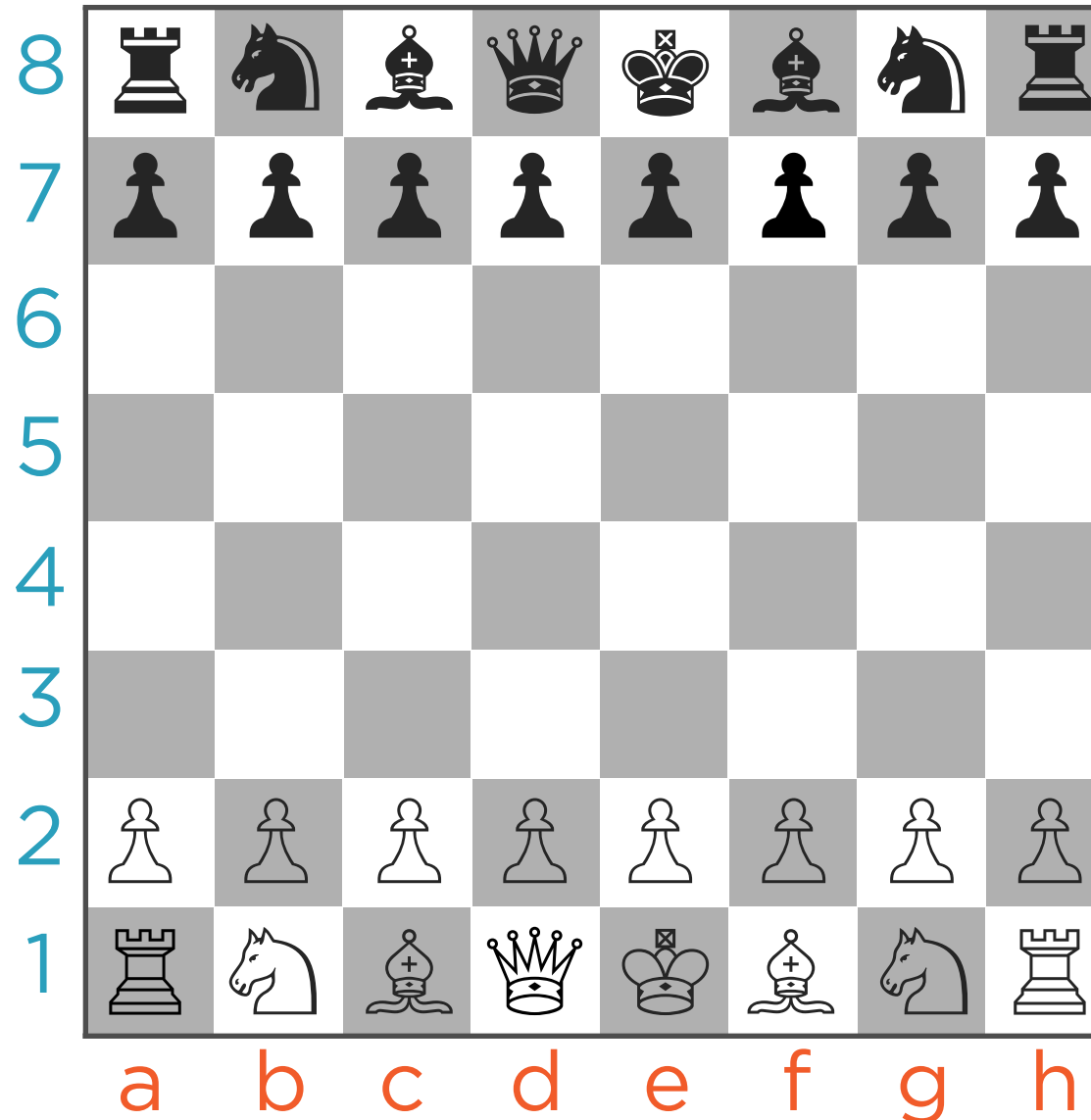
# Chess Piece Encoding

```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



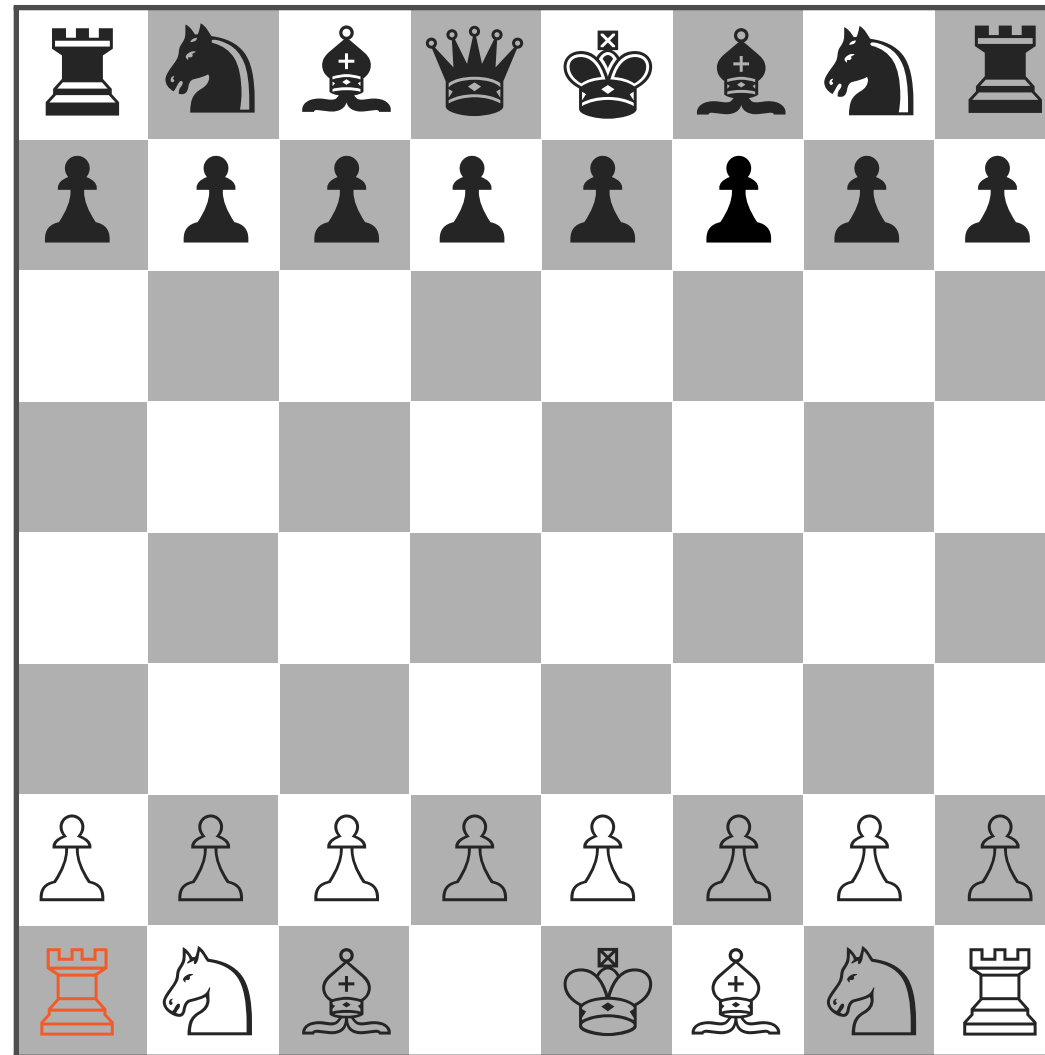
# Chess Piece Encoding

```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



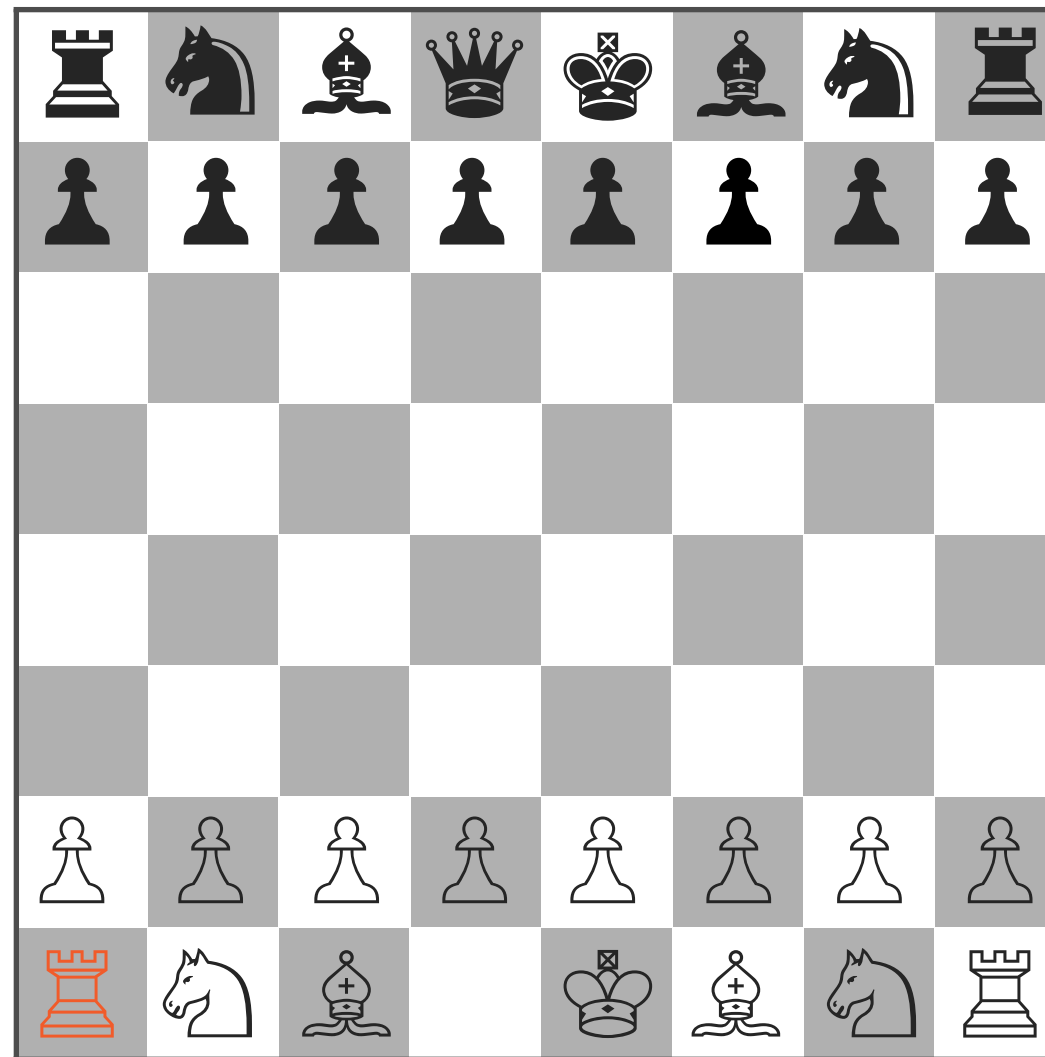
# Chess Piece Encoding

```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding

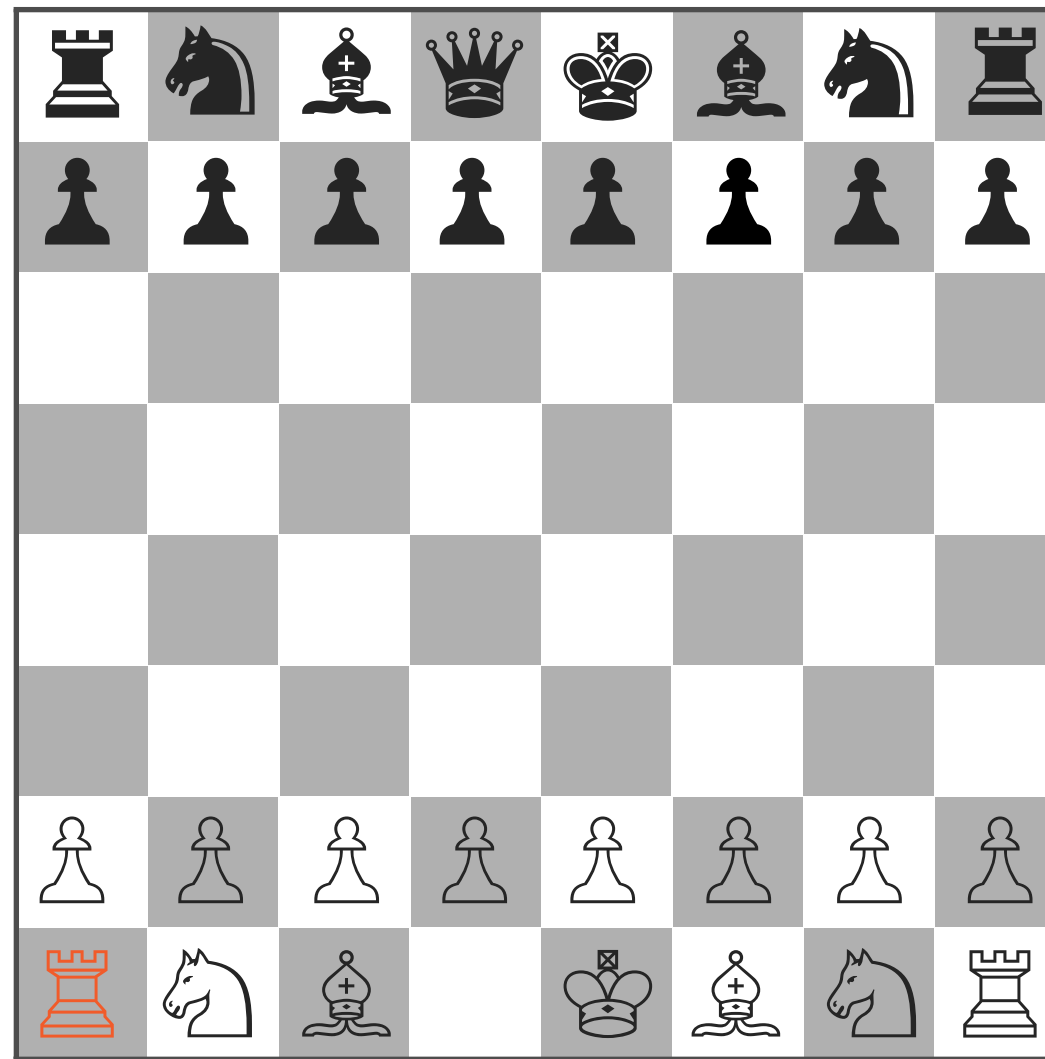
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



a

# Chess Piece Encoding

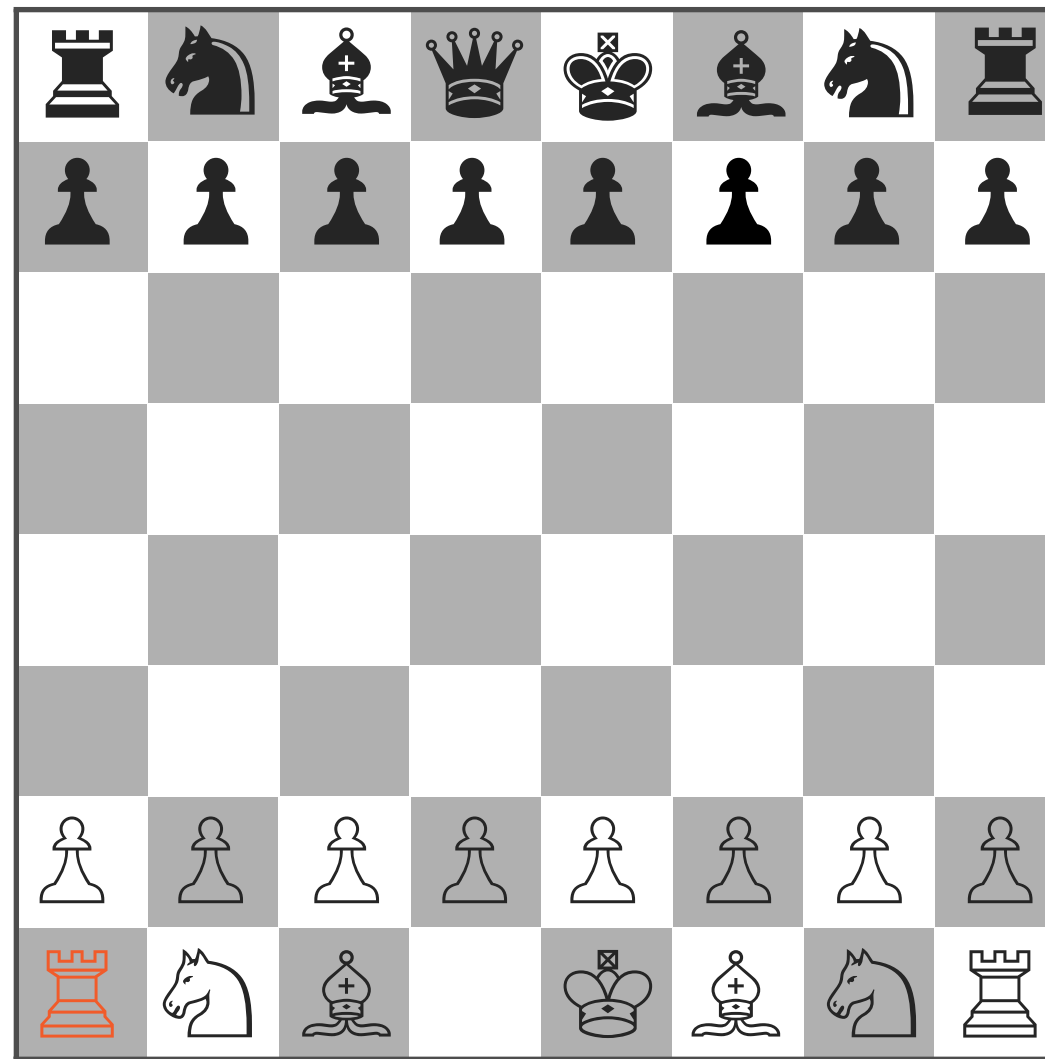
```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



a b

# Chess Piece Encoding

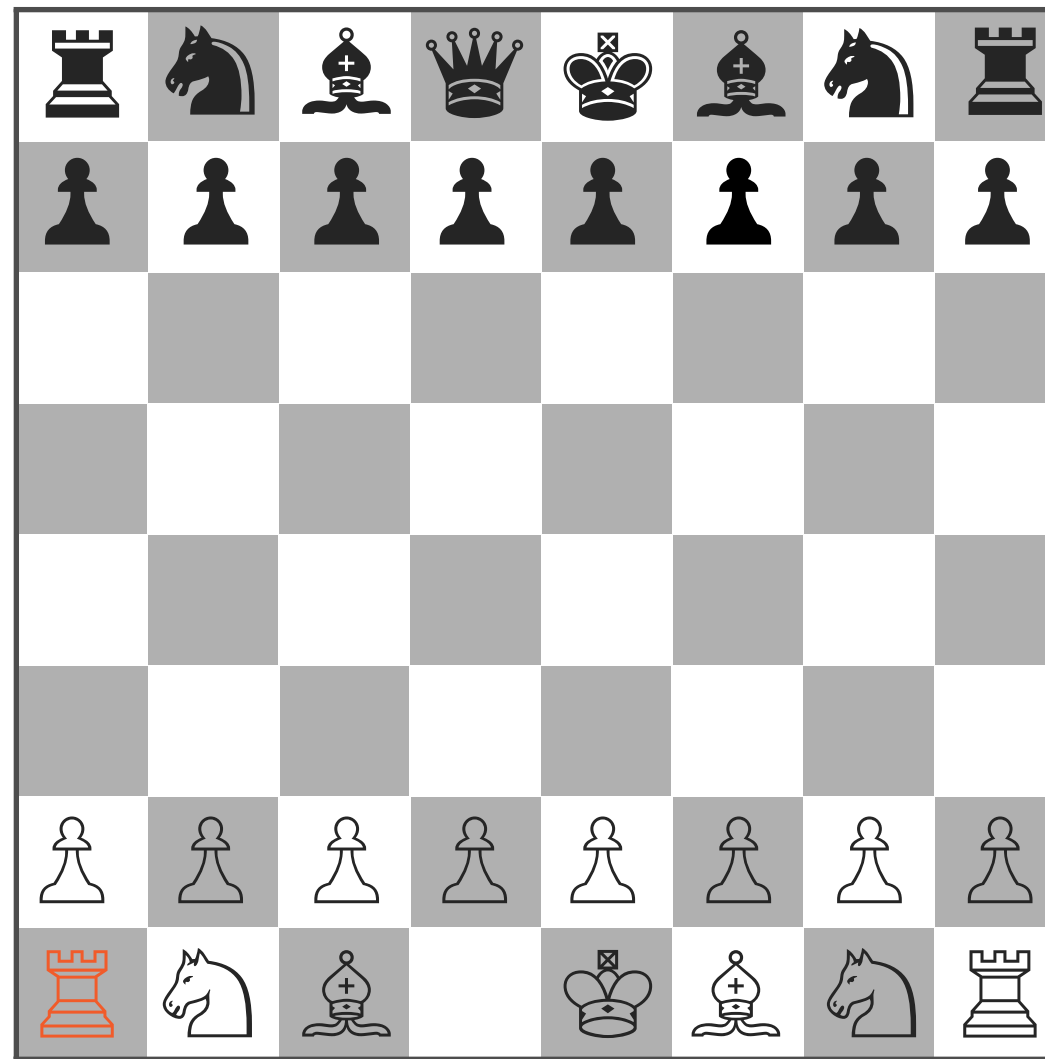
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



a b c

# Chess Piece Encoding

```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```

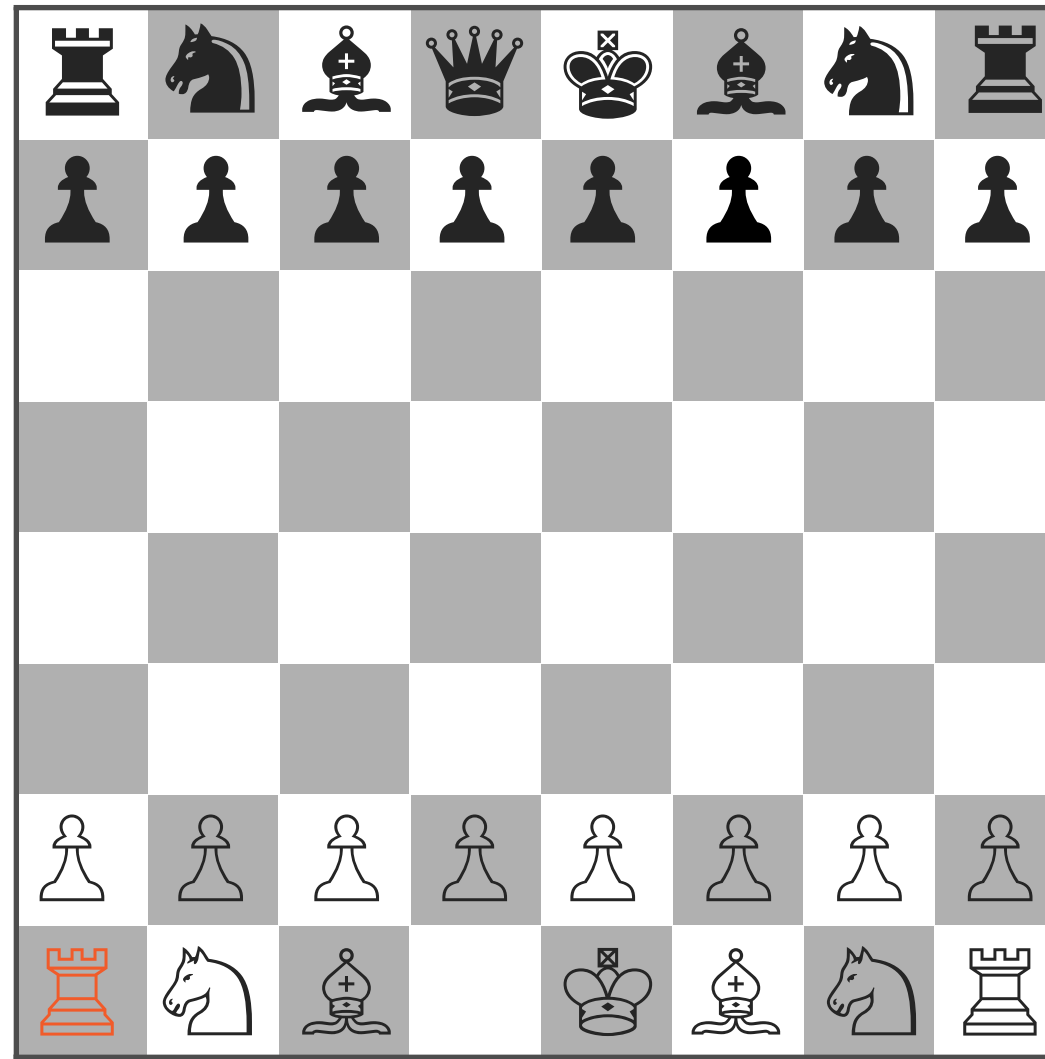


a b c d



# Chess Piece Encoding

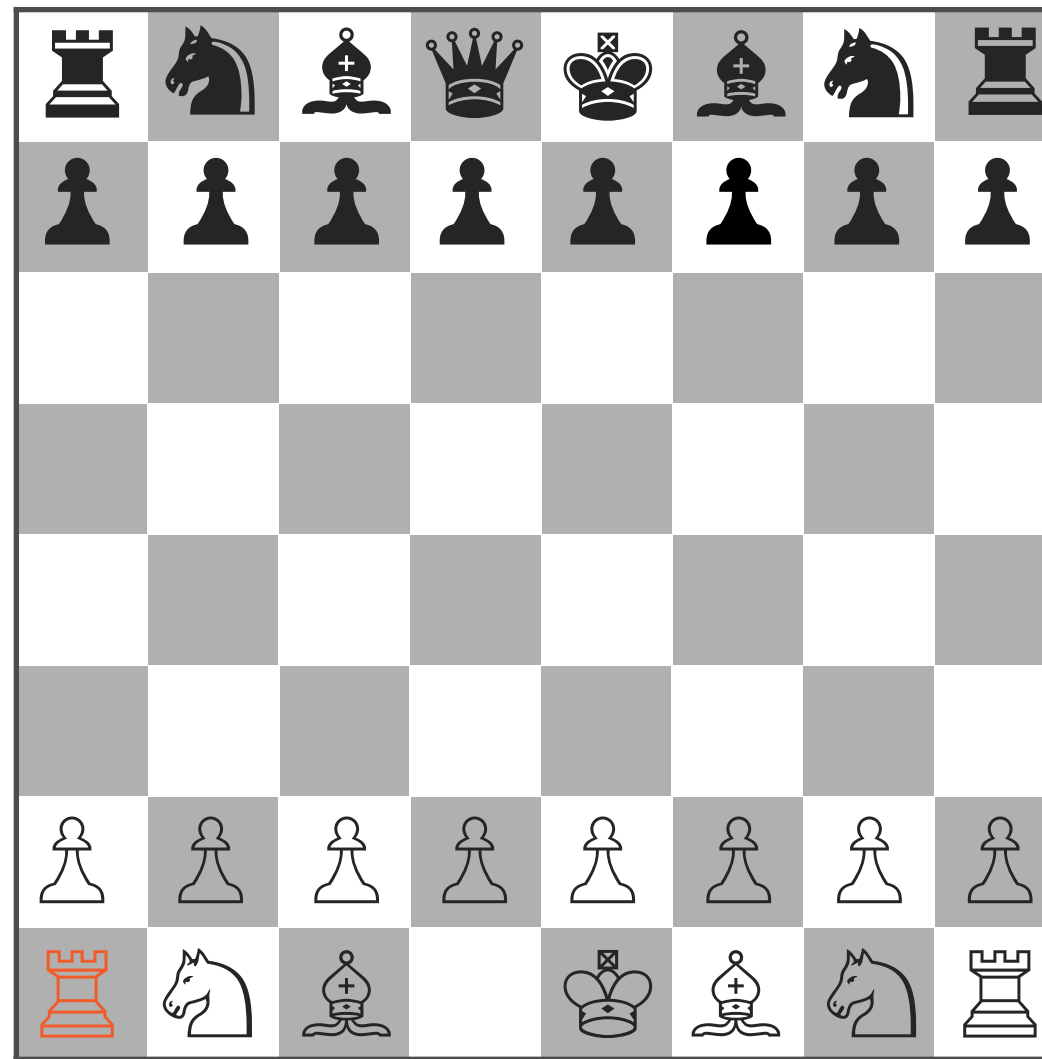
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♖': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



a b c d e

# Chess Piece Encoding

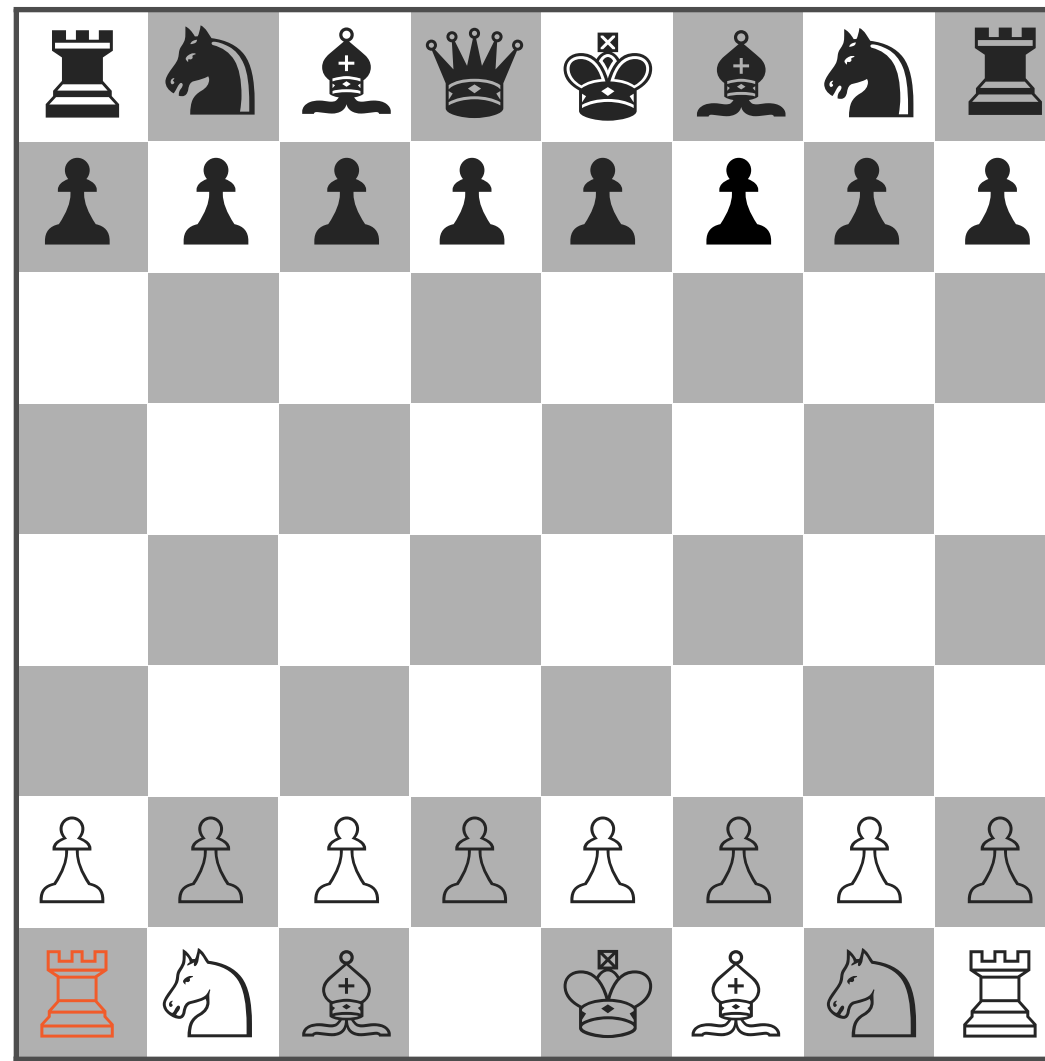
```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



a b c d e f

# Chess Piece Encoding

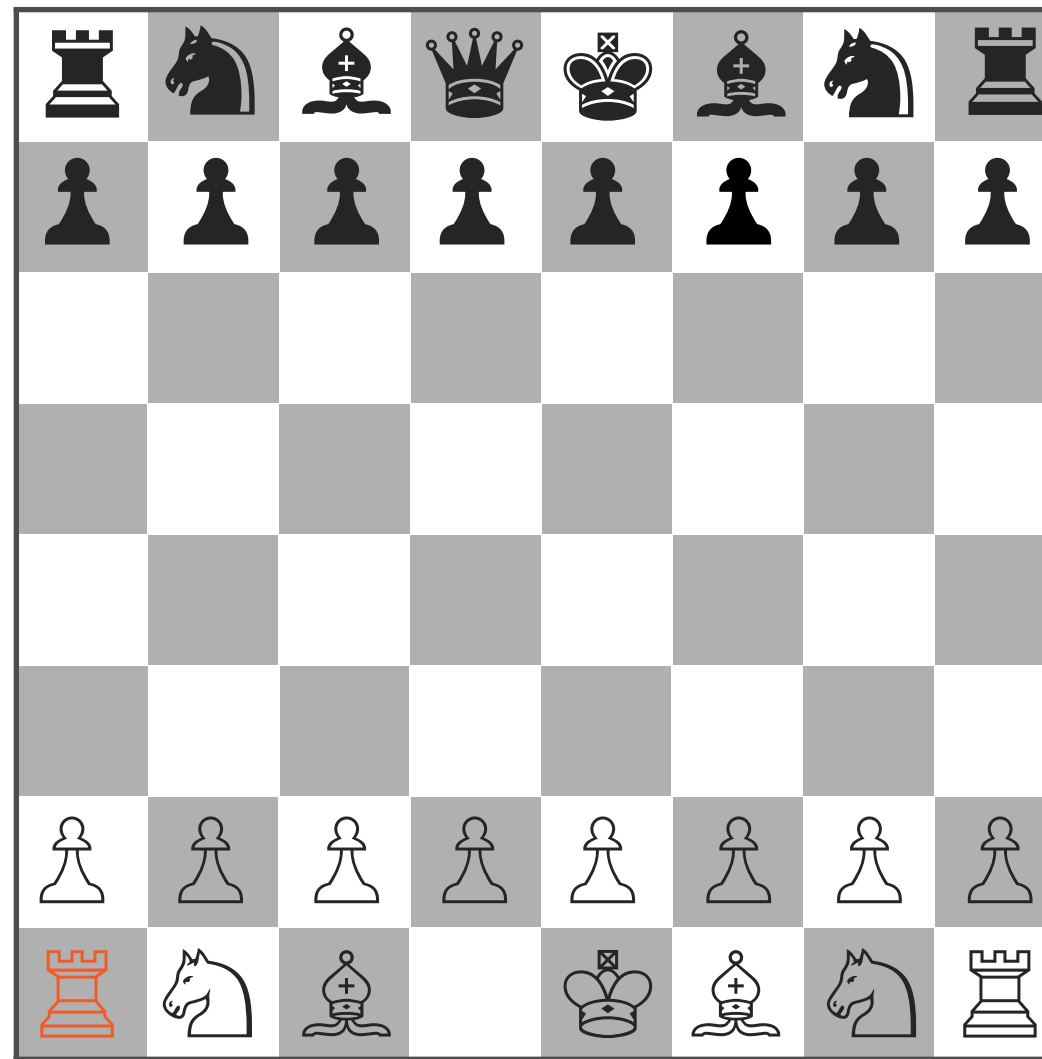
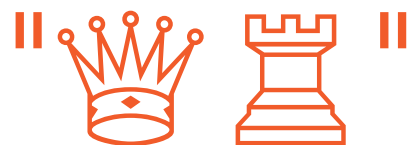
```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



a b c d e f g

# Chess Piece Encoding

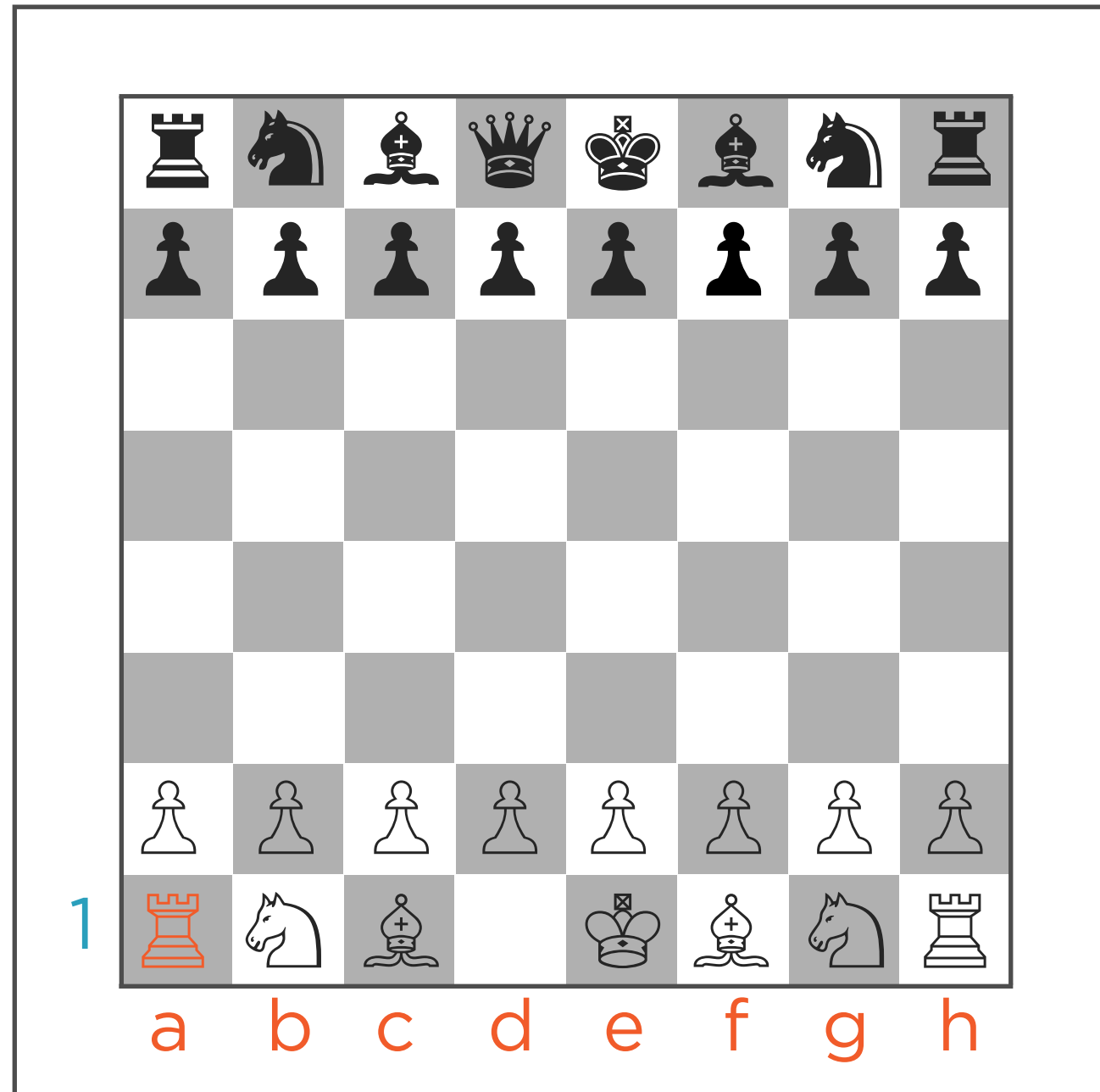
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



a b c d e f g h

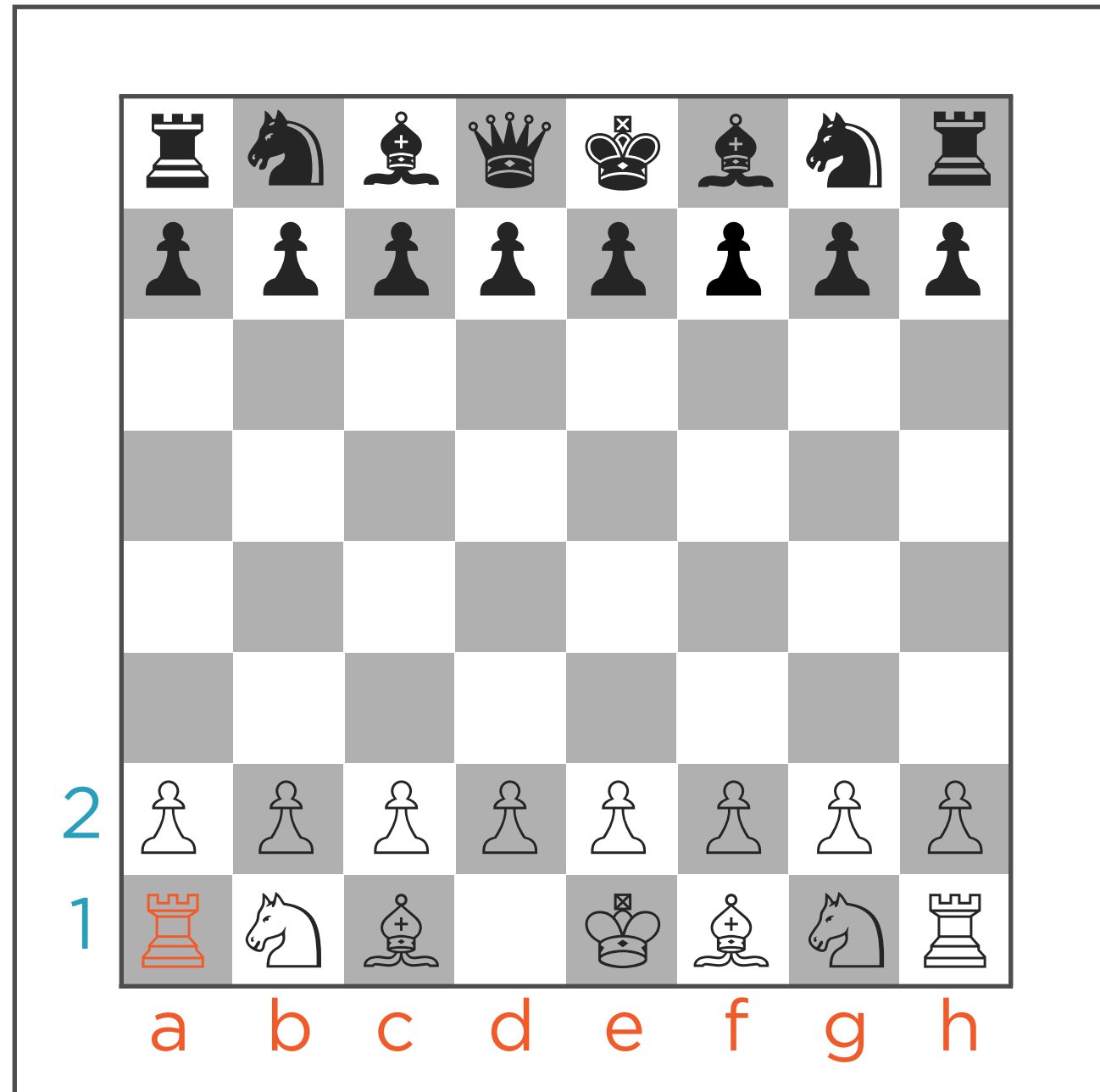
# Chess Piece Encoding

```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



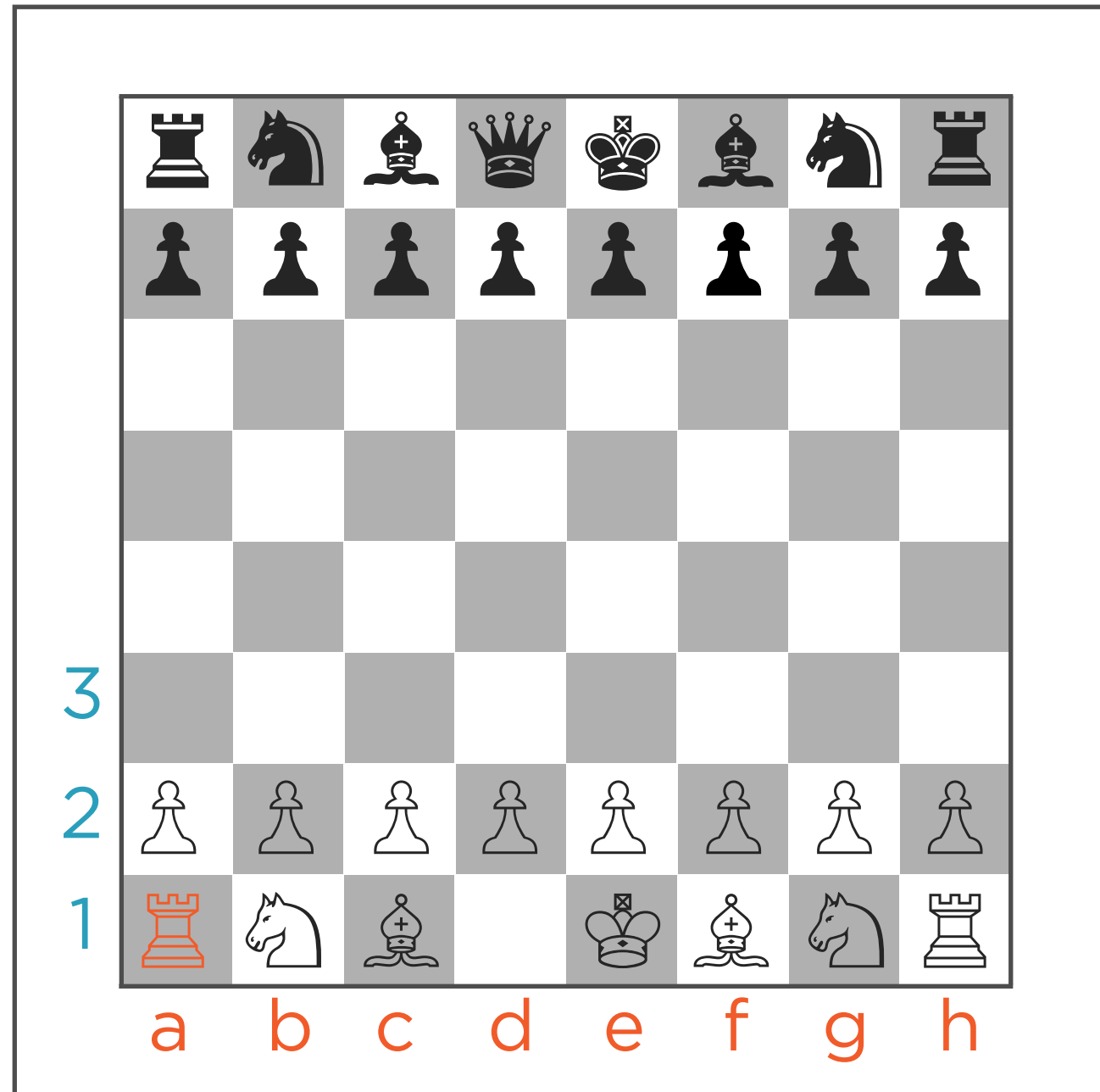
# Chess Piece Encoding

```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



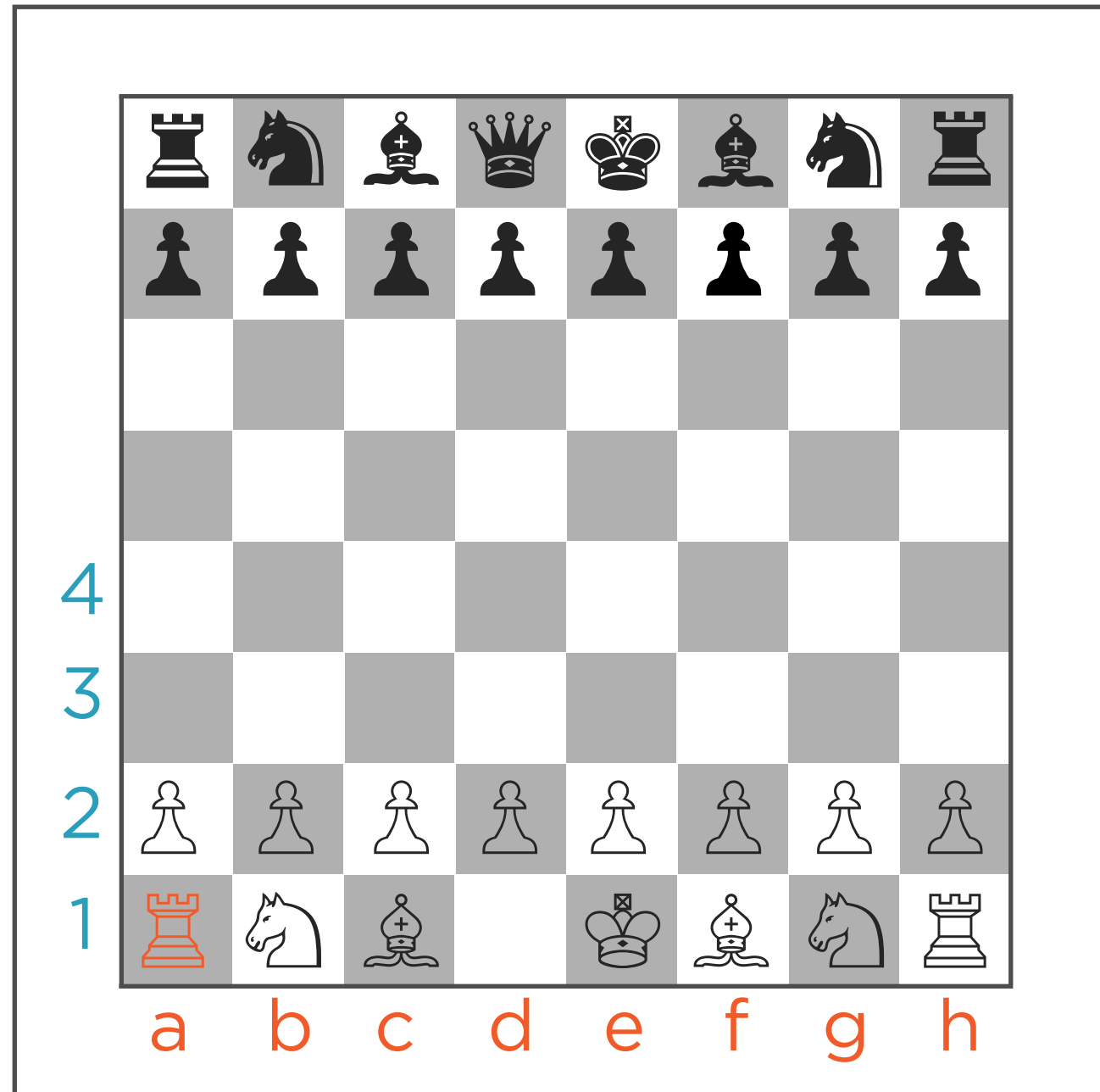
# Chess Piece Encoding

```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♙': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♙♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding

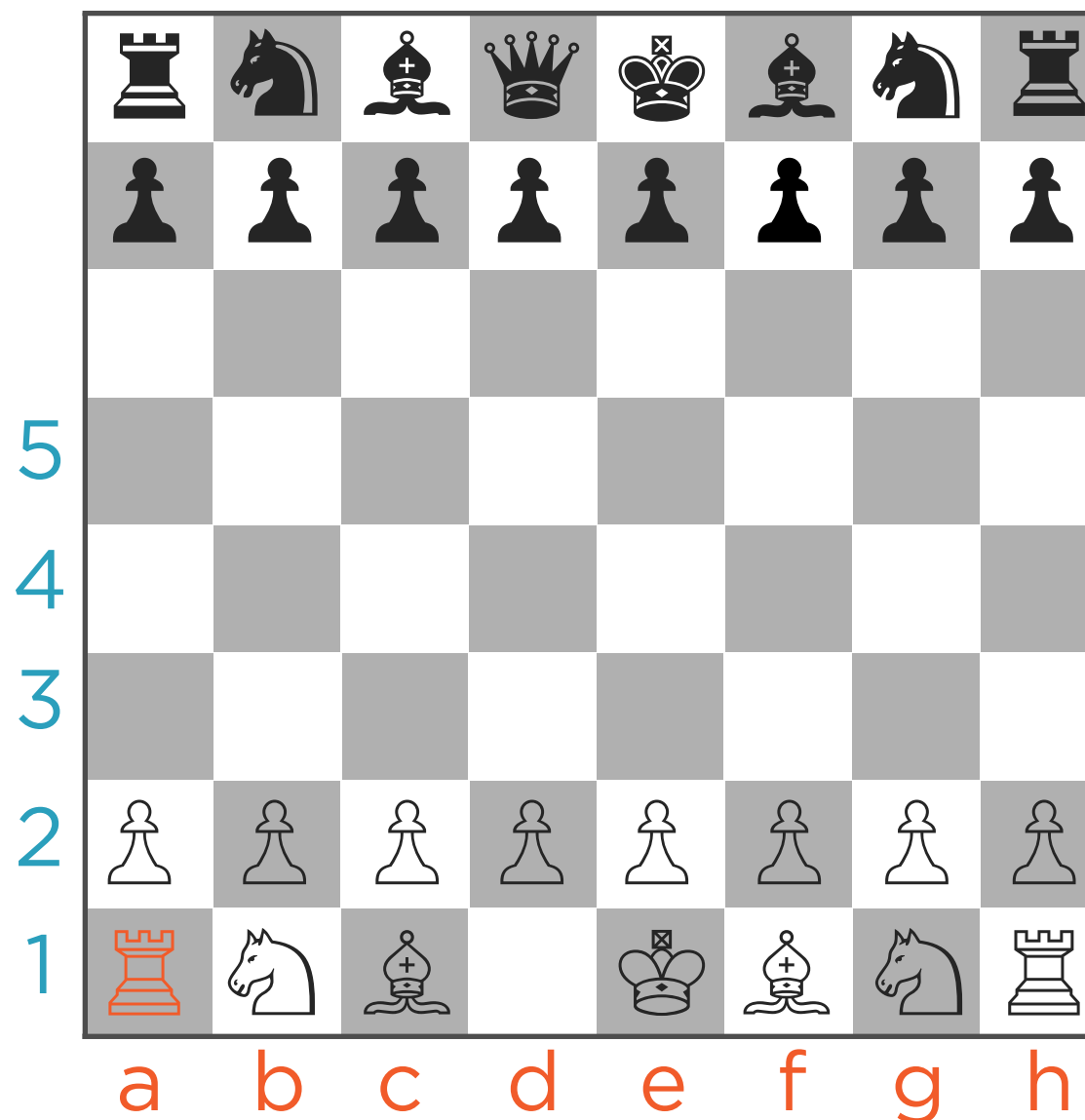
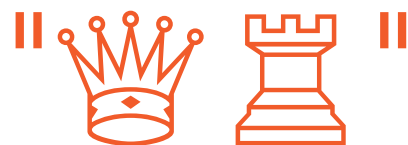
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```





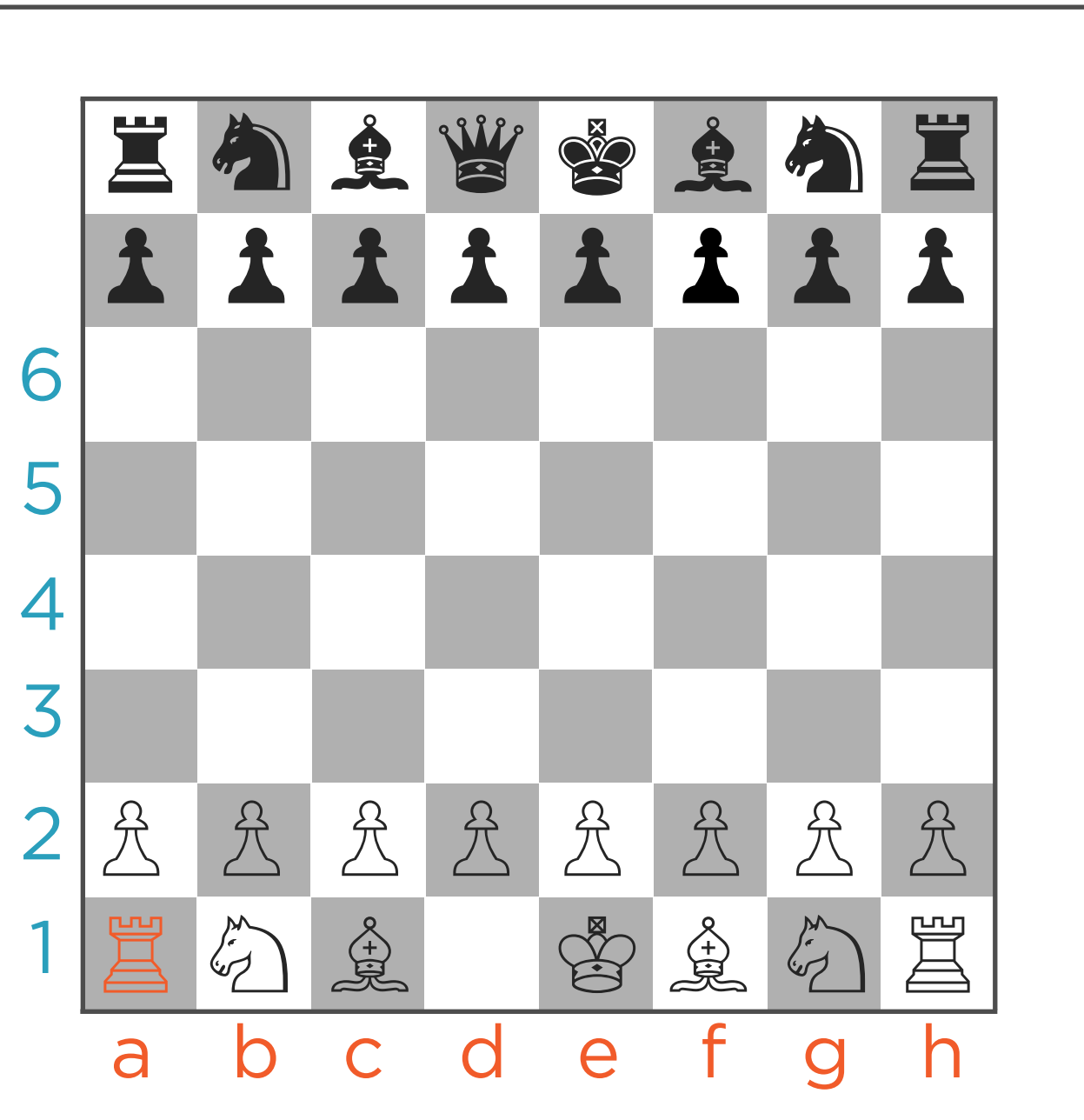
# Chess Piece Encoding

```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



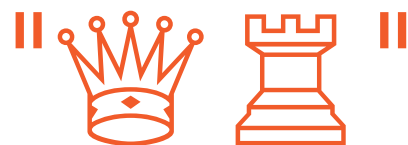
# Chess Piece Encoding

```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



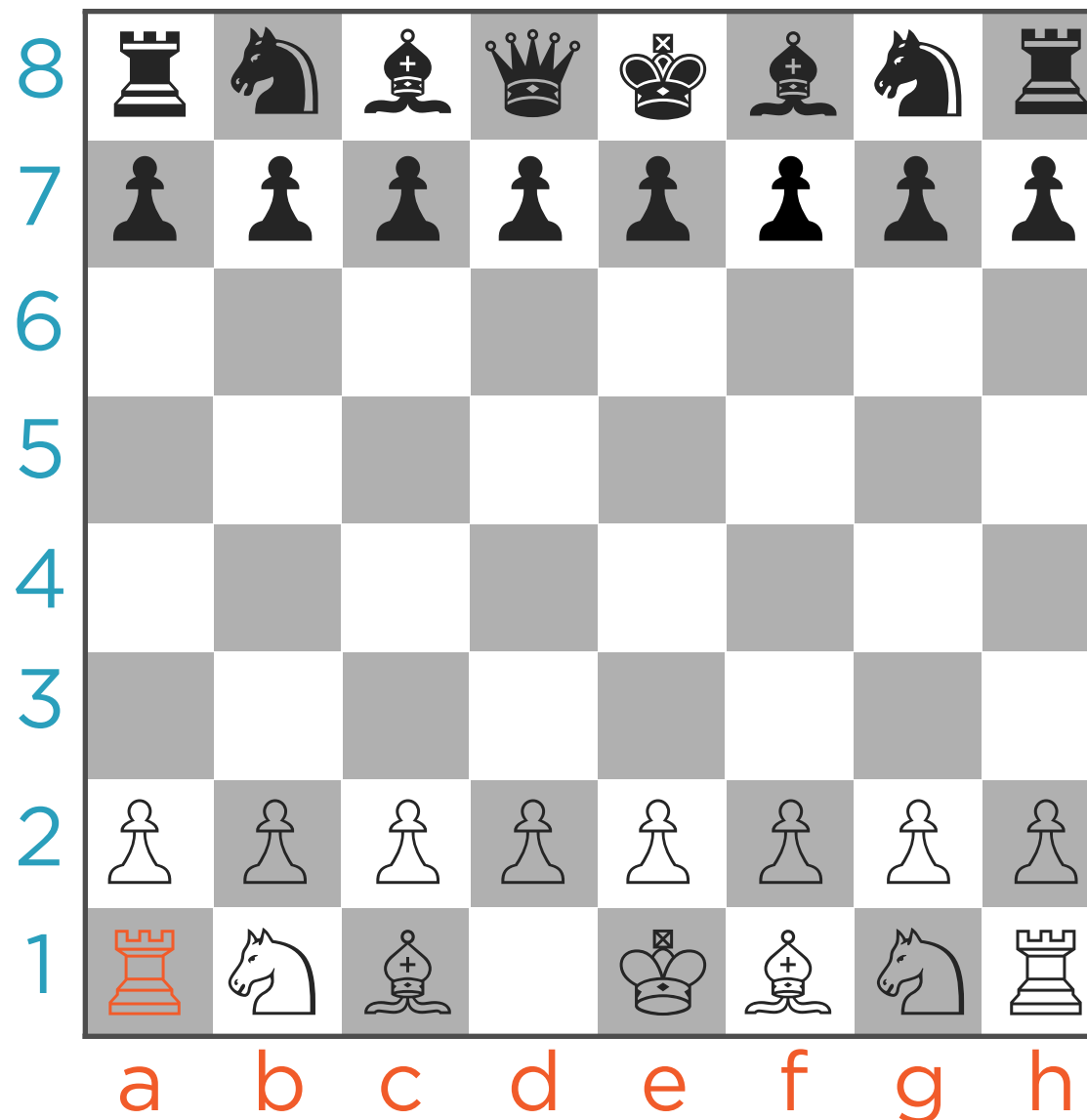
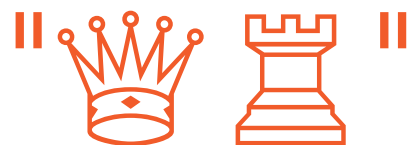
# Chess Piece Encoding

```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♖': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



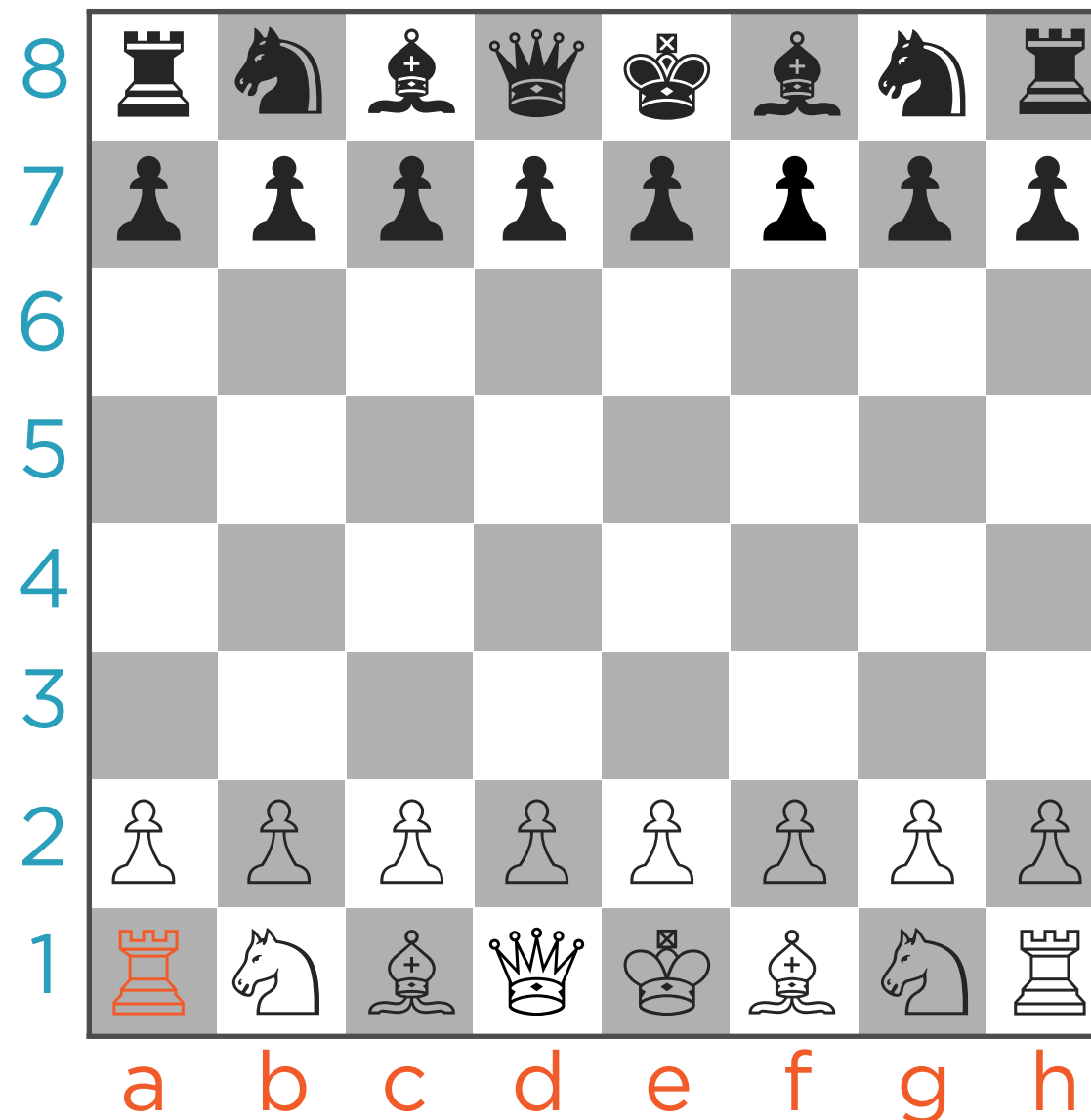
# Chess Piece Encoding

```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding

```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding



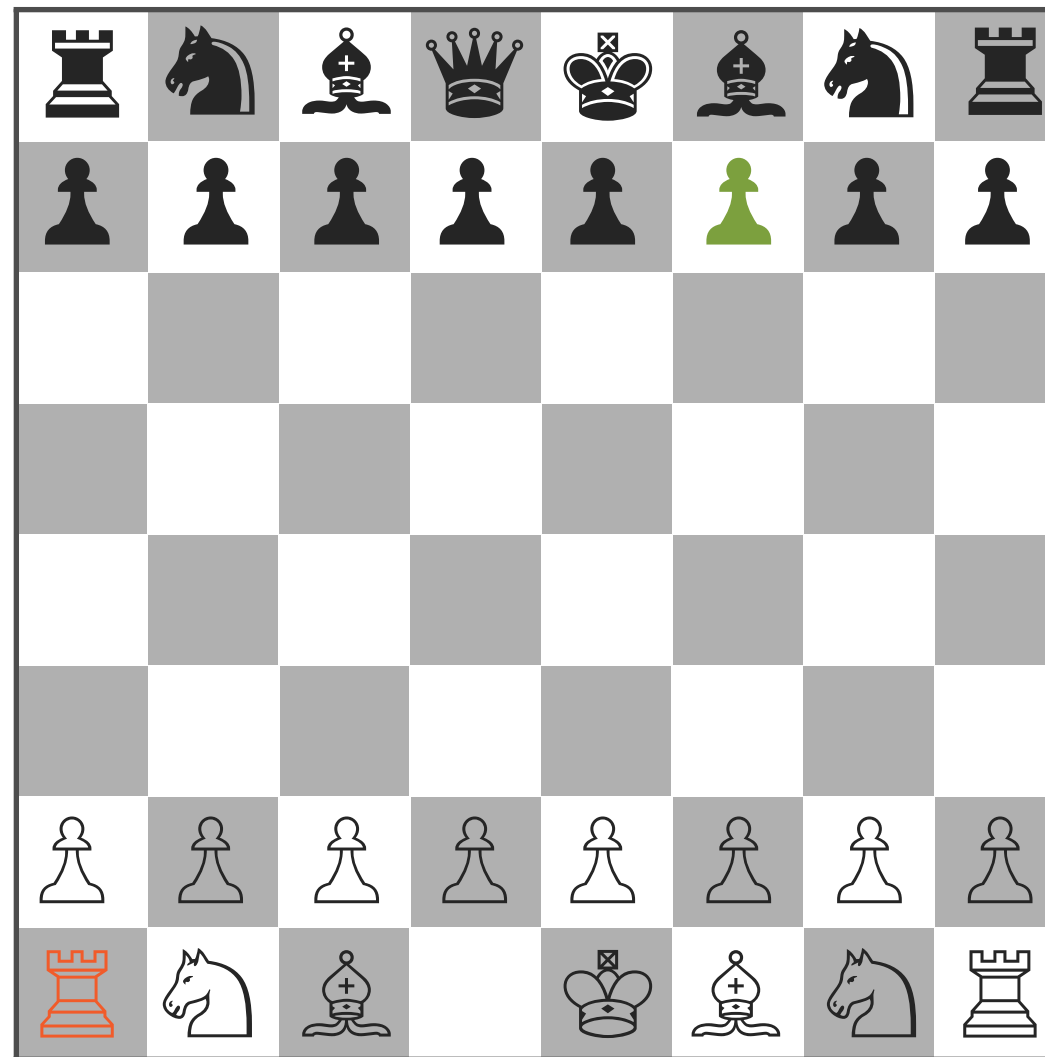
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding



```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



a

# Chess Piece Encoding



```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



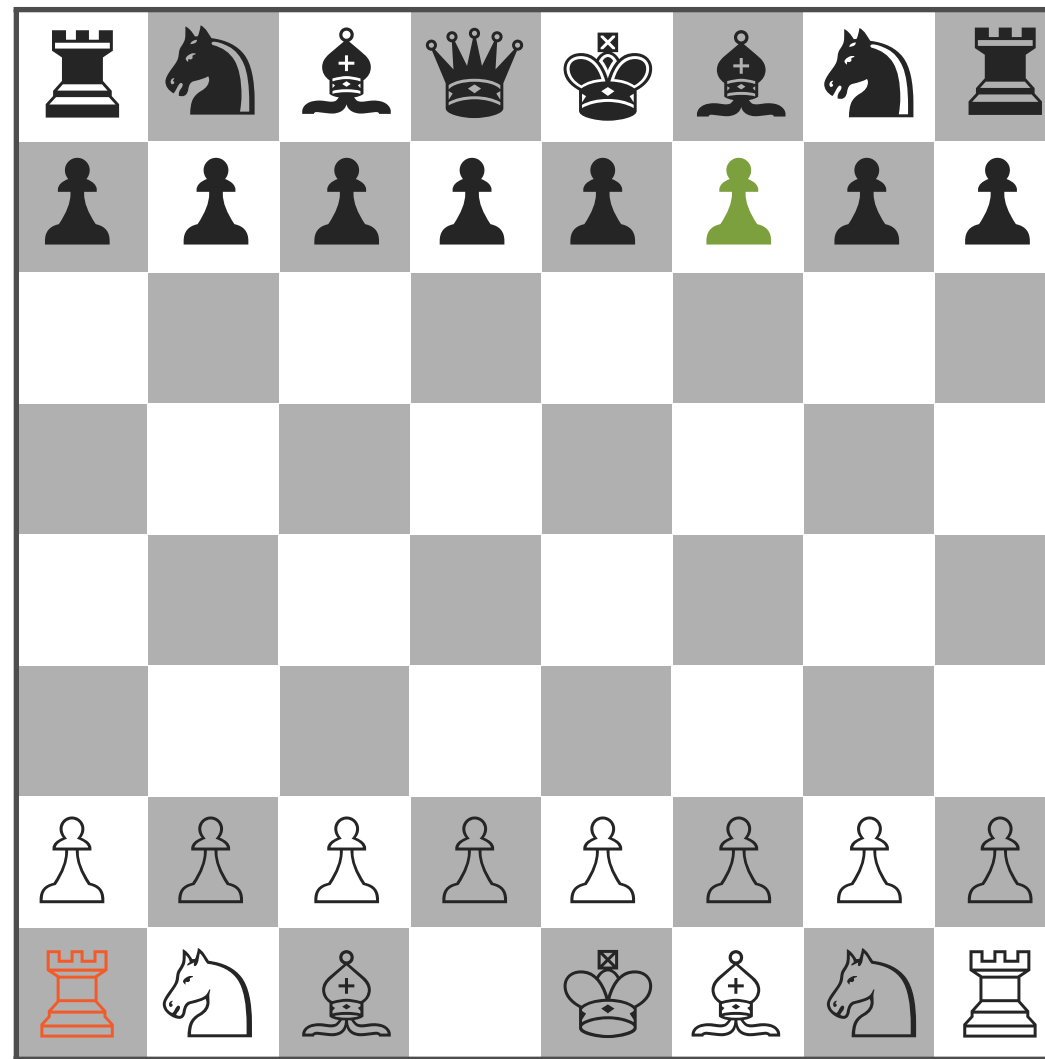
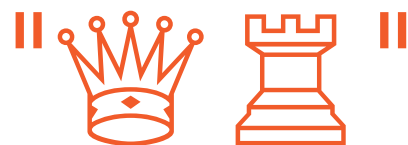
a b



# Chess Piece Encoding



```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```

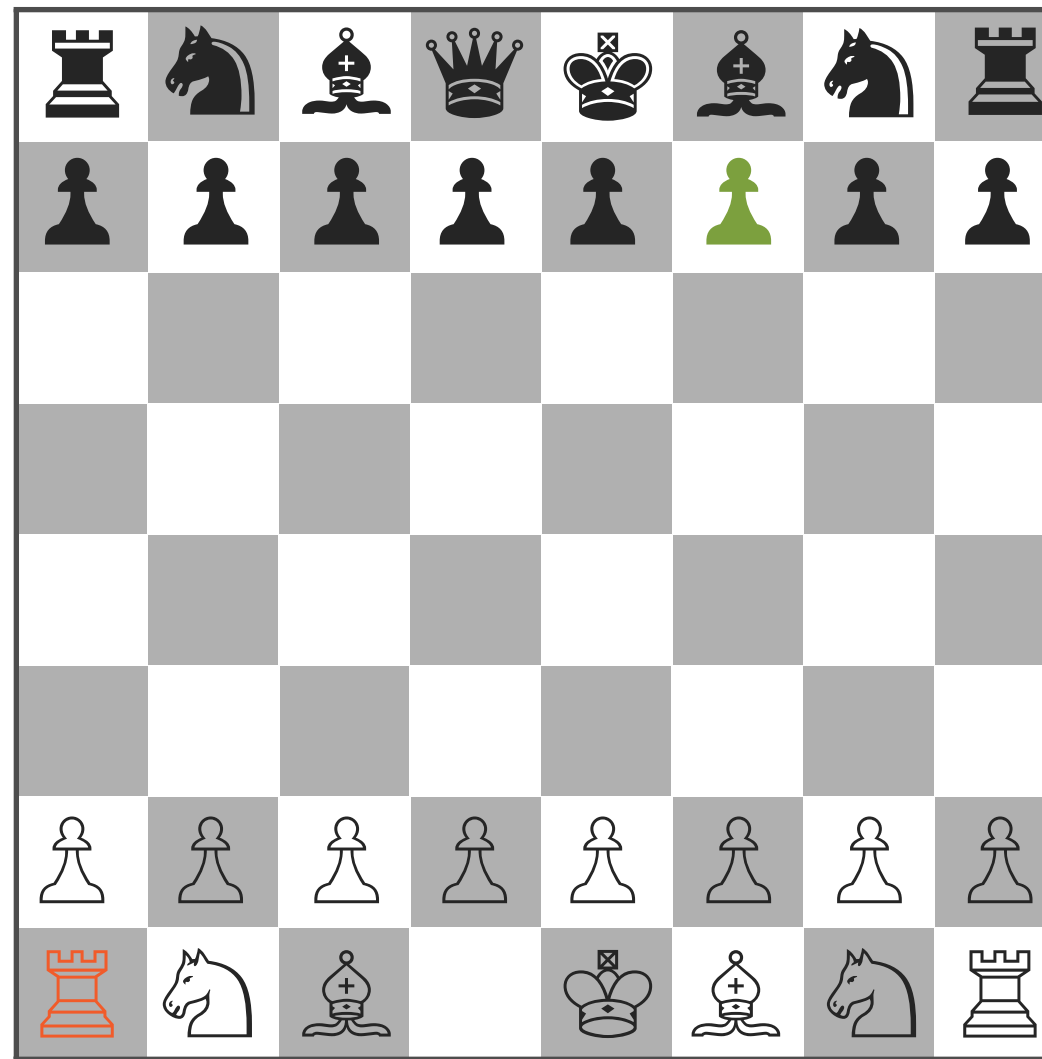


a b c

# Chess Piece Encoding



```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```

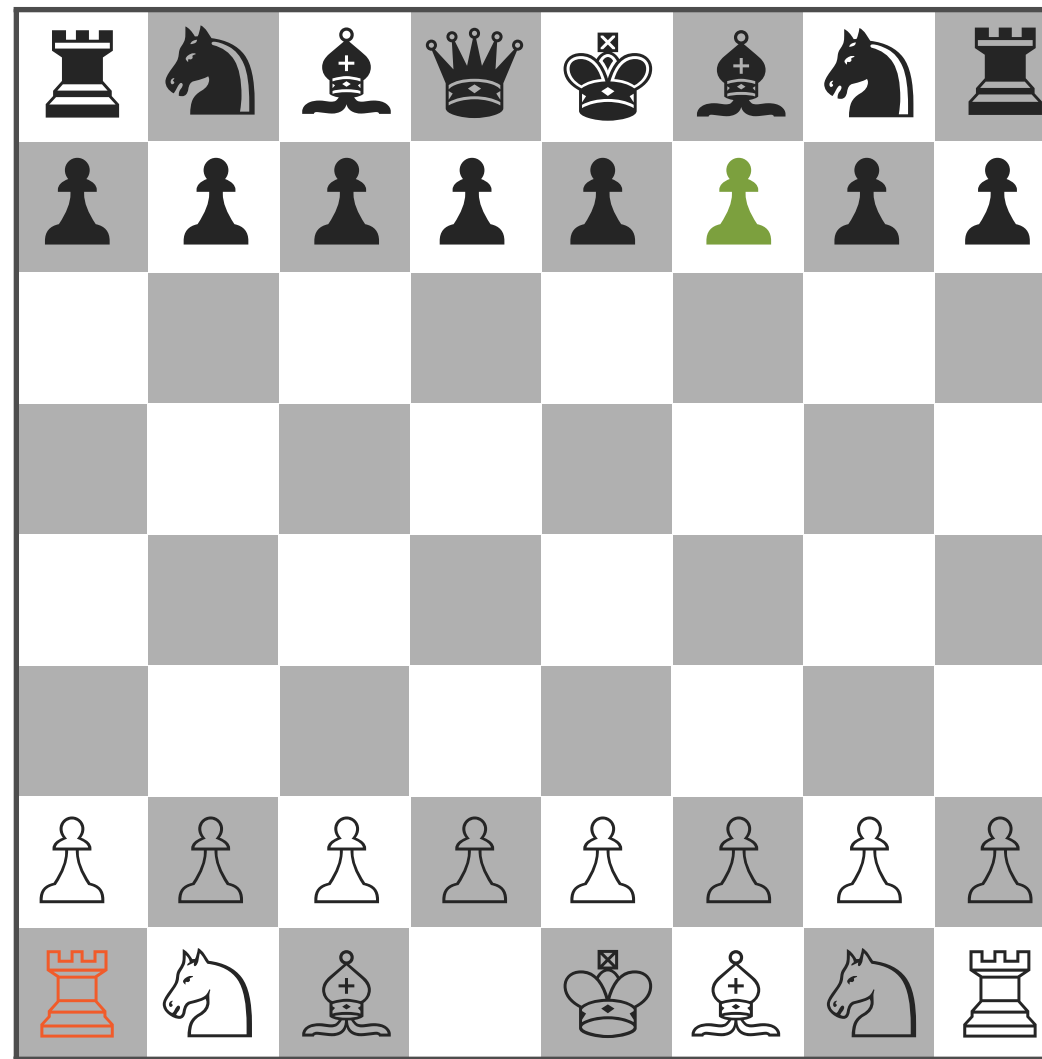


a b c d

# Chess Piece Encoding



```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```

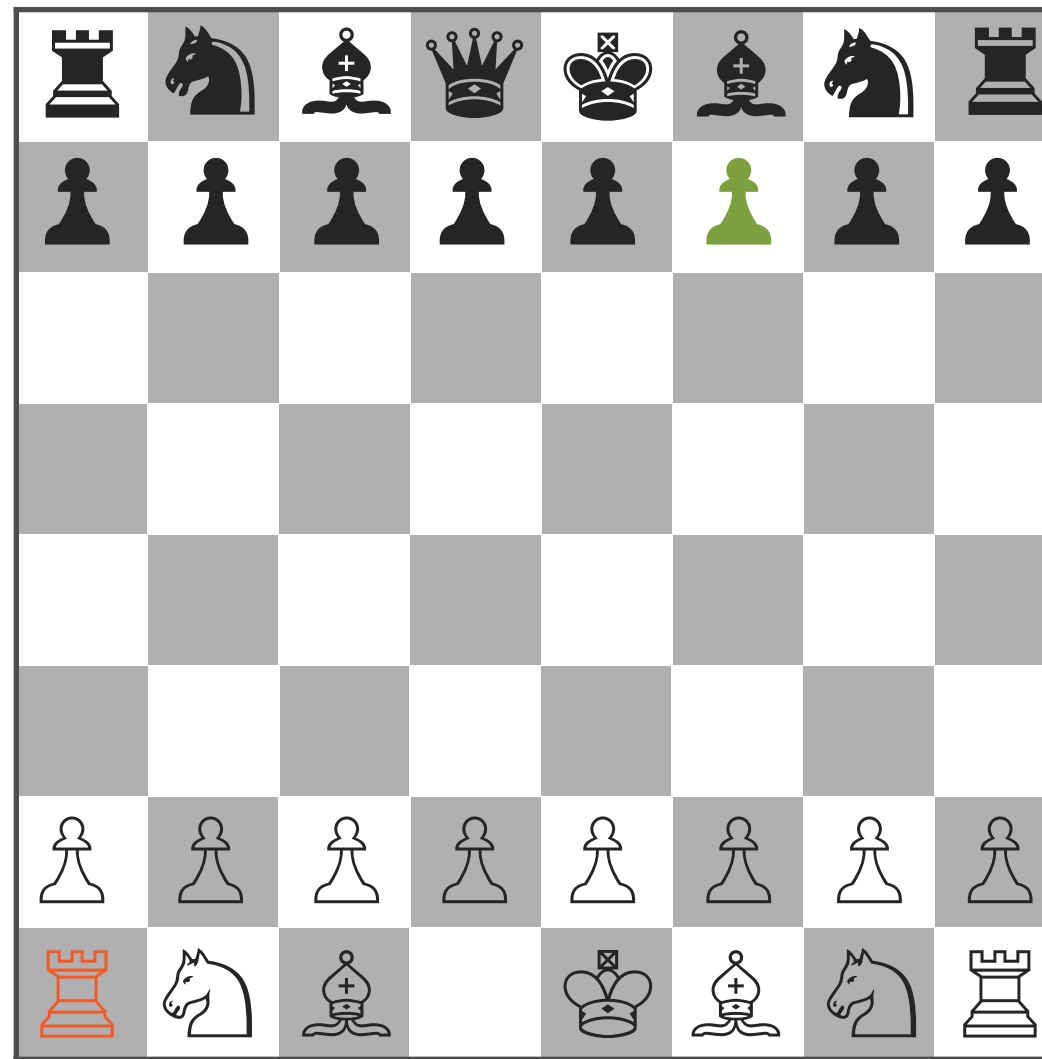


a b c d e

# Chess Piece Encoding



```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```

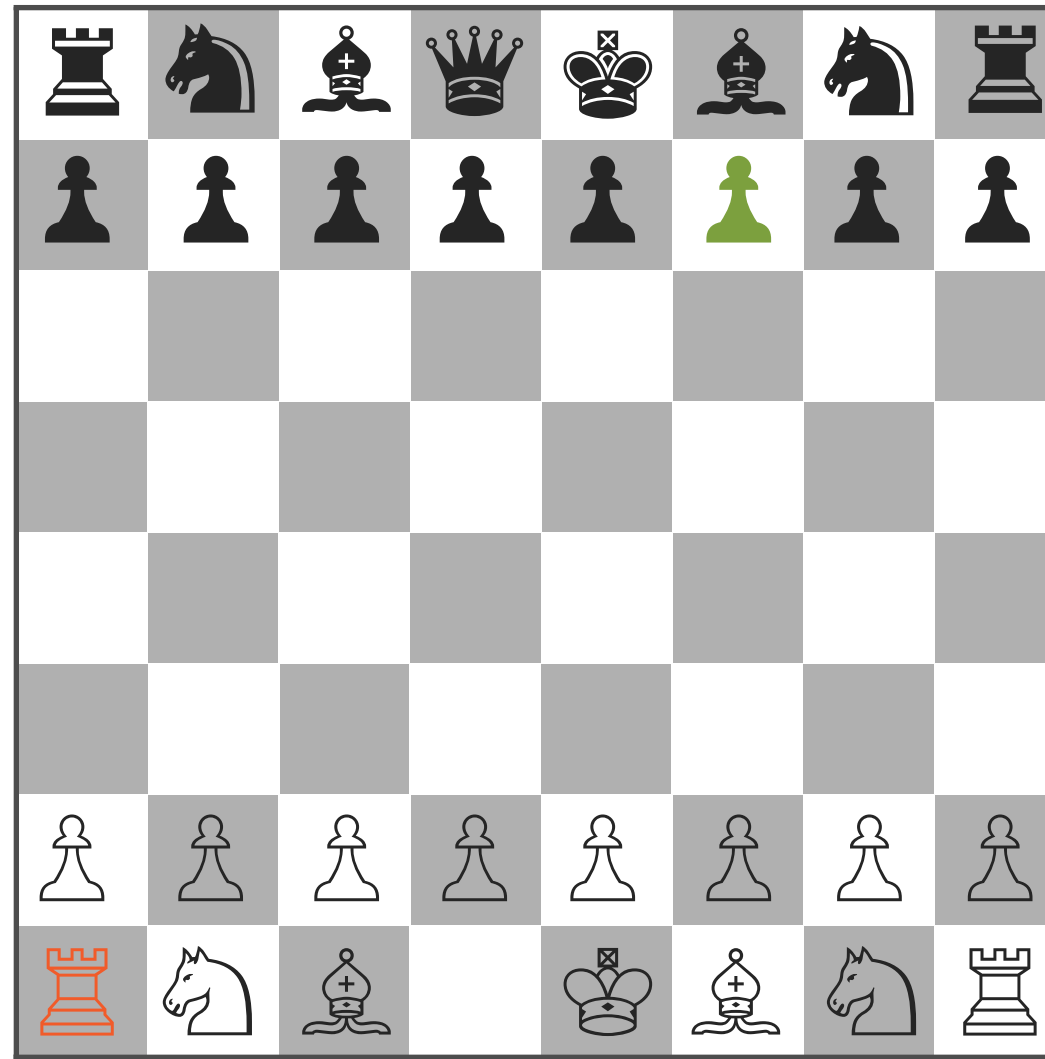


a b c d e f

# Chess Piece Encoding



```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



a b c d e f g

# Chess Piece Encoding



```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```

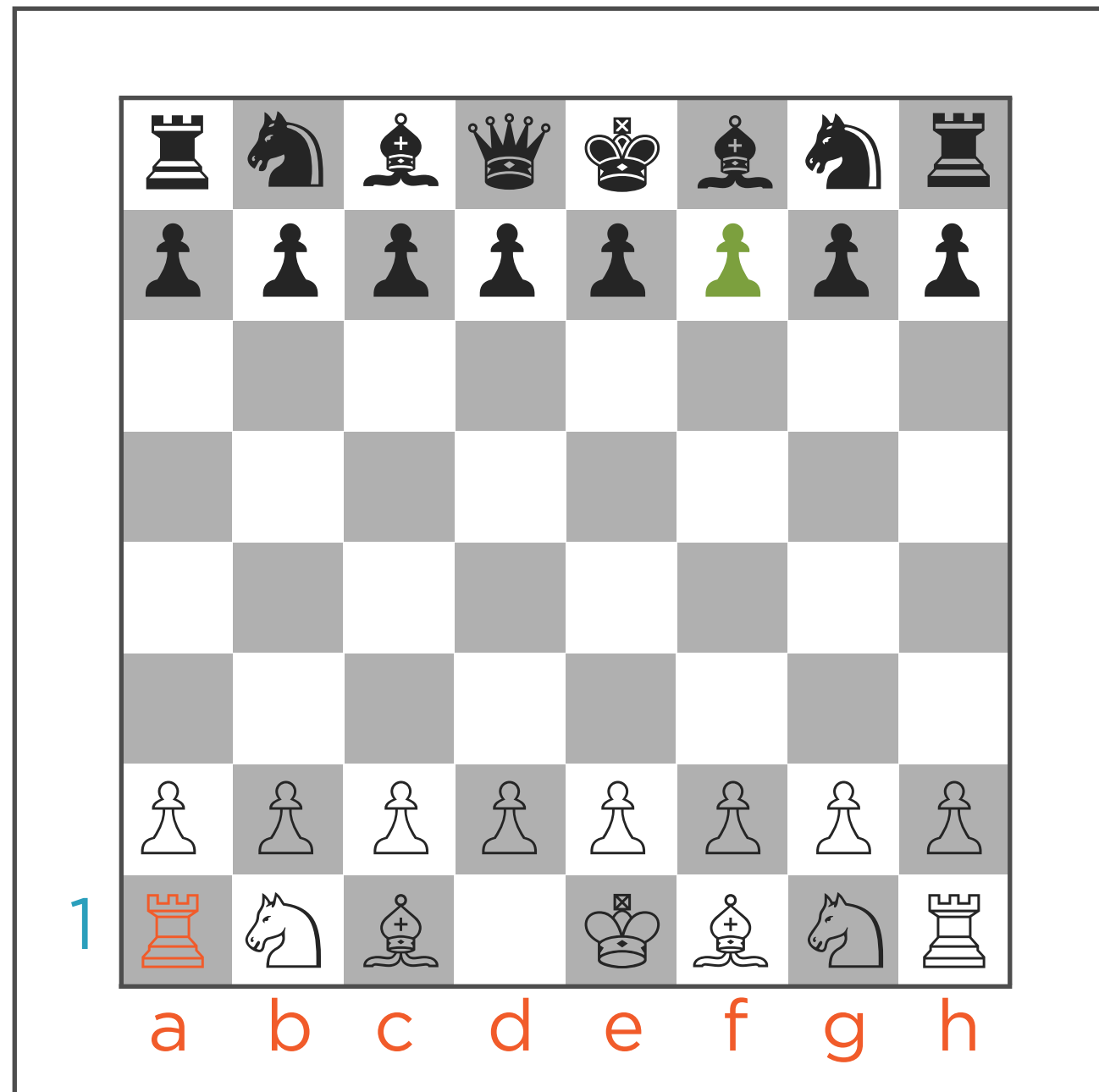


a b c d e f g h

# Chess Piece Encoding



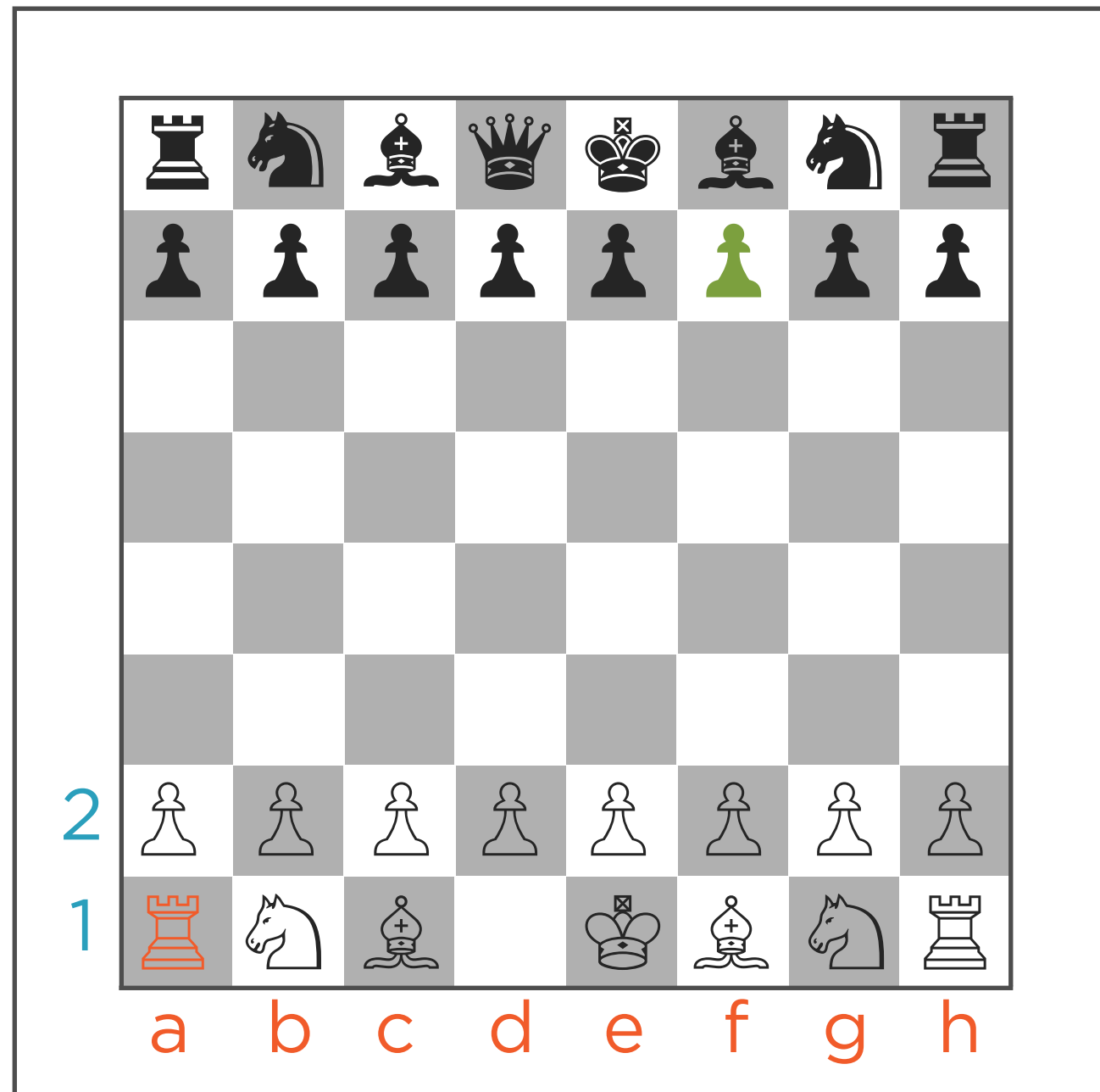
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding



```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```

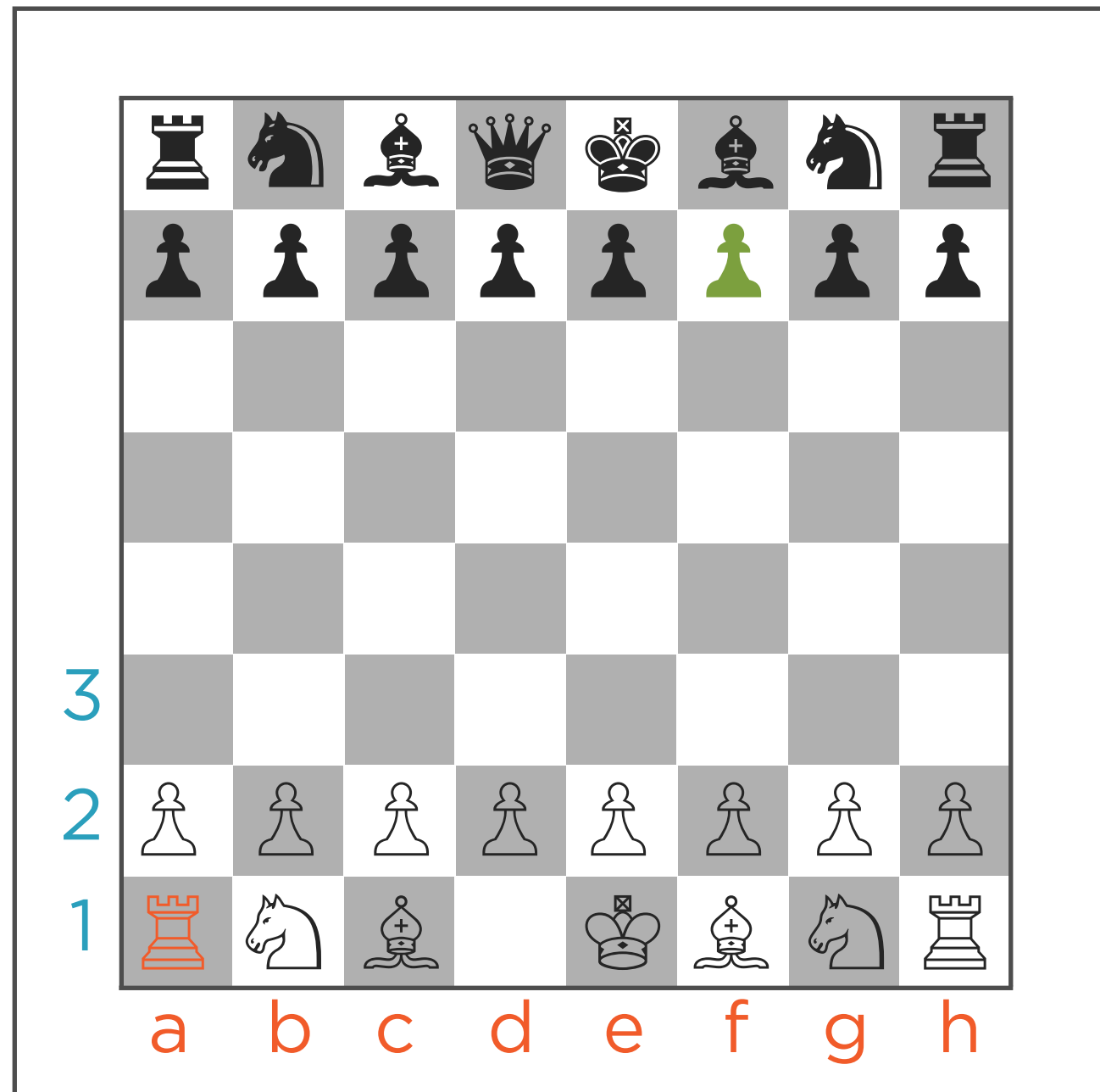
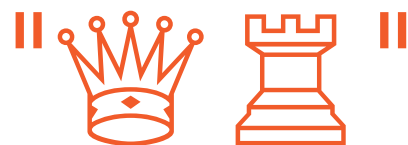




# Chess Piece Encoding



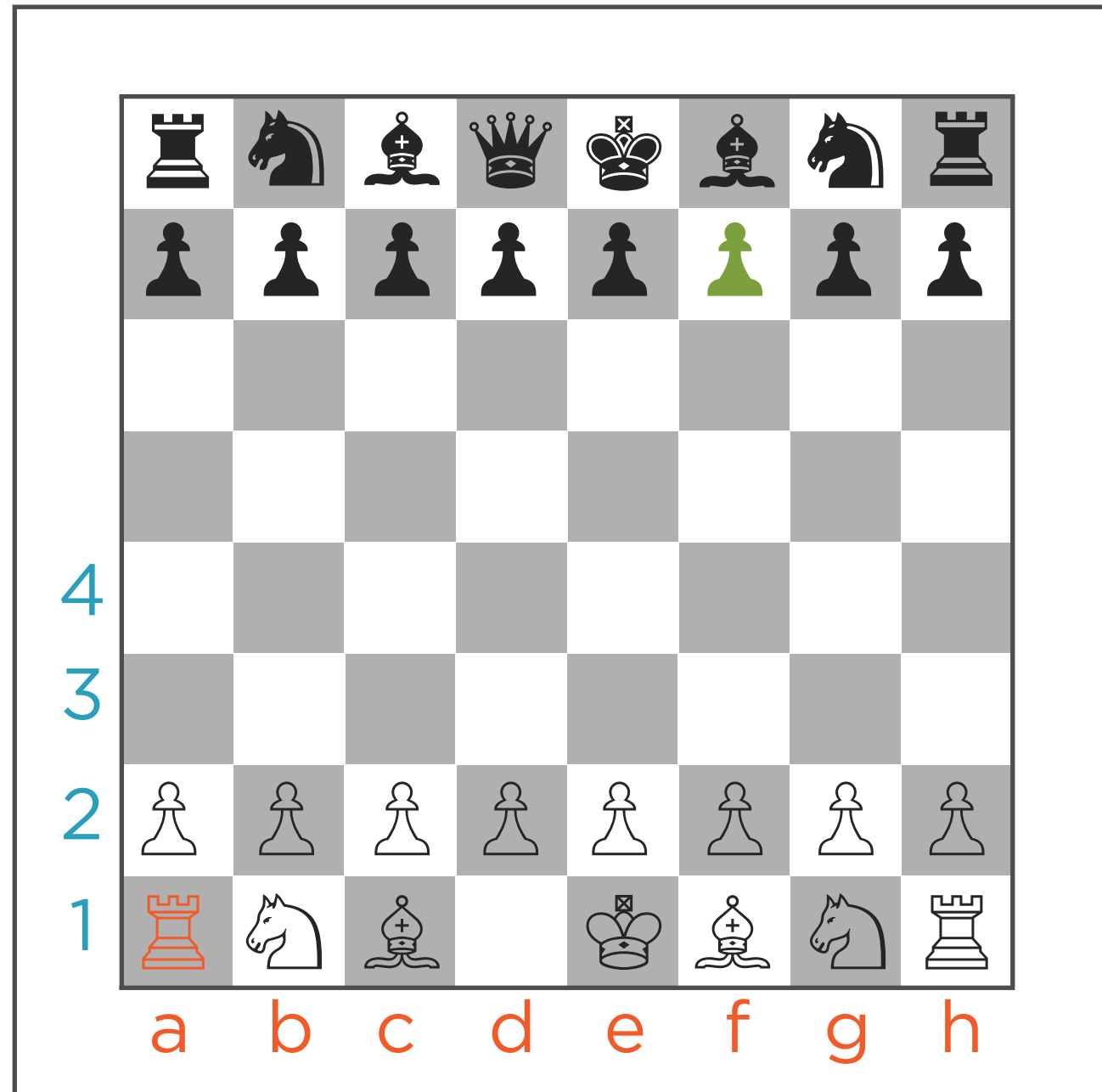
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding



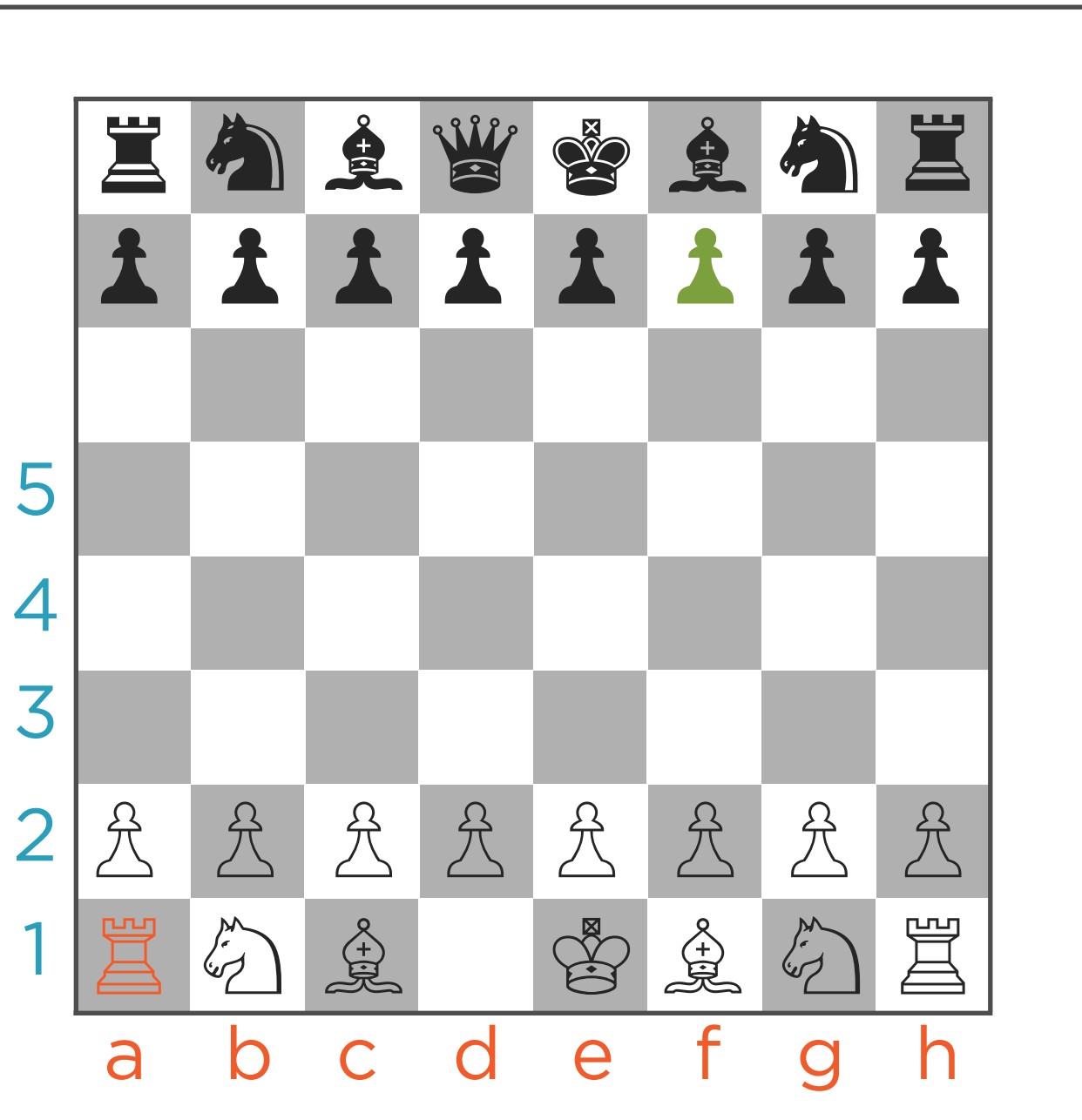
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding



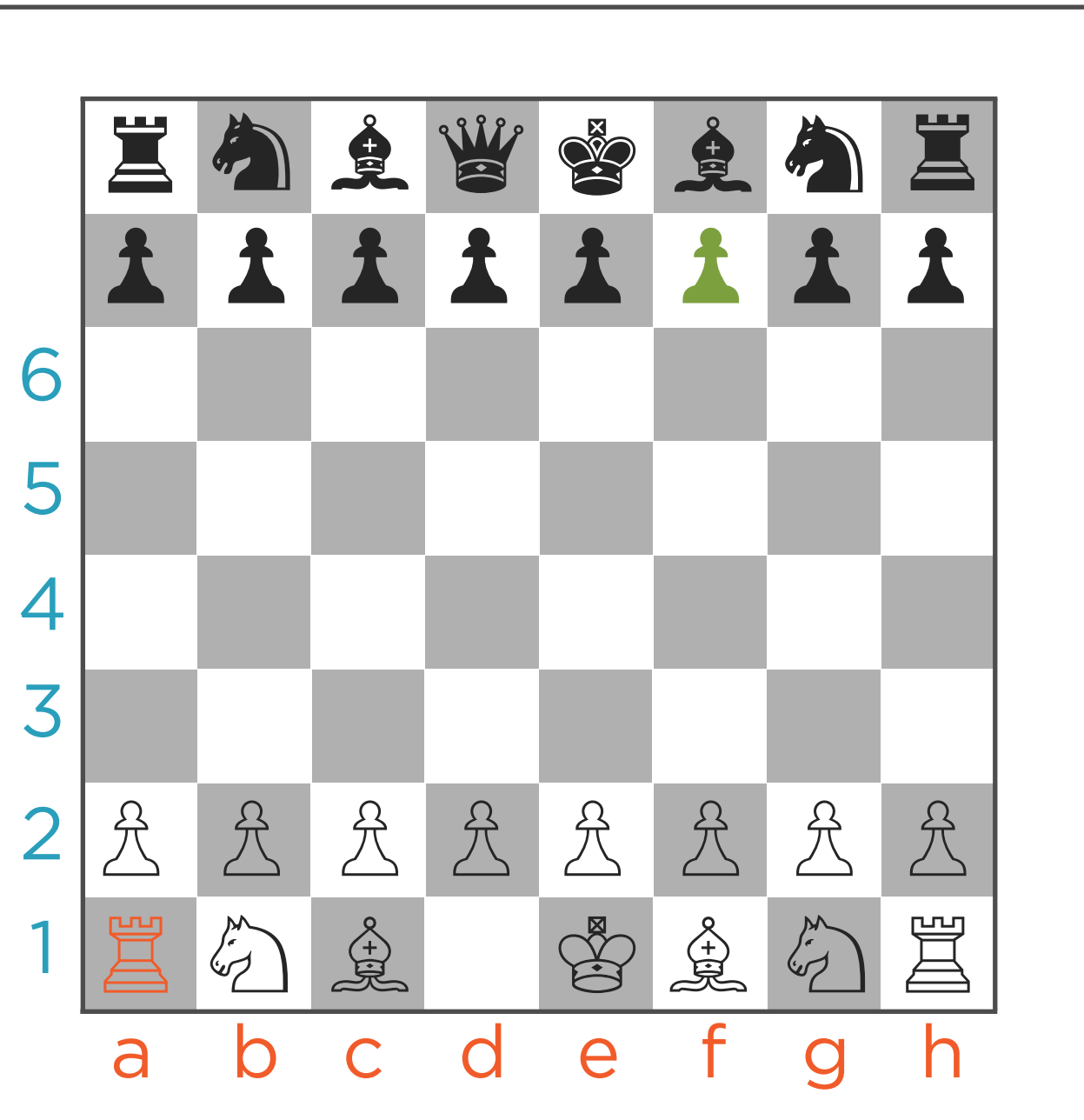
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding



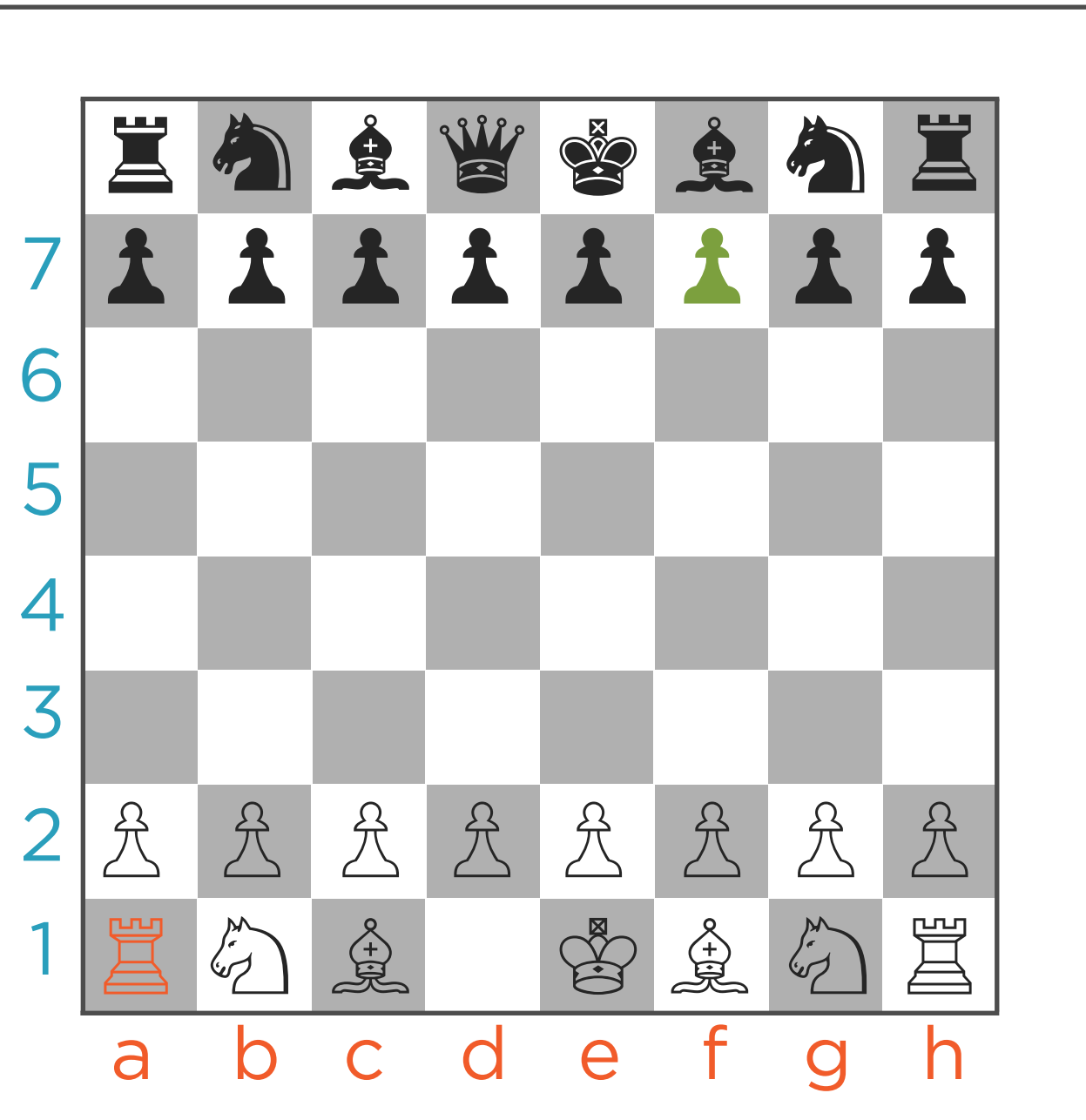
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding



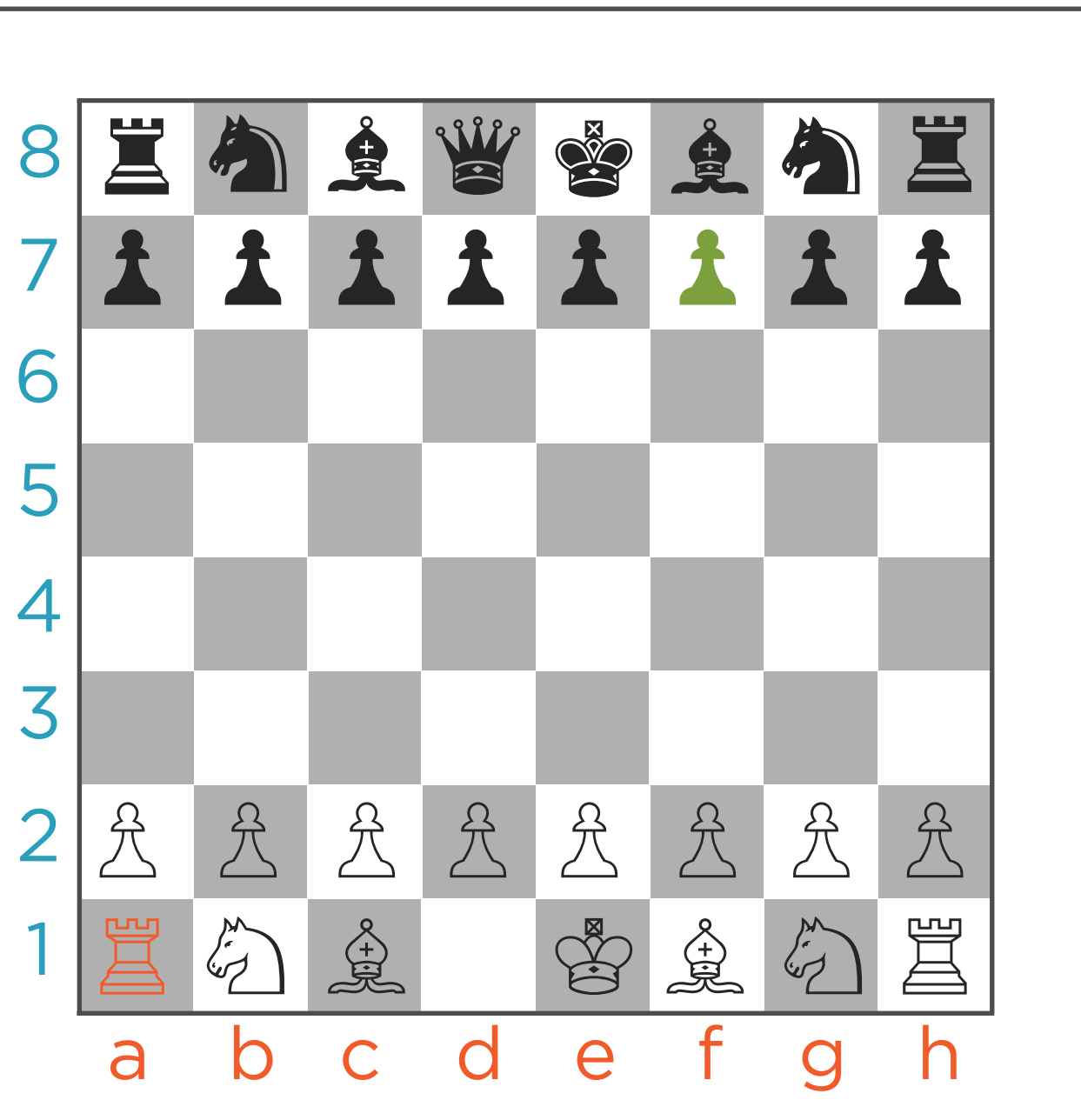
```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



# Chess Piece Encoding



```
{ '♔♖': ChessCoordinate('a', 1),  
  '♔♞': ChessCoordinate('b', 1),  
  '♔♝': ChessCoordinate('c', 1),  
  '♔♔': ChessCoordinate('d', 1),  
  '♔♔': ChessCoordinate('e', 1),  
  ...  
  '♚♞♟': ChessCoordinate('f', 7),  
  '♚♞♟': ChessCoordinate('g', 7),  
  '♚♖♟': ChessCoordinate('h', 7),  
}
```



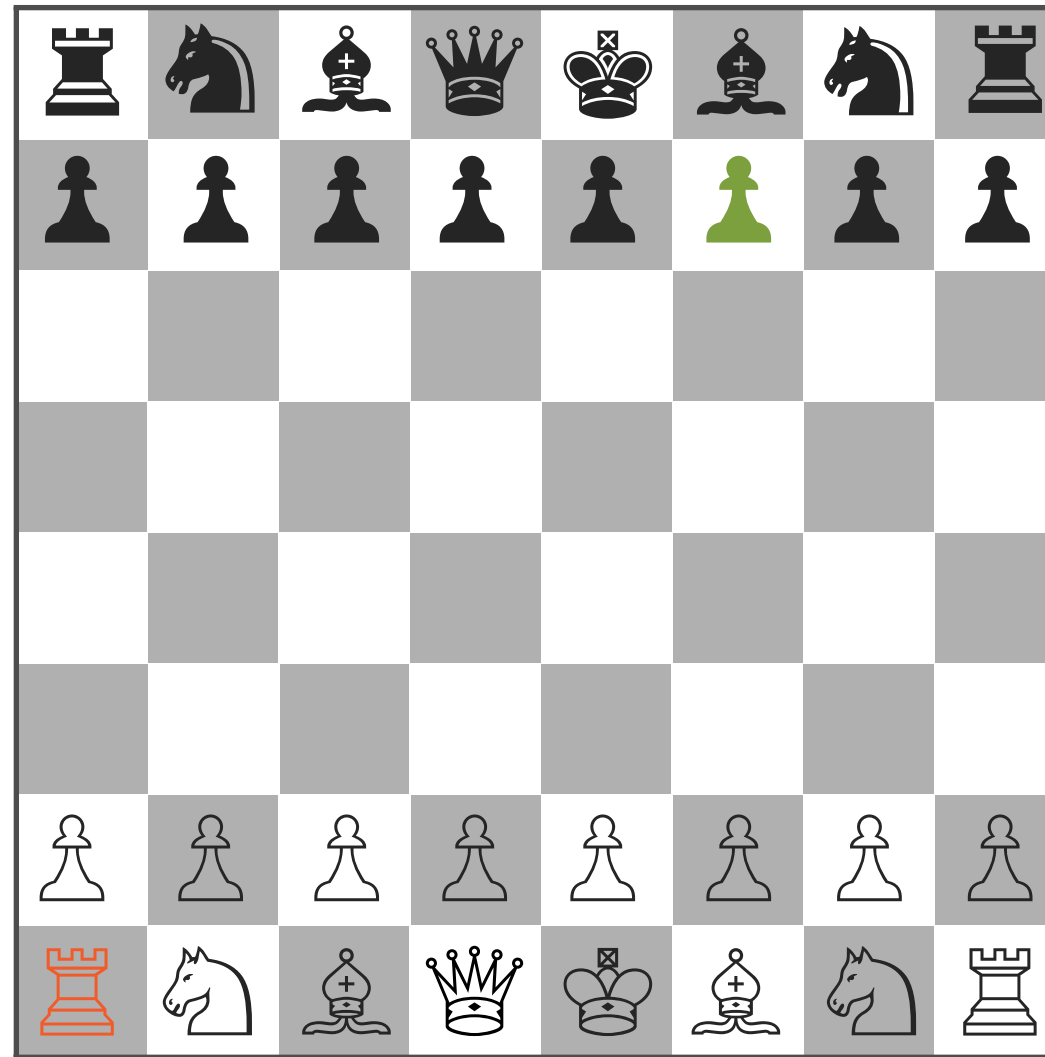
# Chess Piece Encoding



```
{ '♔♖' : ChessCoordinate('a', 1),  
  '♔♞' : ChessCoordinate('b', 1),  
  '♔♝' : ChessCoordinate('c', 1),  
  '♔♔' : ChessCoordinate('d', 1),  
  '♔♔' : ChessCoordinate('e', 1),  
  ...  
  '♚♞♟' : ChessCoordinate('f', 7),  
  '♚♞♟' : ChessCoordinate('g', 7),  
  '♚♖♟' : ChessCoordinate('h', 7),  
}
```

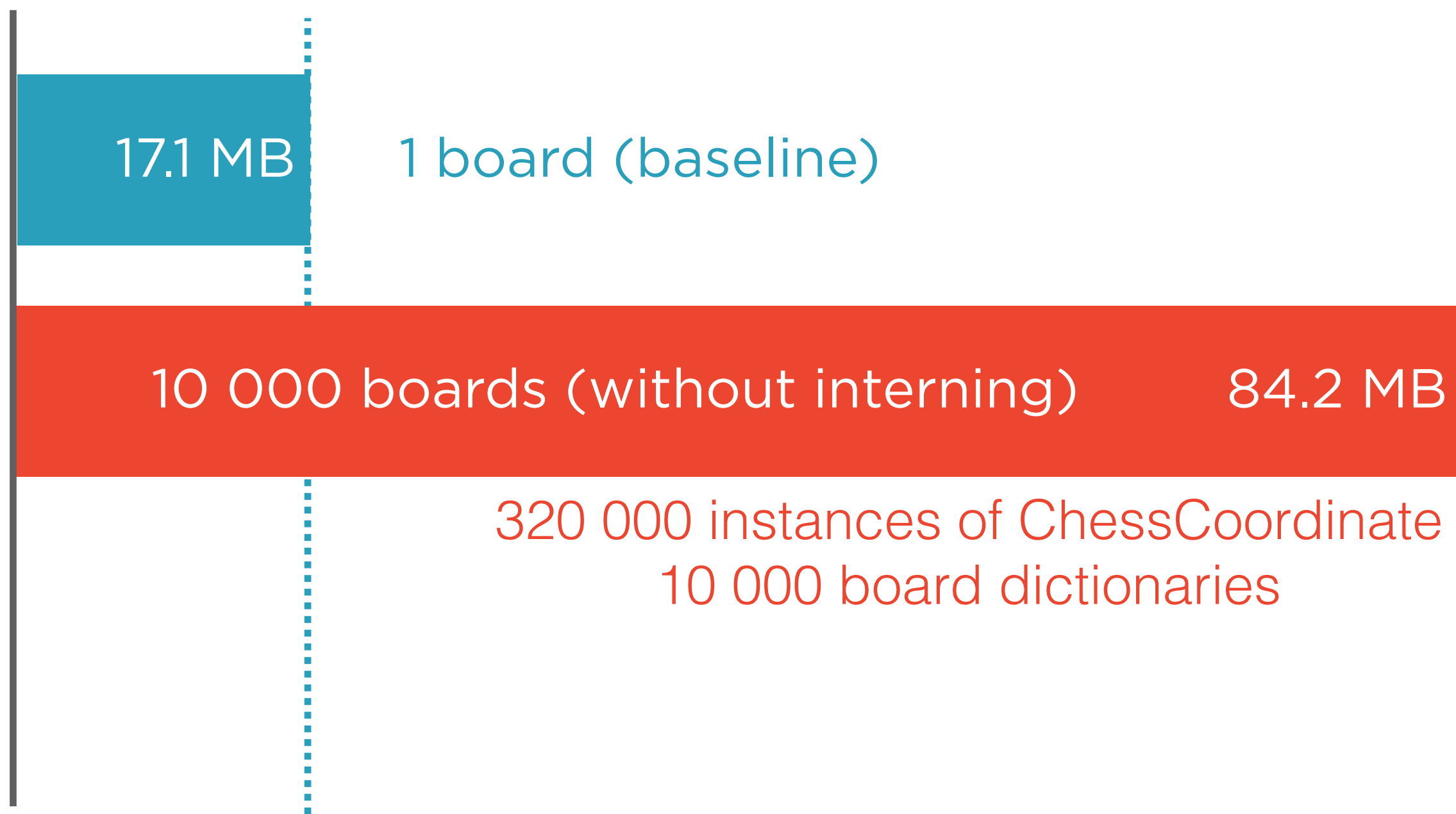


8  
7  
6  
5  
4  
3  
2  
1



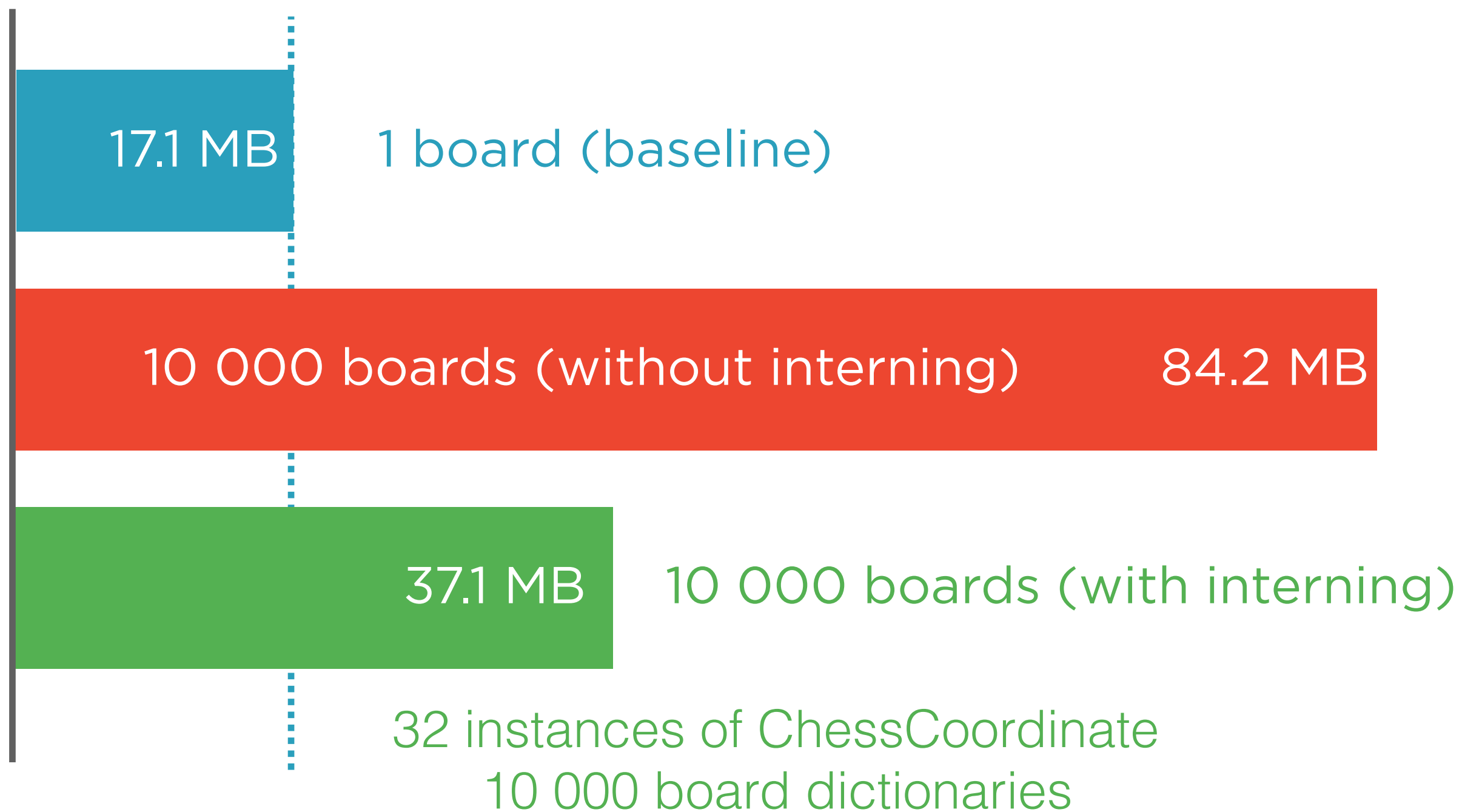
a b c d e f g h

# Chess Board Memory Usage

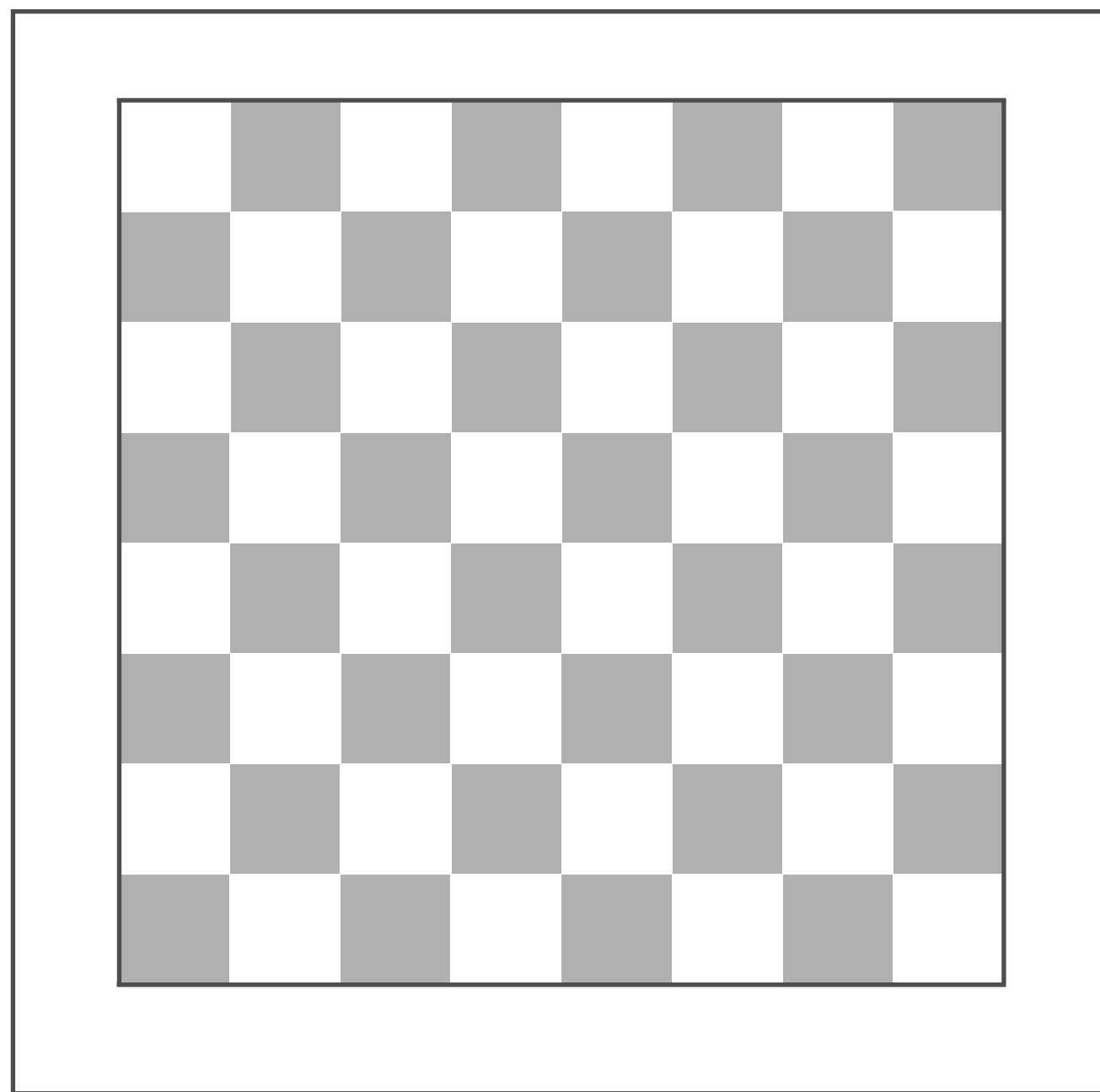




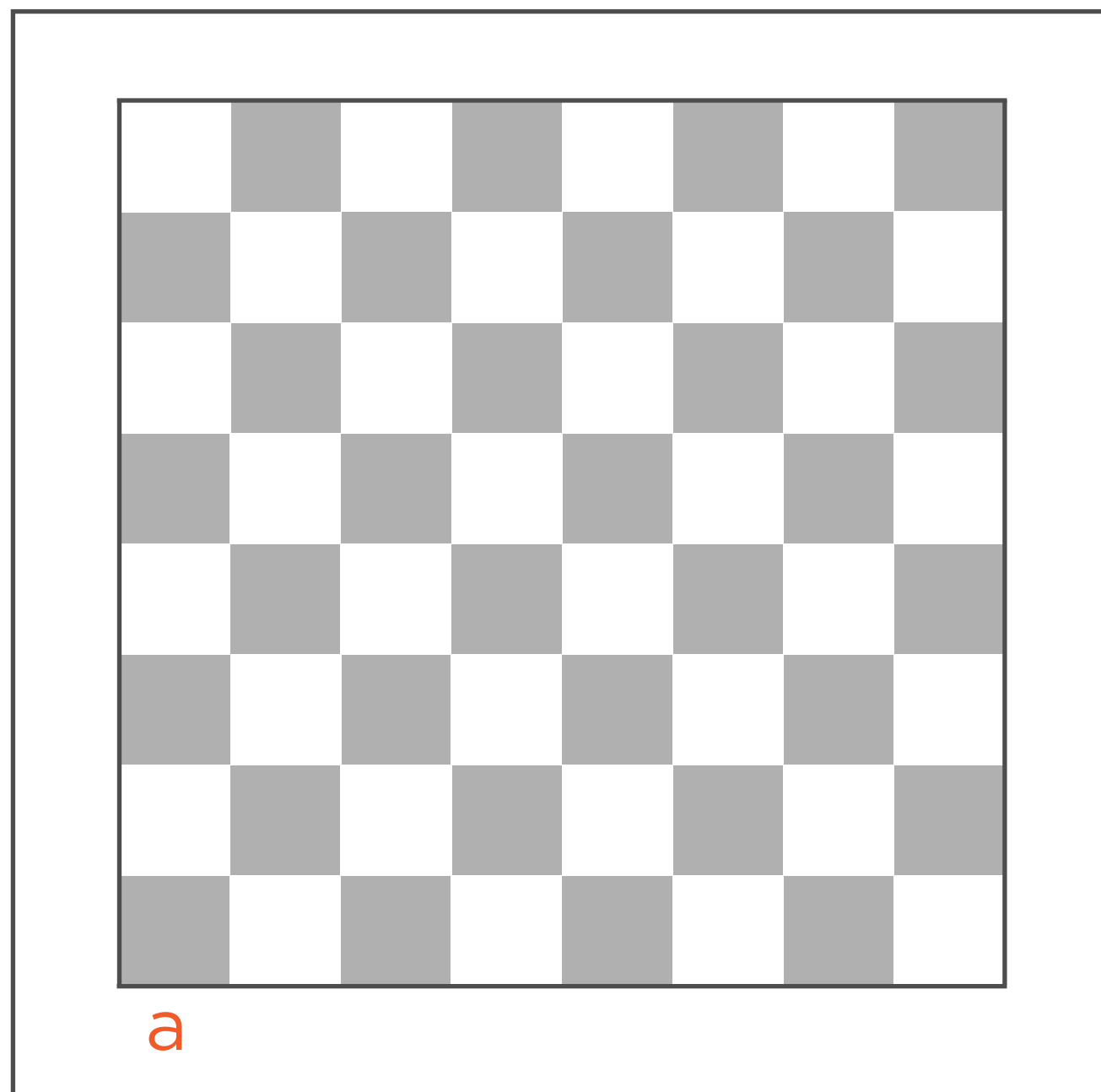
# Chess Board Memory Usage



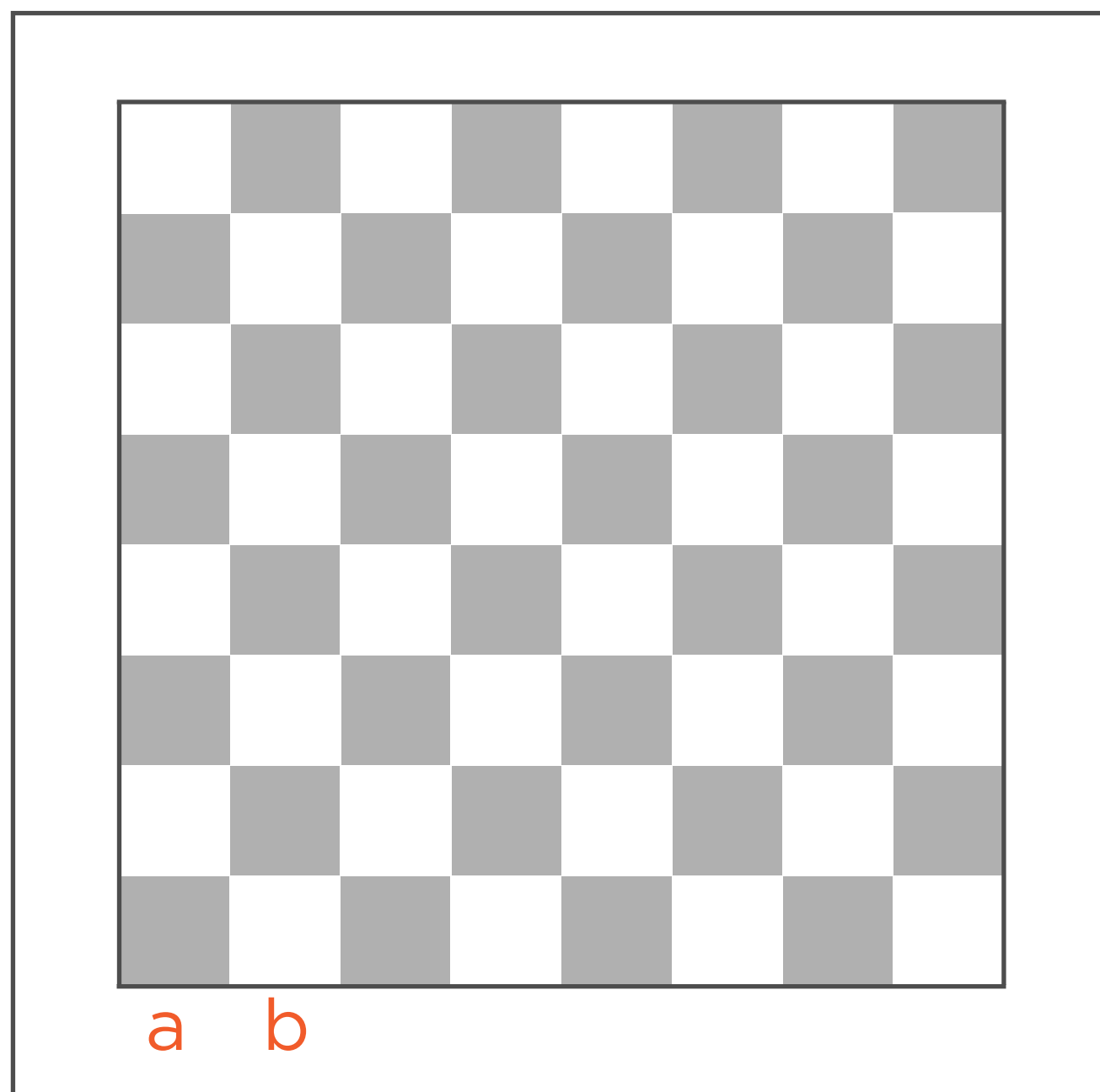
# Sixty-Four Positions, Thirty-Two Pieces



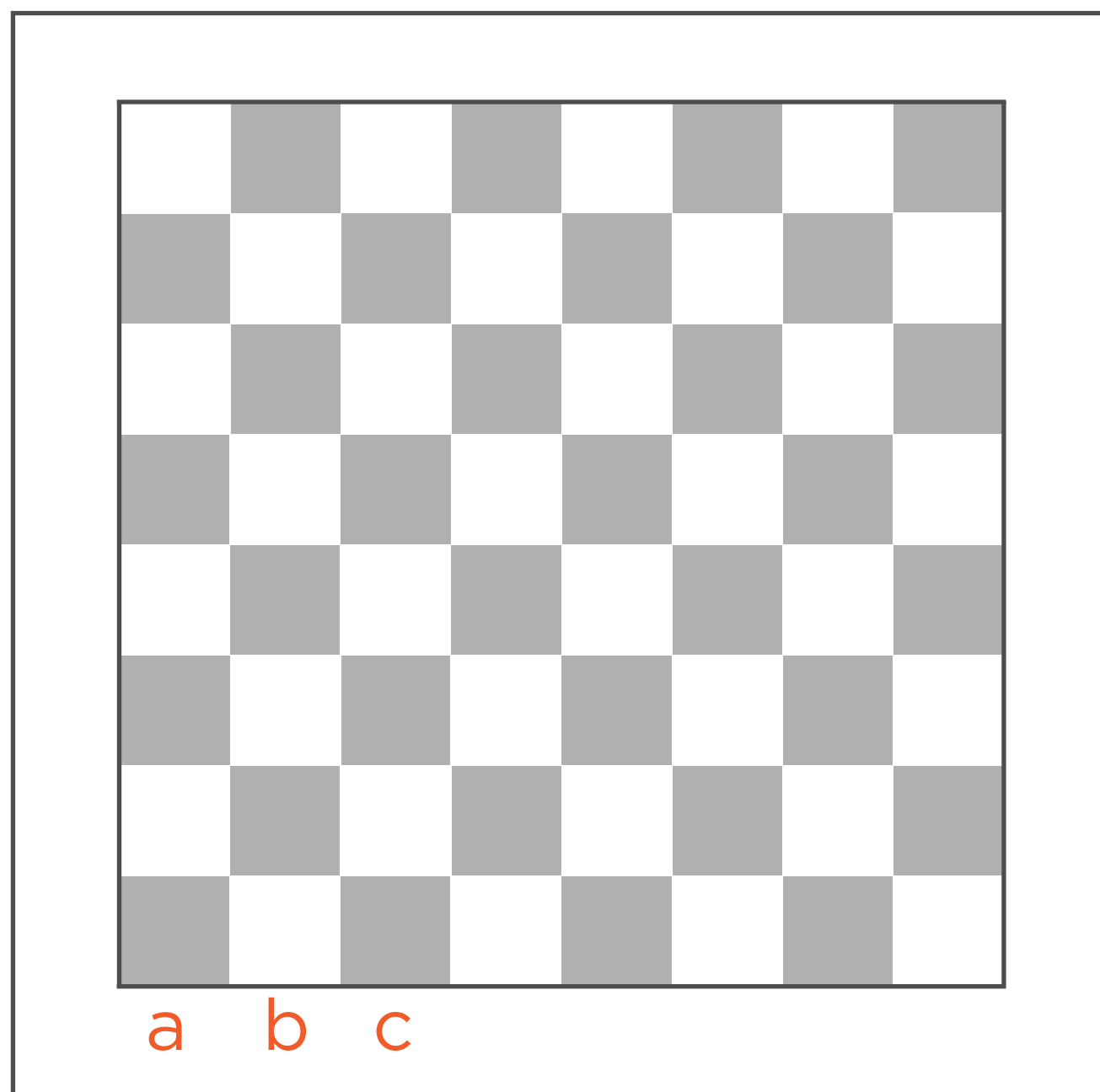
# Sixty-Four Positions, Thirty-Two Pieces



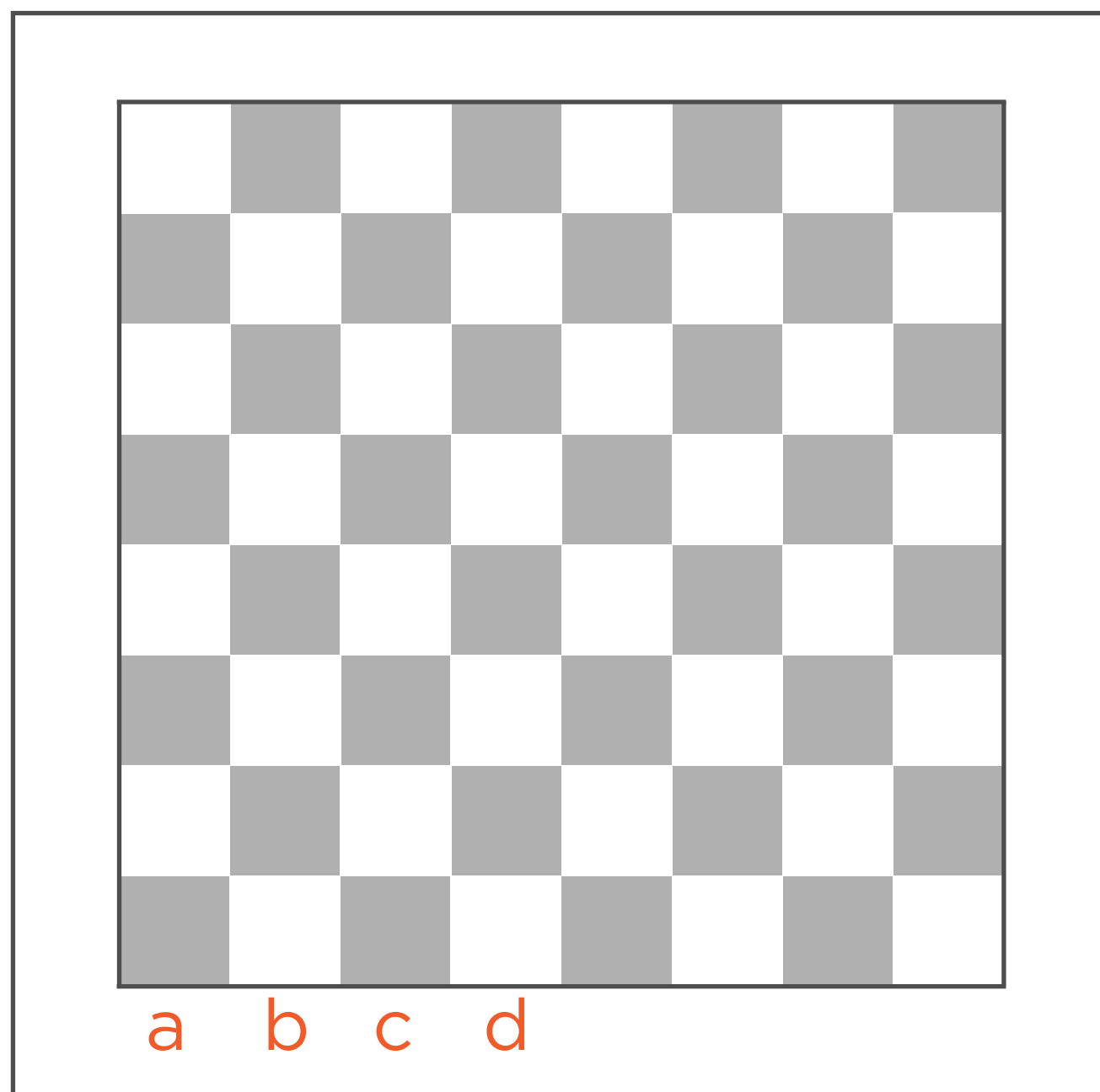
# Sixty-Four Positions, Thirty-Two Pieces



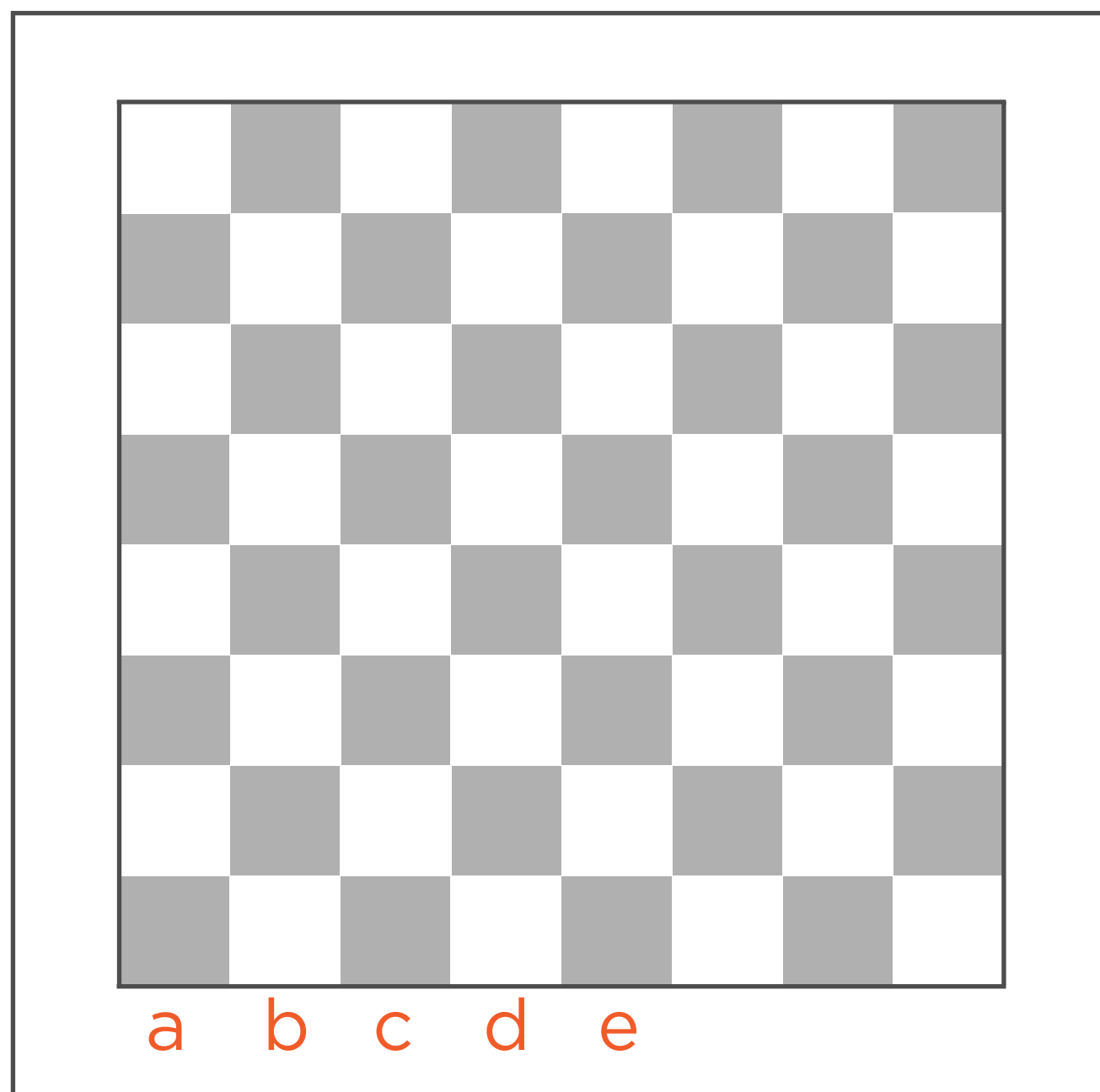
# Sixty-Four Positions, Thirty-Two Pieces



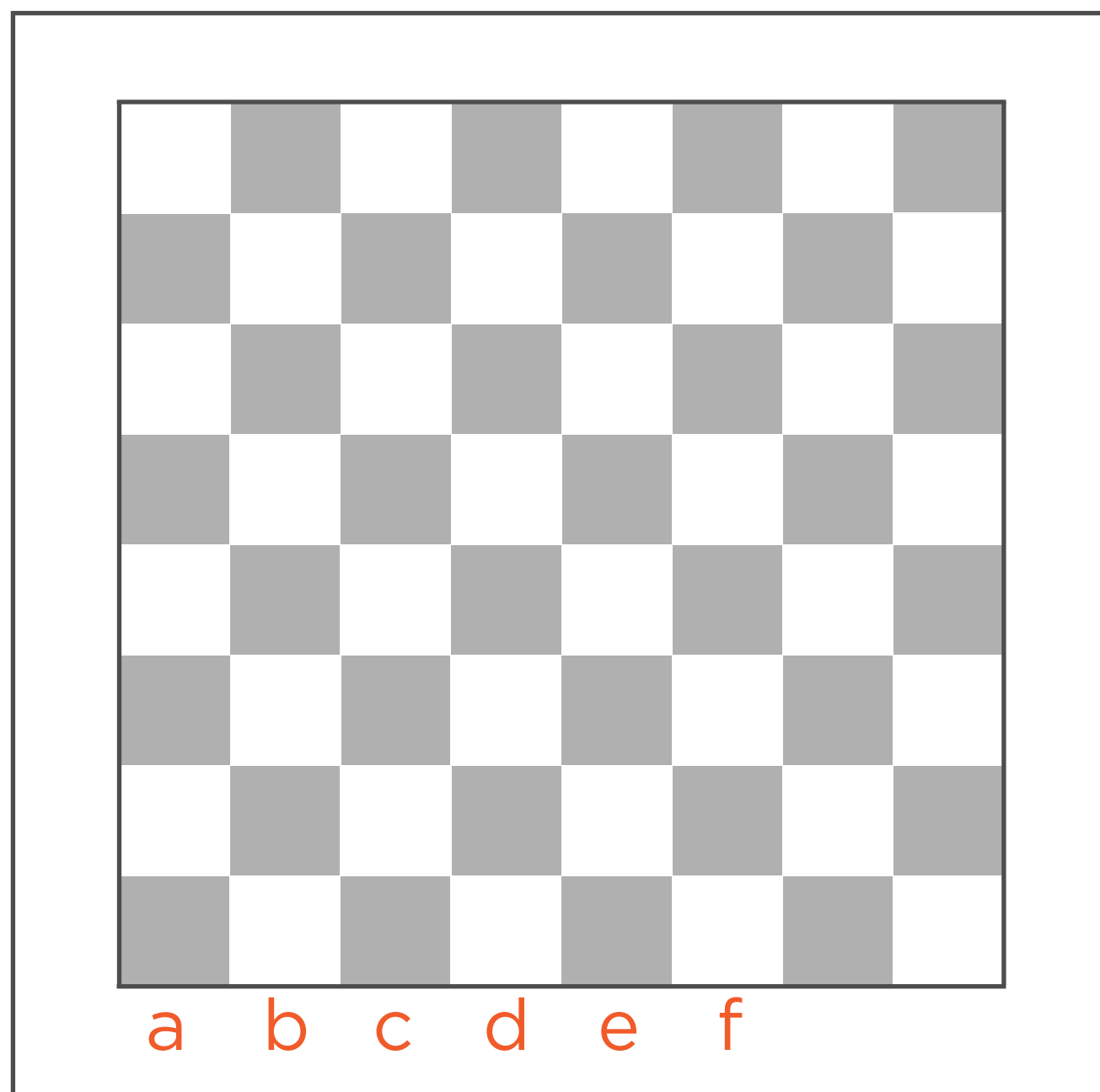
# Sixty-Four Positions, Thirty-Two Pieces



# Sixty-Four Positions, Thirty-Two Pieces

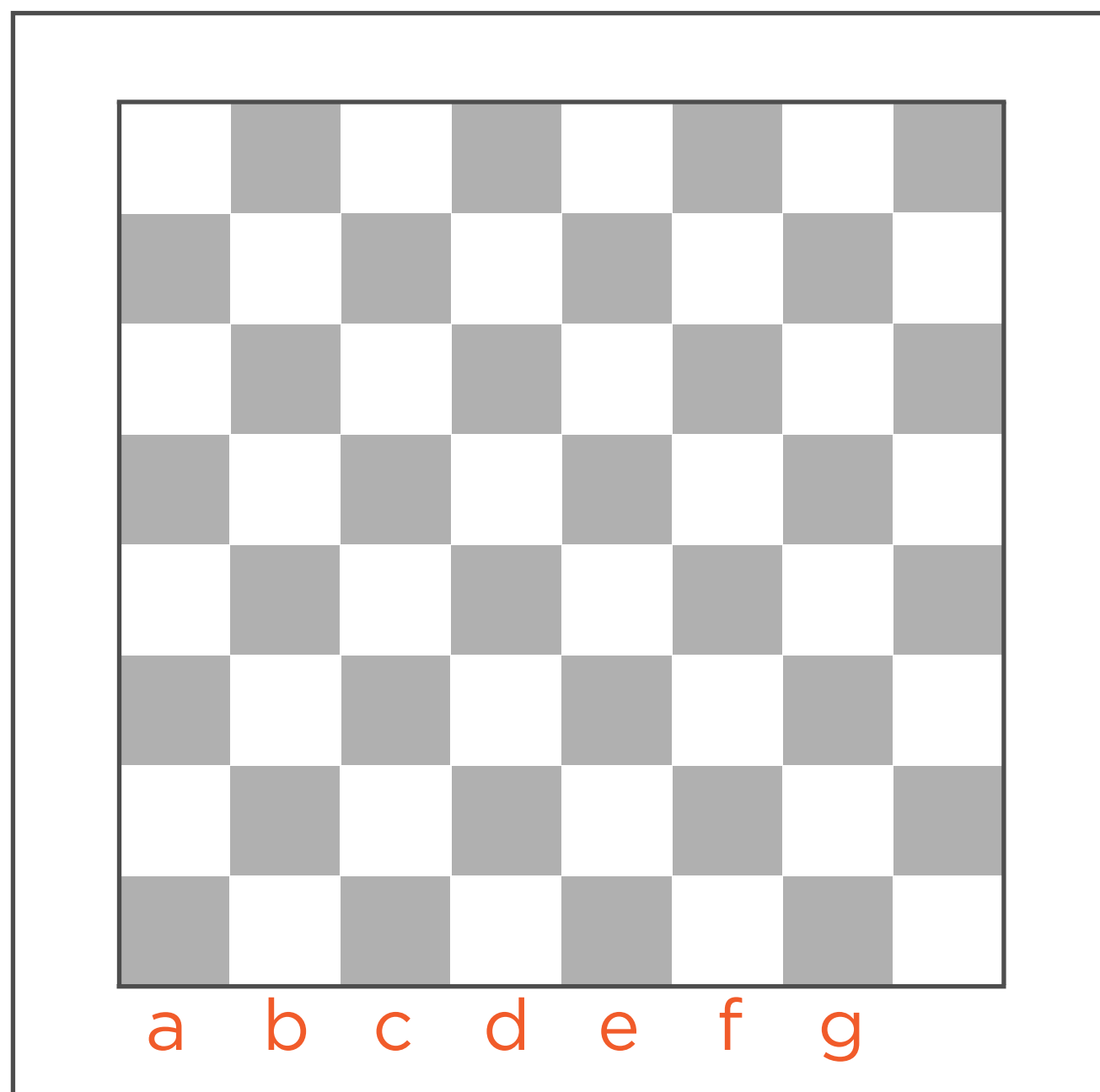


# Sixty-Four Positions, Thirty-Two Pieces

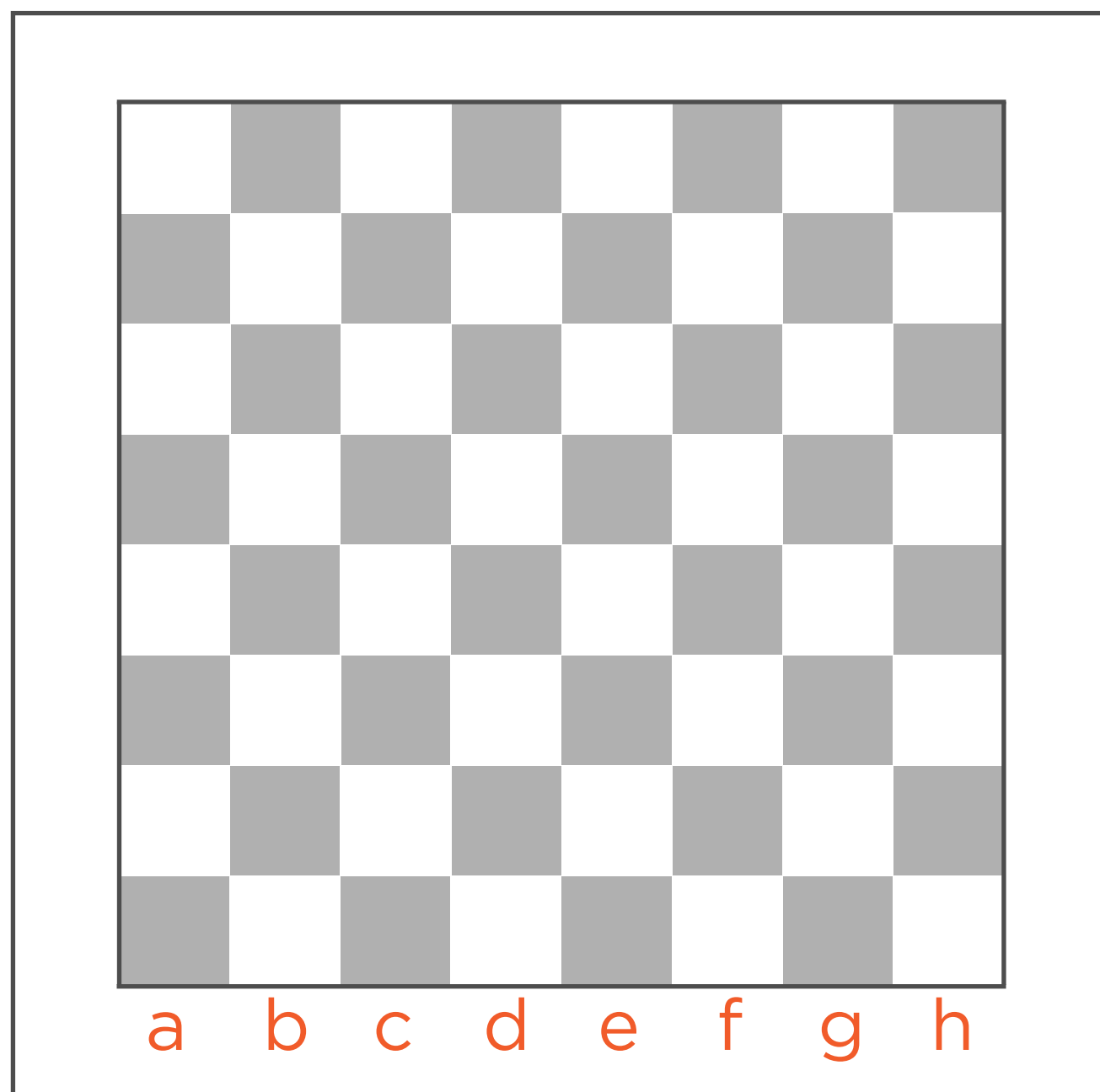




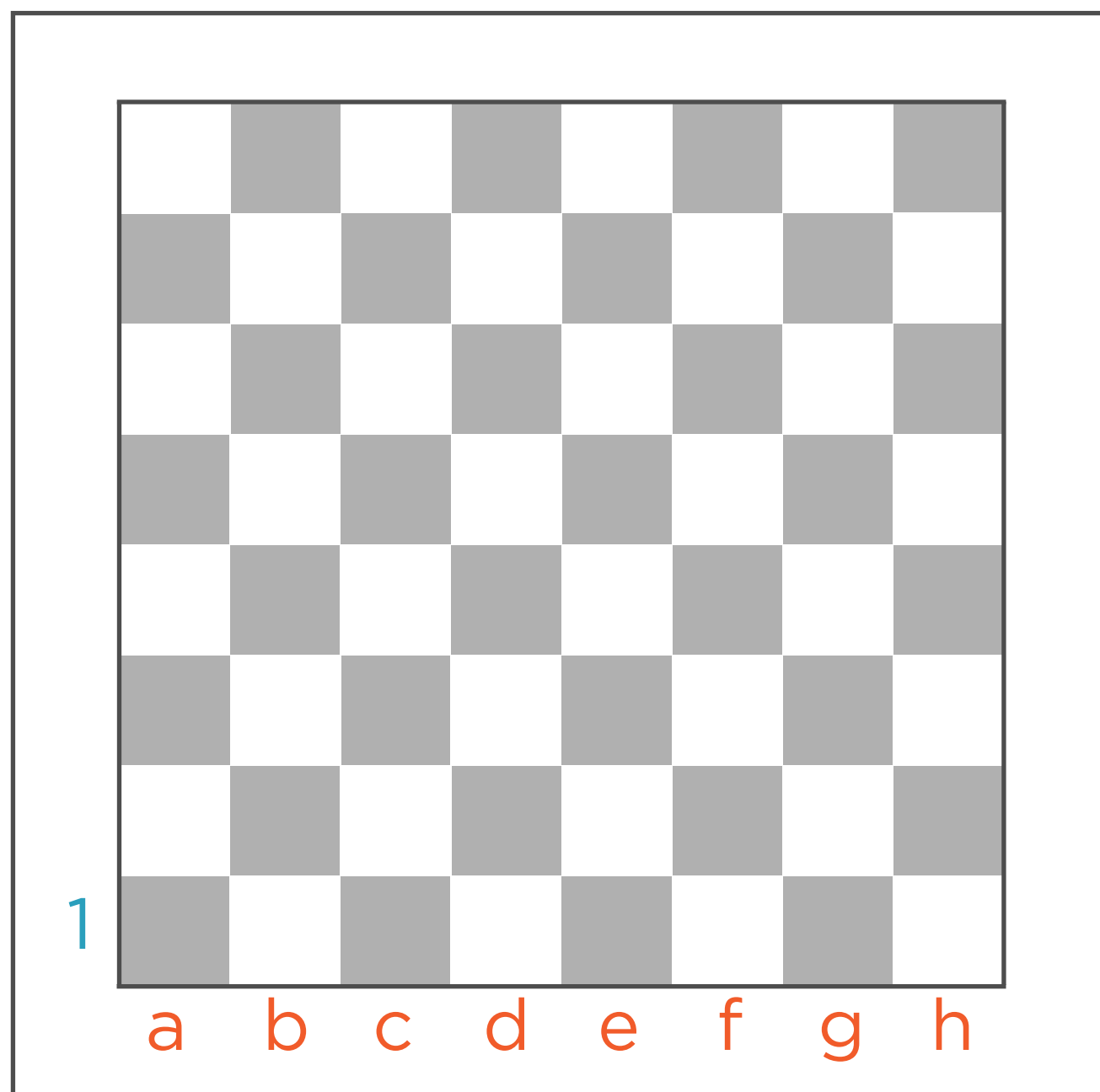
# Sixty-Four Positions, Thirty-Two Pieces



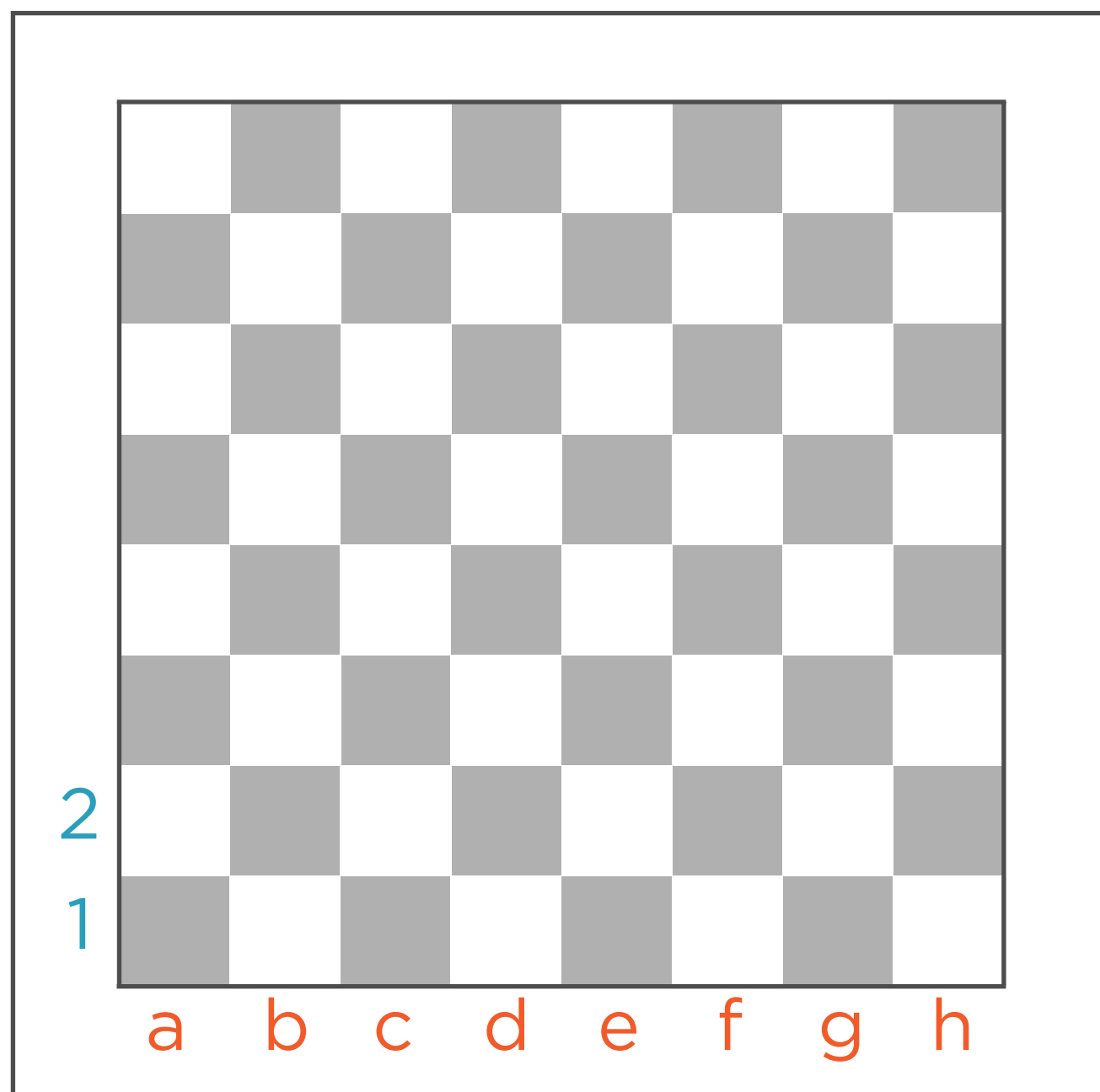
# Sixty-Four Positions, Thirty-Two Pieces



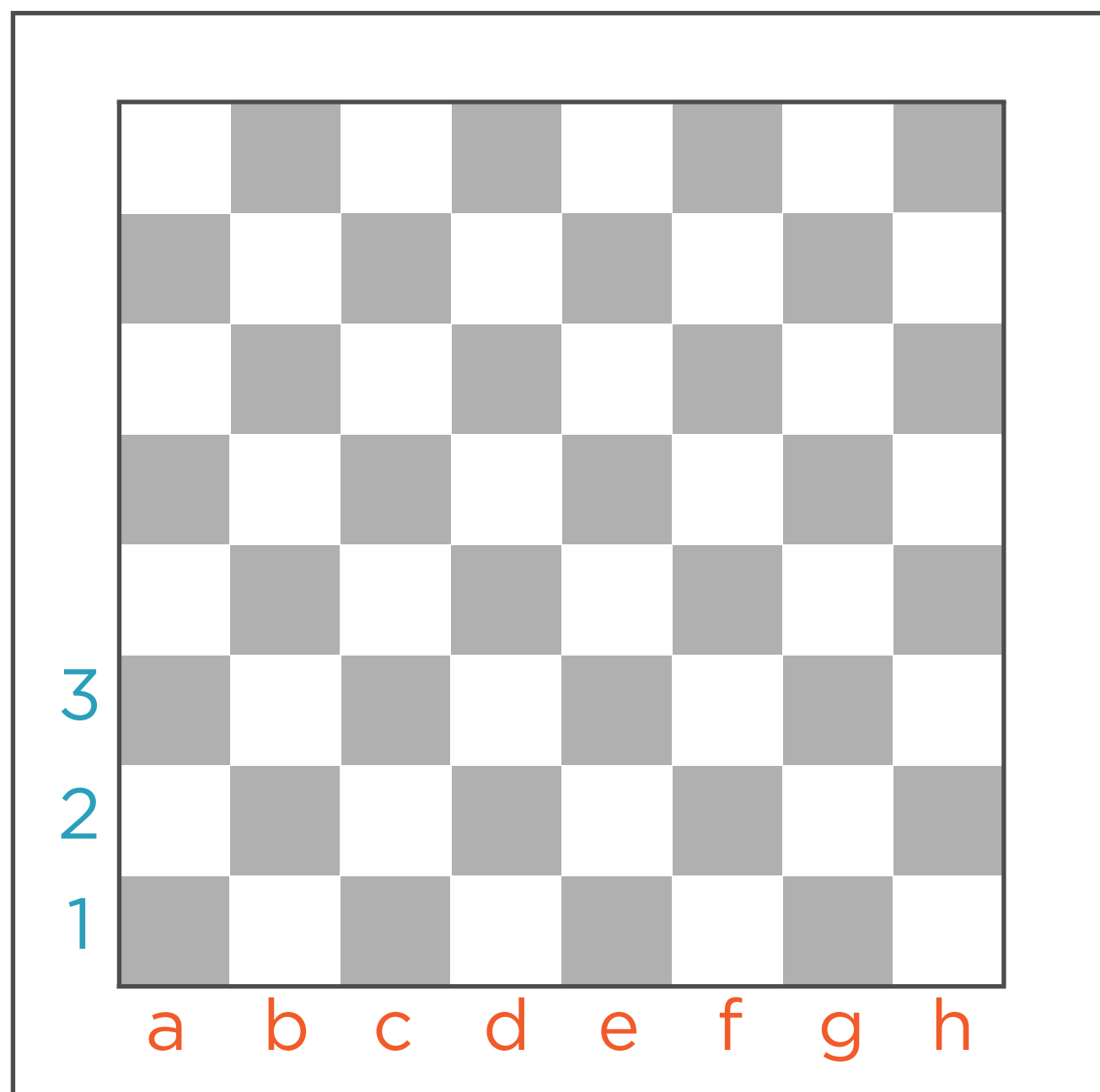
# Sixty-Four Positions, Thirty-Two Pieces



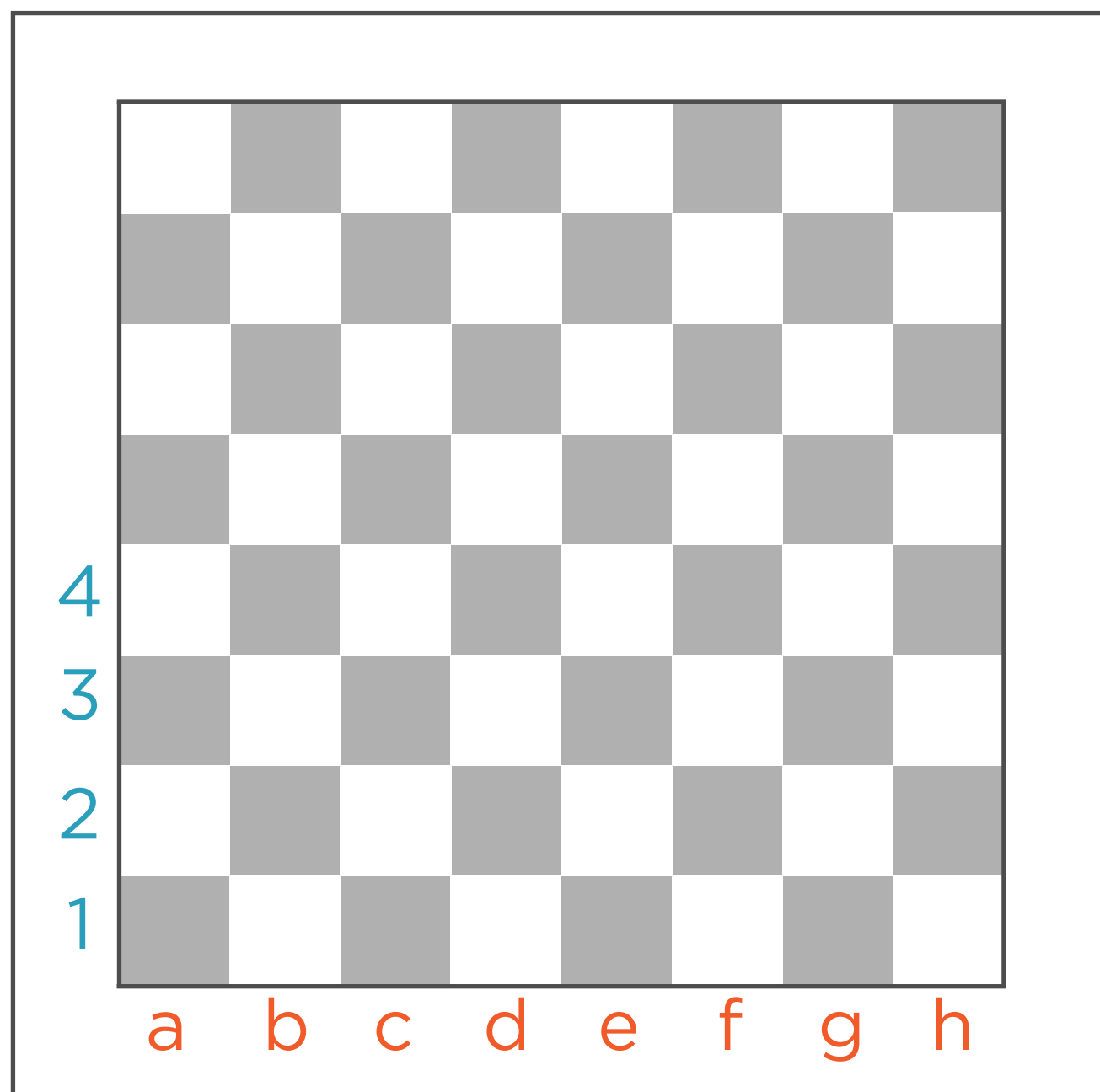
# Sixty-Four Positions, Thirty-Two Pieces



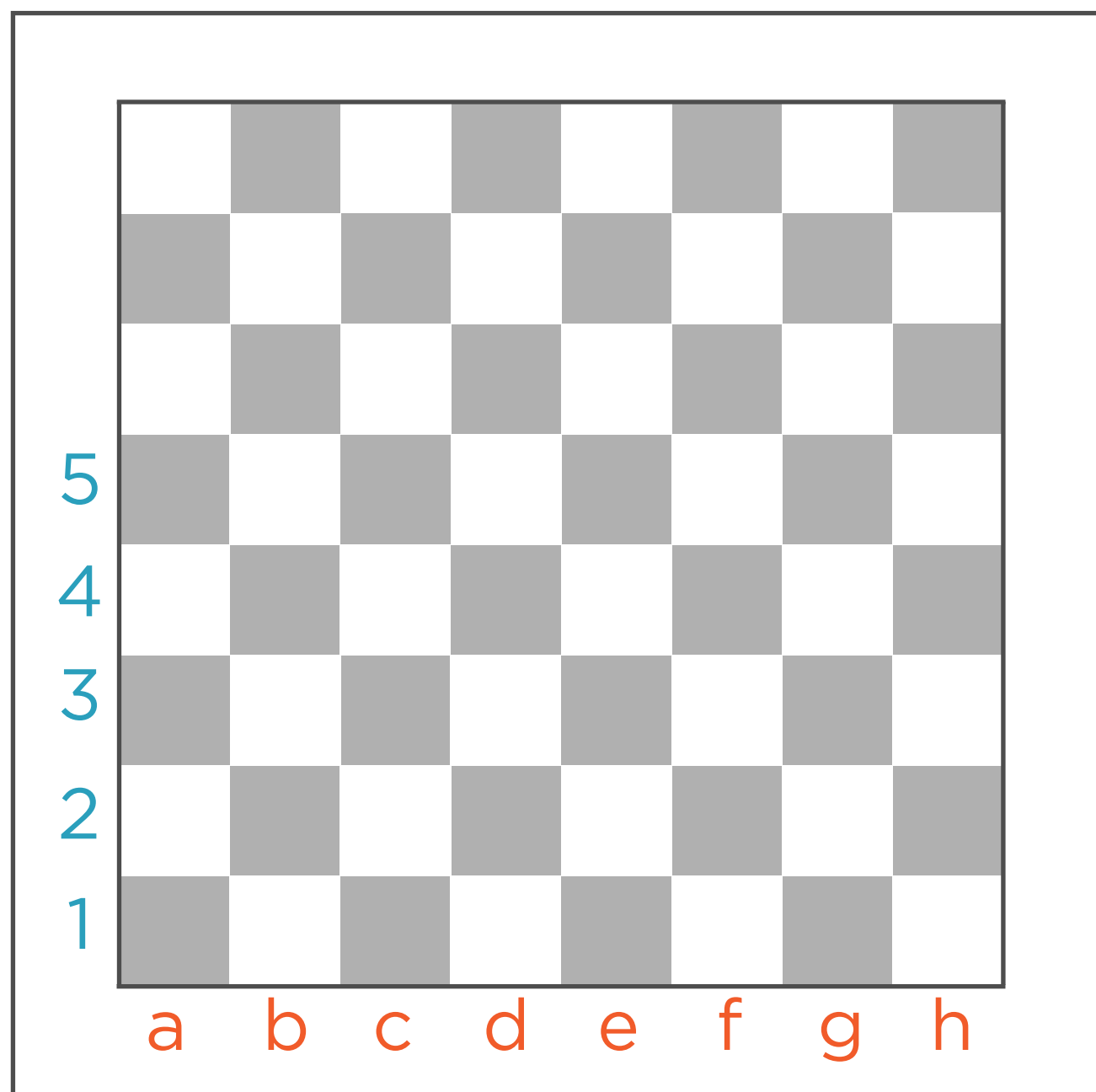
# Sixty-Four Positions, Thirty-Two Pieces



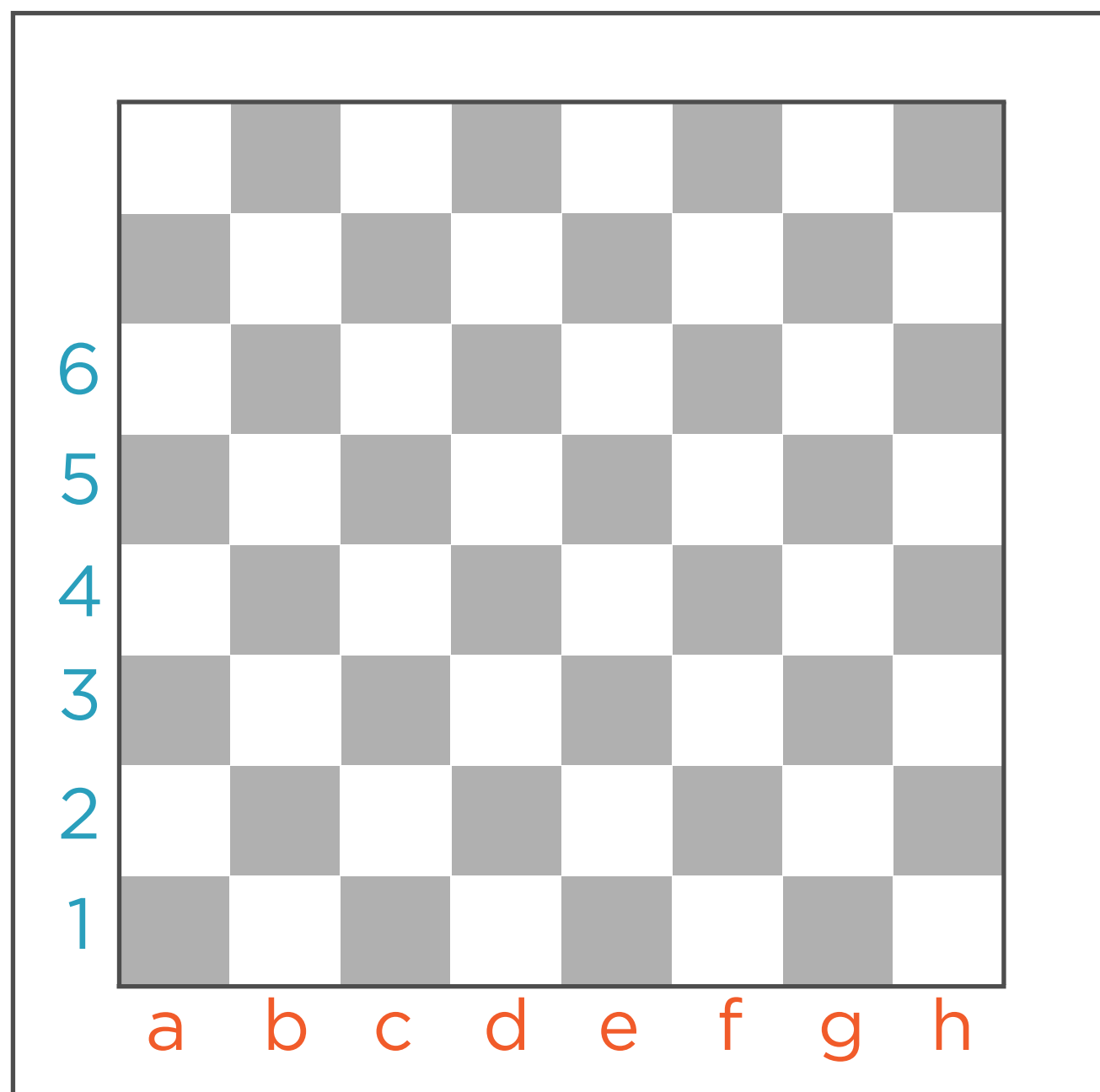
# Sixty-Four Positions, Thirty-Two Pieces



# Sixty-Four Positions, Thirty-Two Pieces

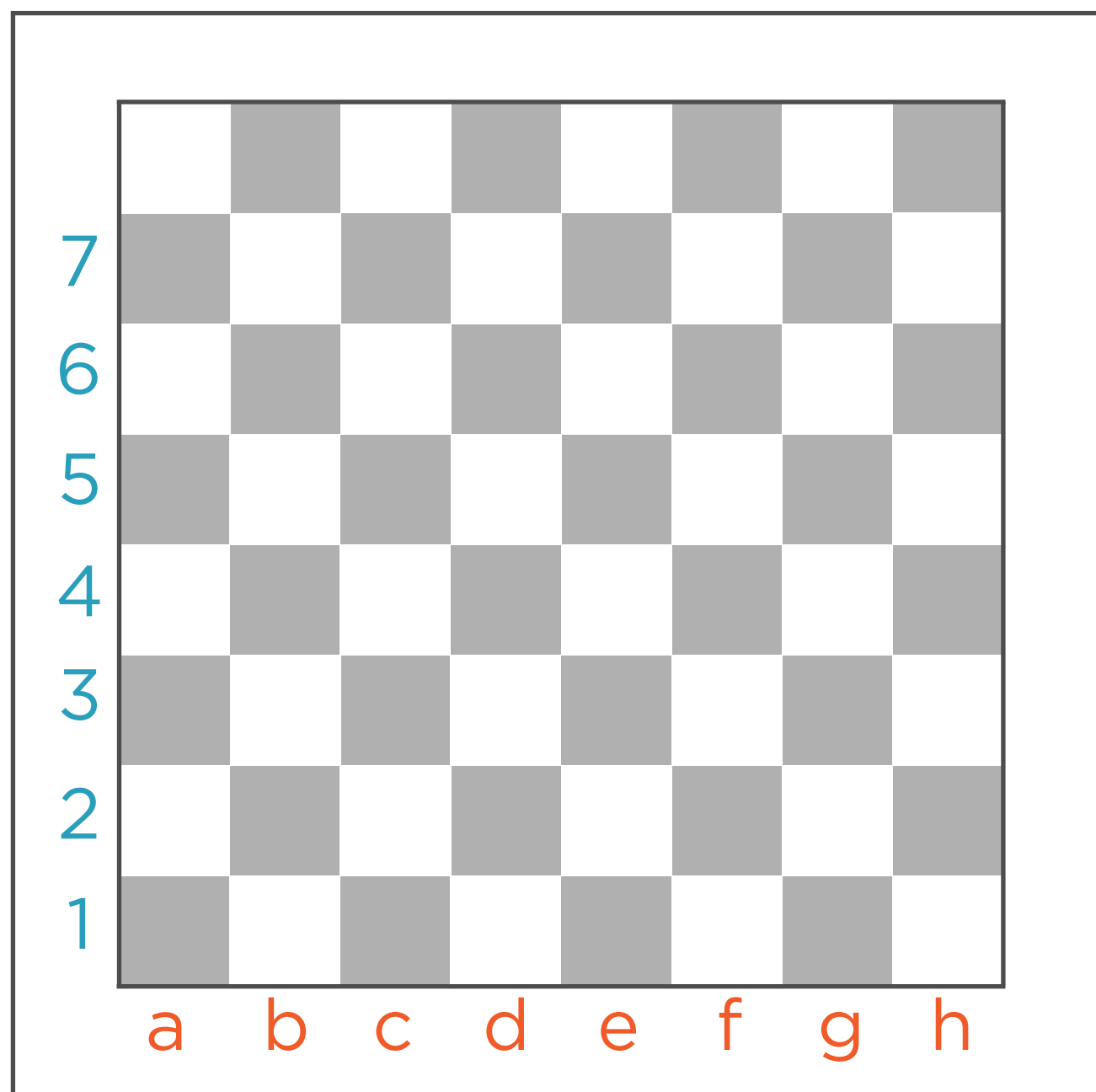


# Sixty-Four Positions, Thirty-Two Pieces

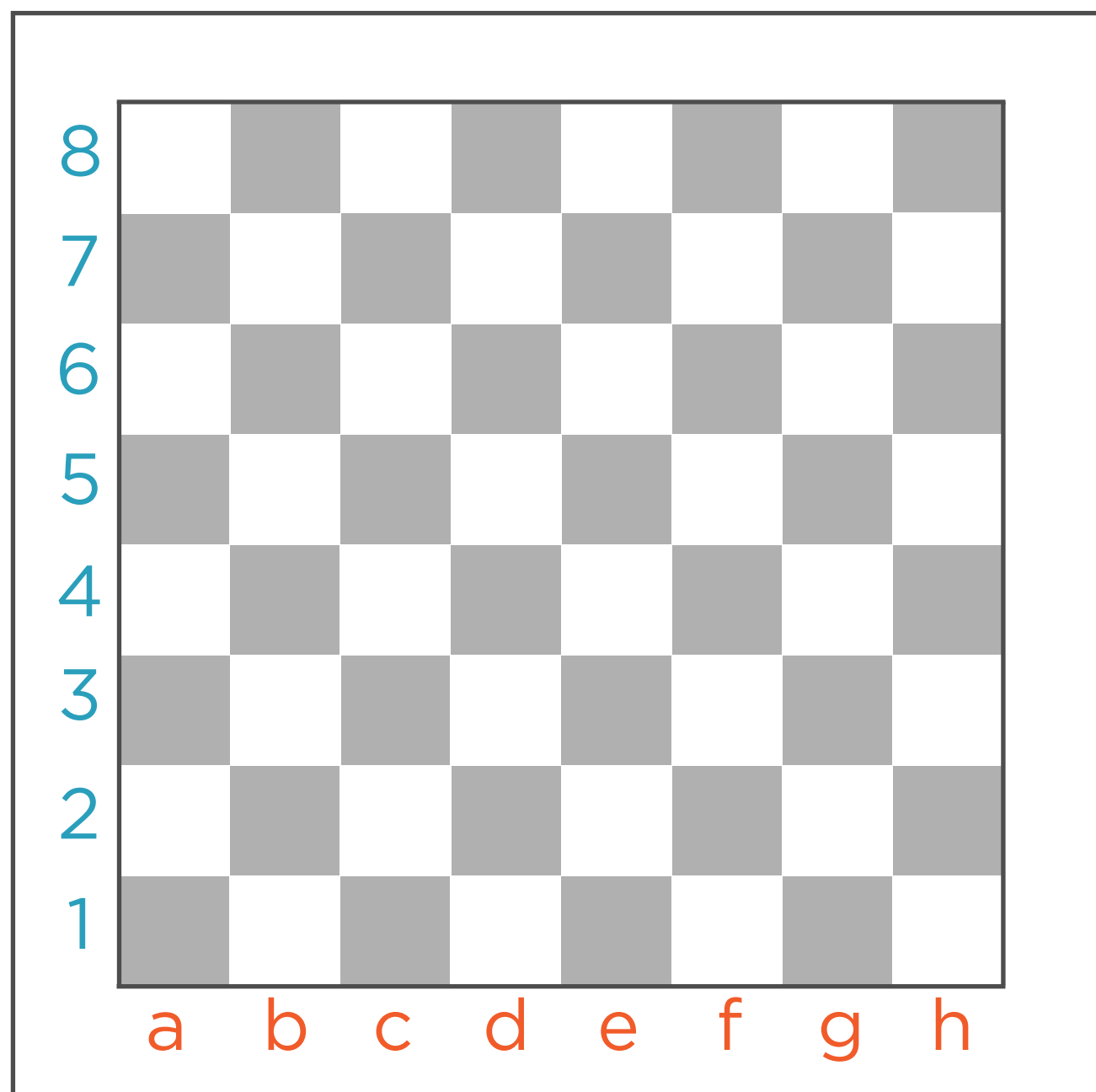




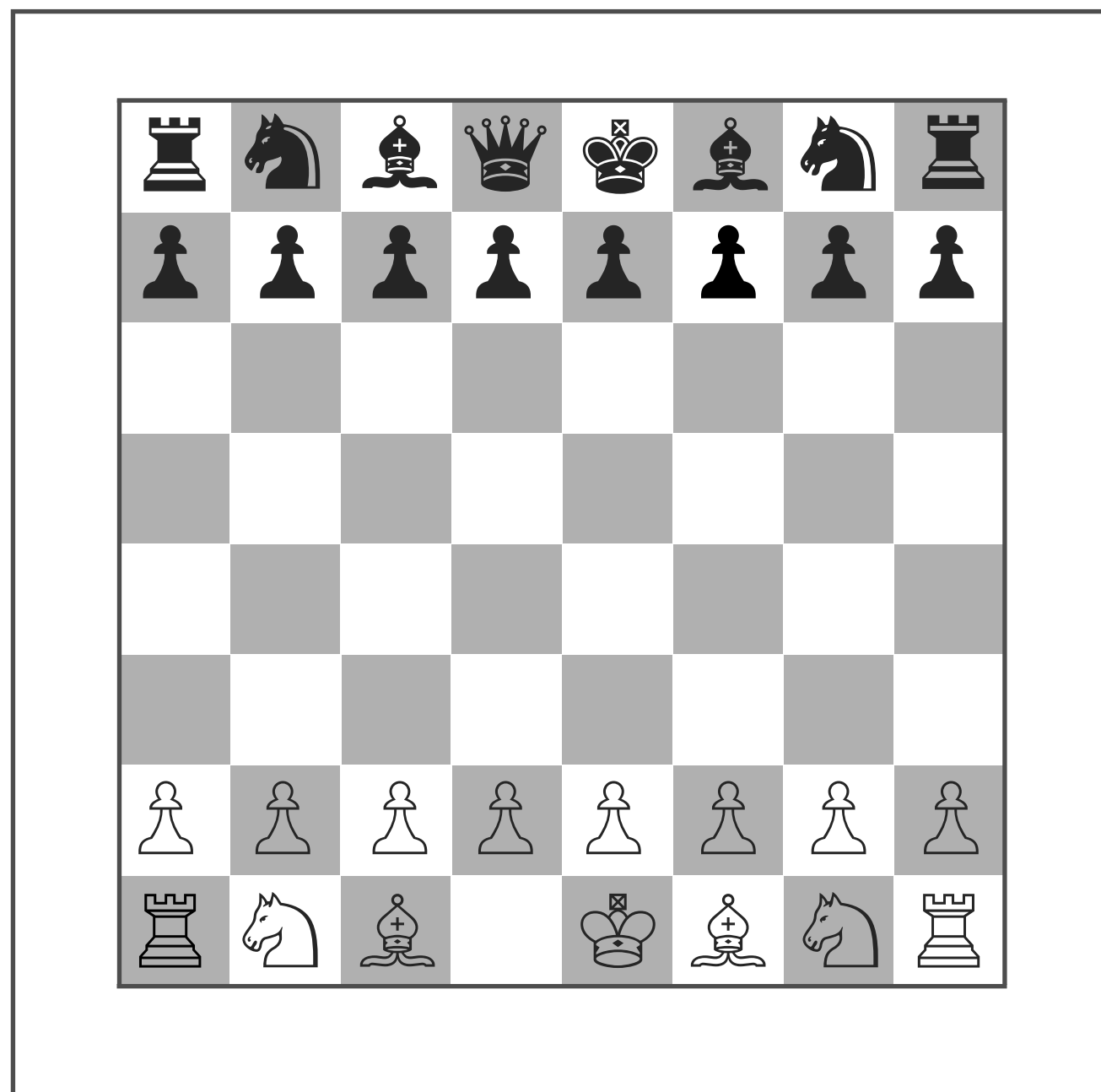
# Sixty-Four Positions, Thirty-Two Pieces



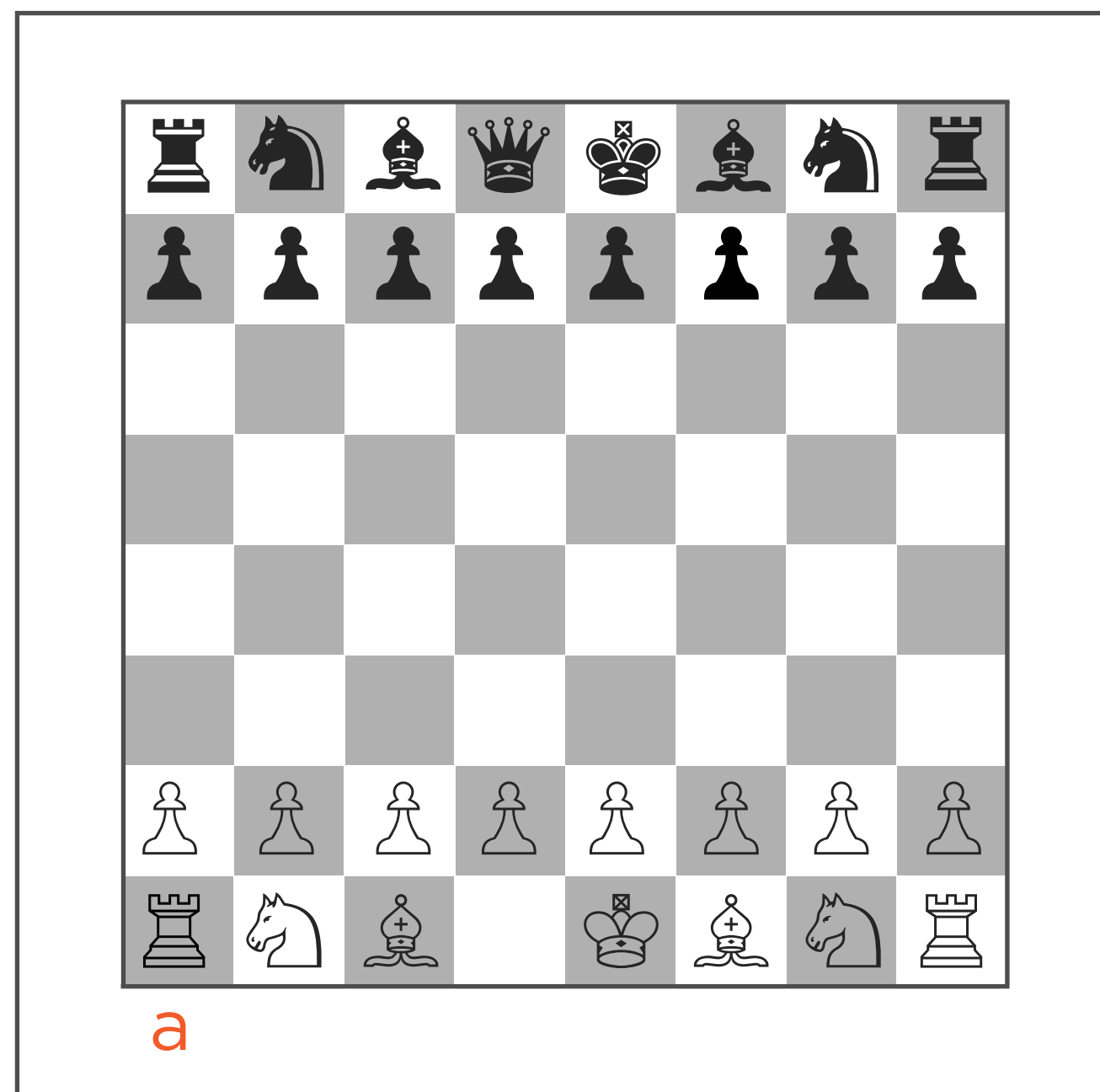
# Sixty-Four Positions, Thirty-Two Pieces



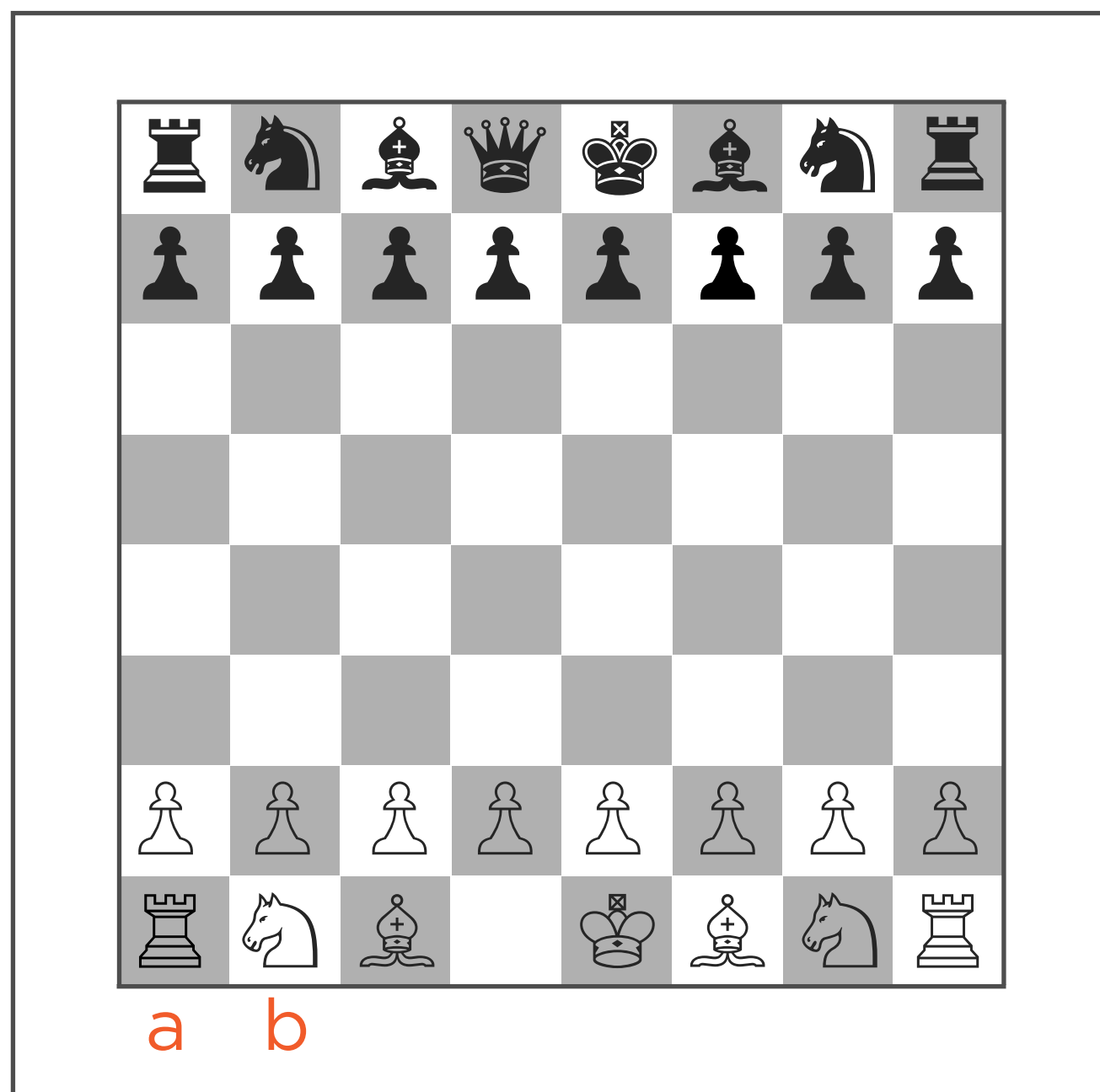
# Sixty-Four Positions, Thirty-Two Pieces



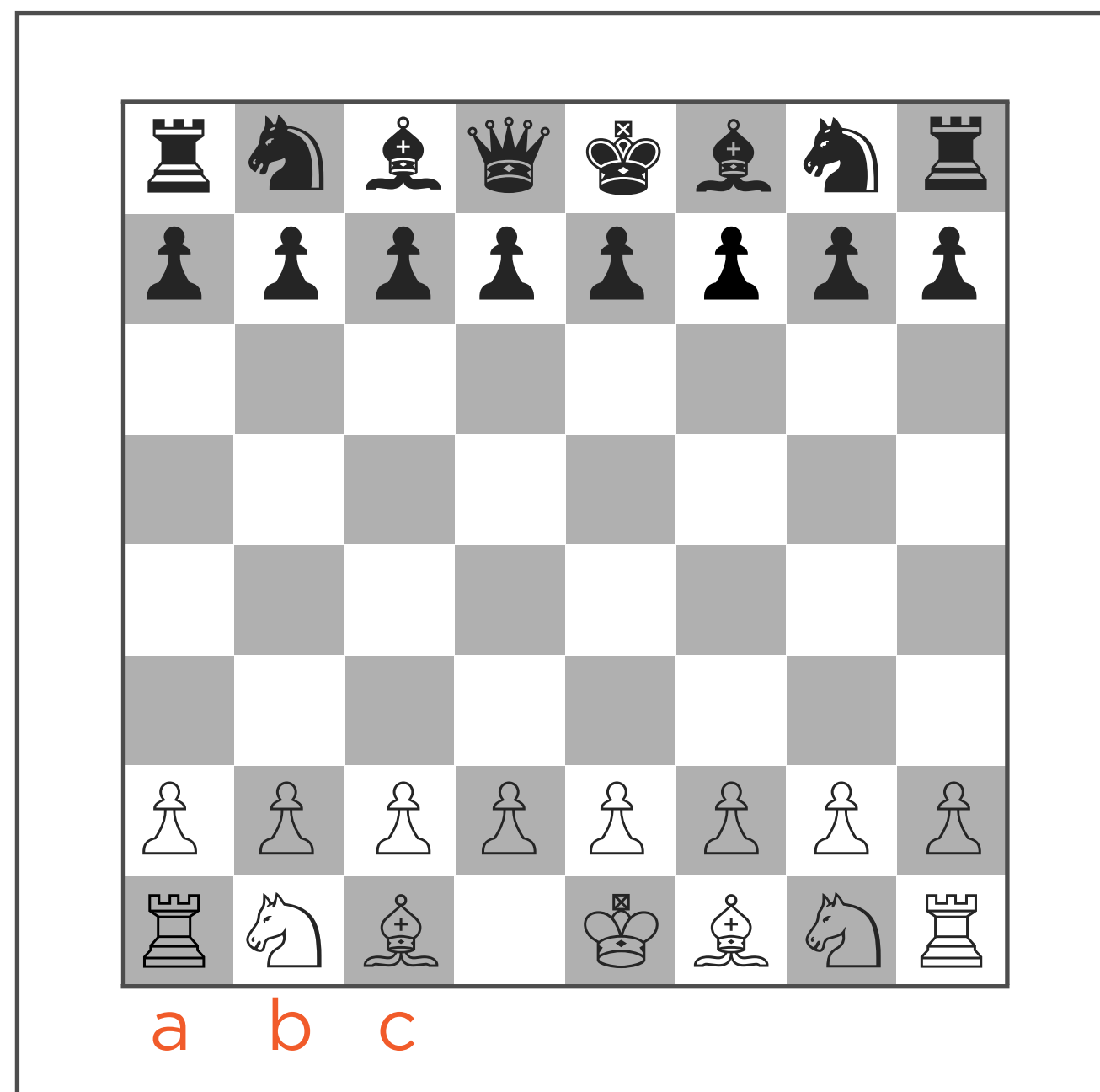
# Sixty-Four Positions, Thirty-Two Pieces



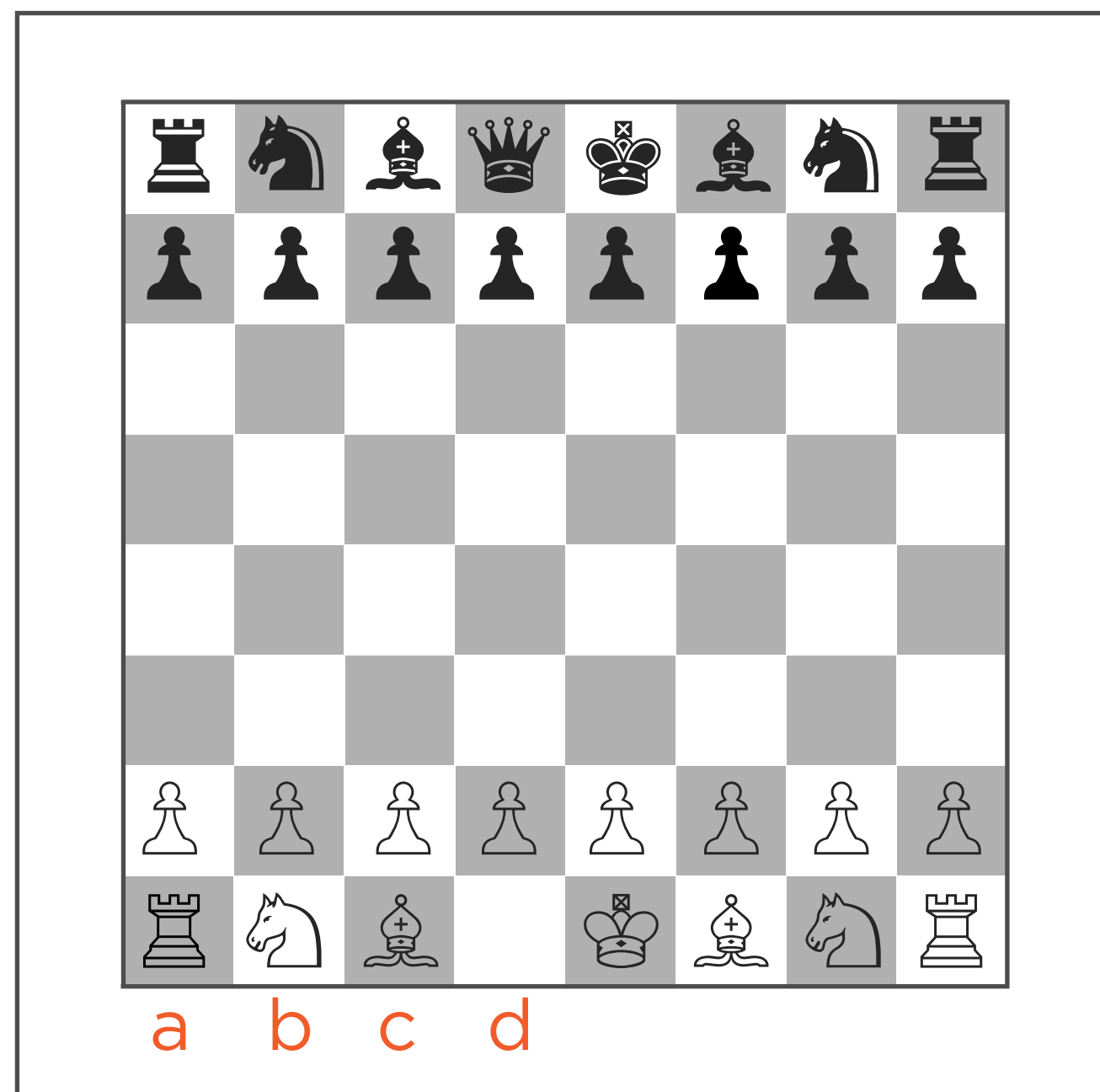
# Sixty-Four Positions, Thirty-Two Pieces



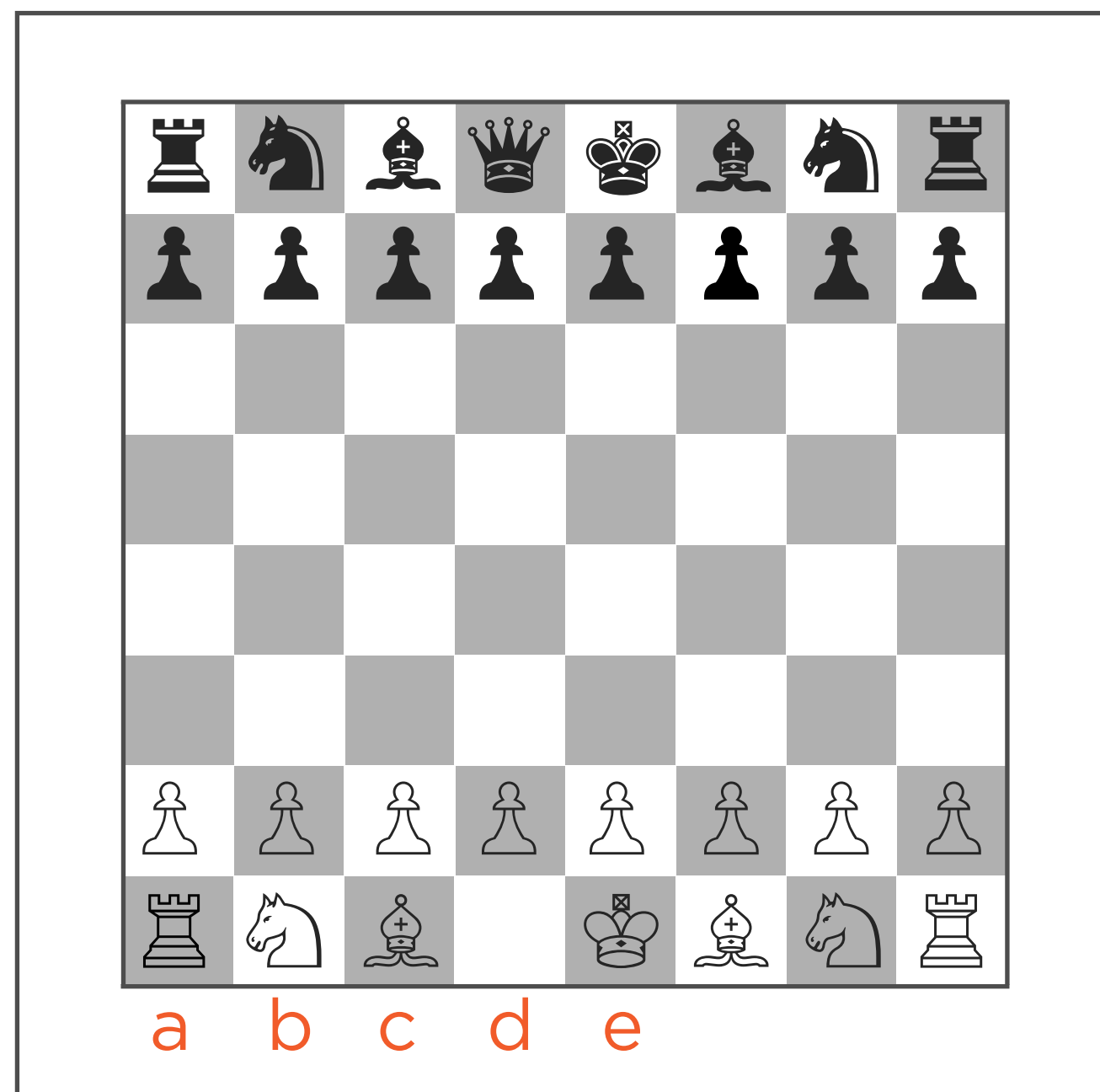
# Sixty-Four Positions, Thirty-Two Pieces



# Sixty-Four Positions, Thirty-Two Pieces

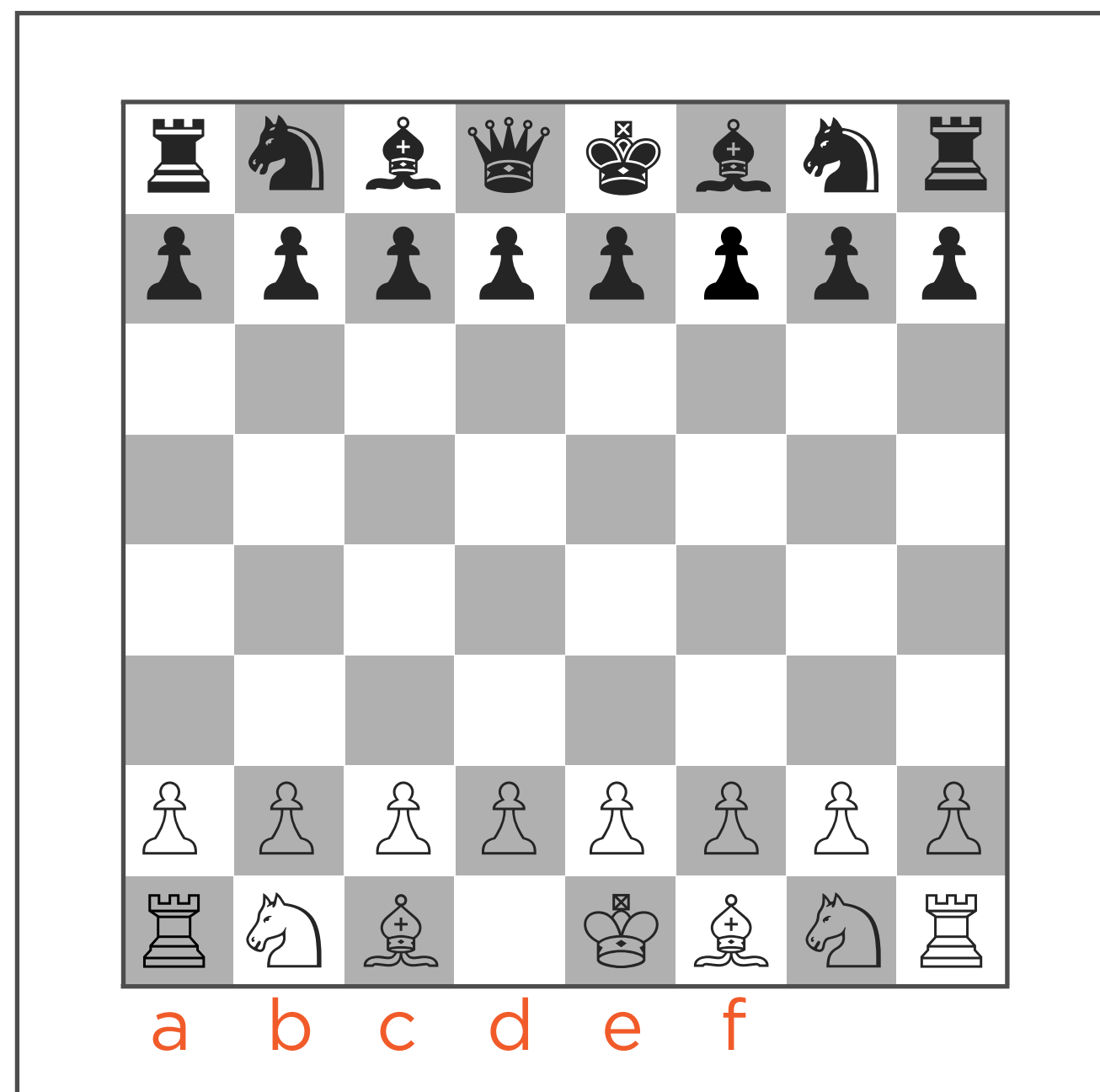


# Sixty-Four Positions, Thirty-Two Pieces

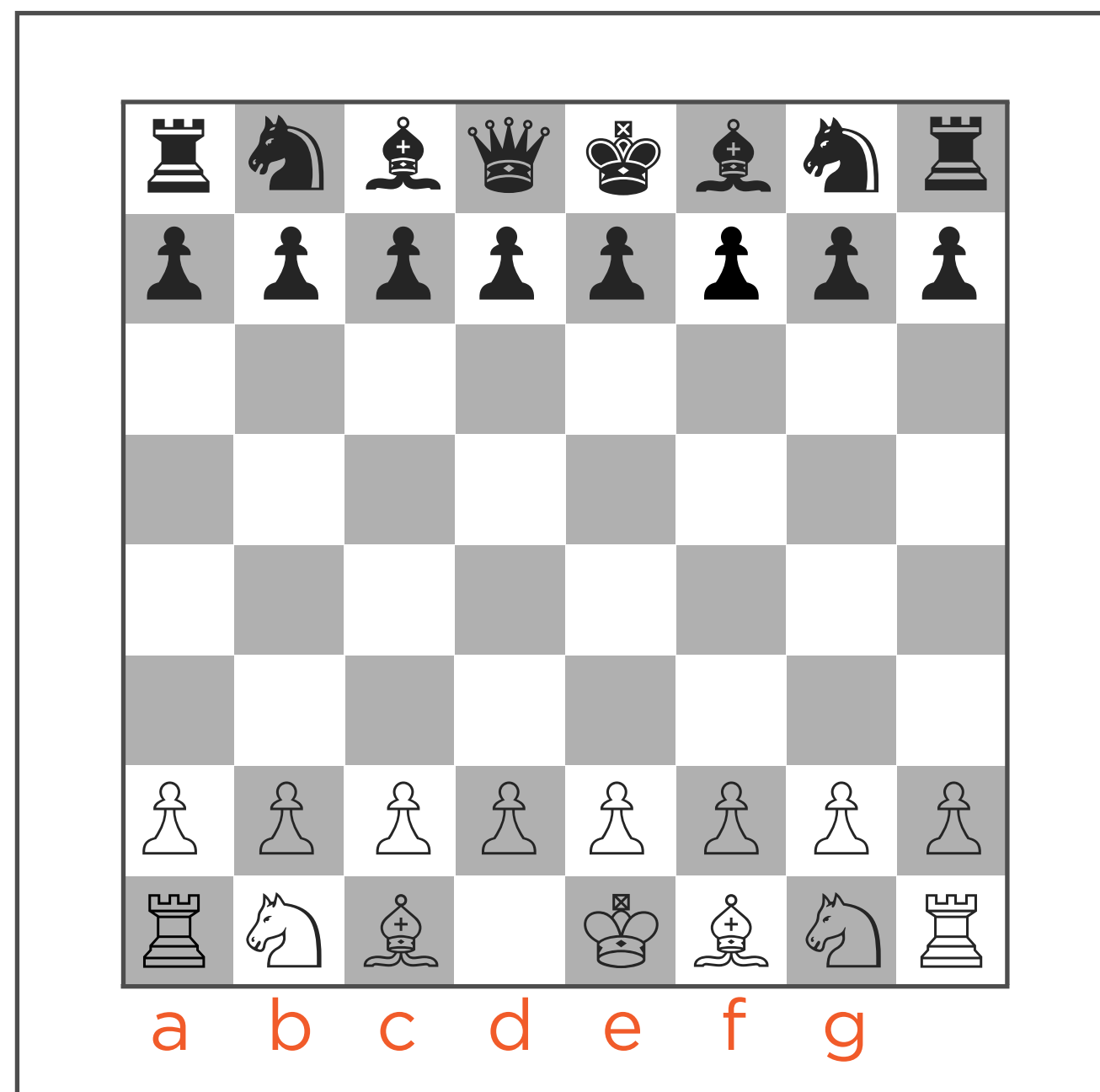




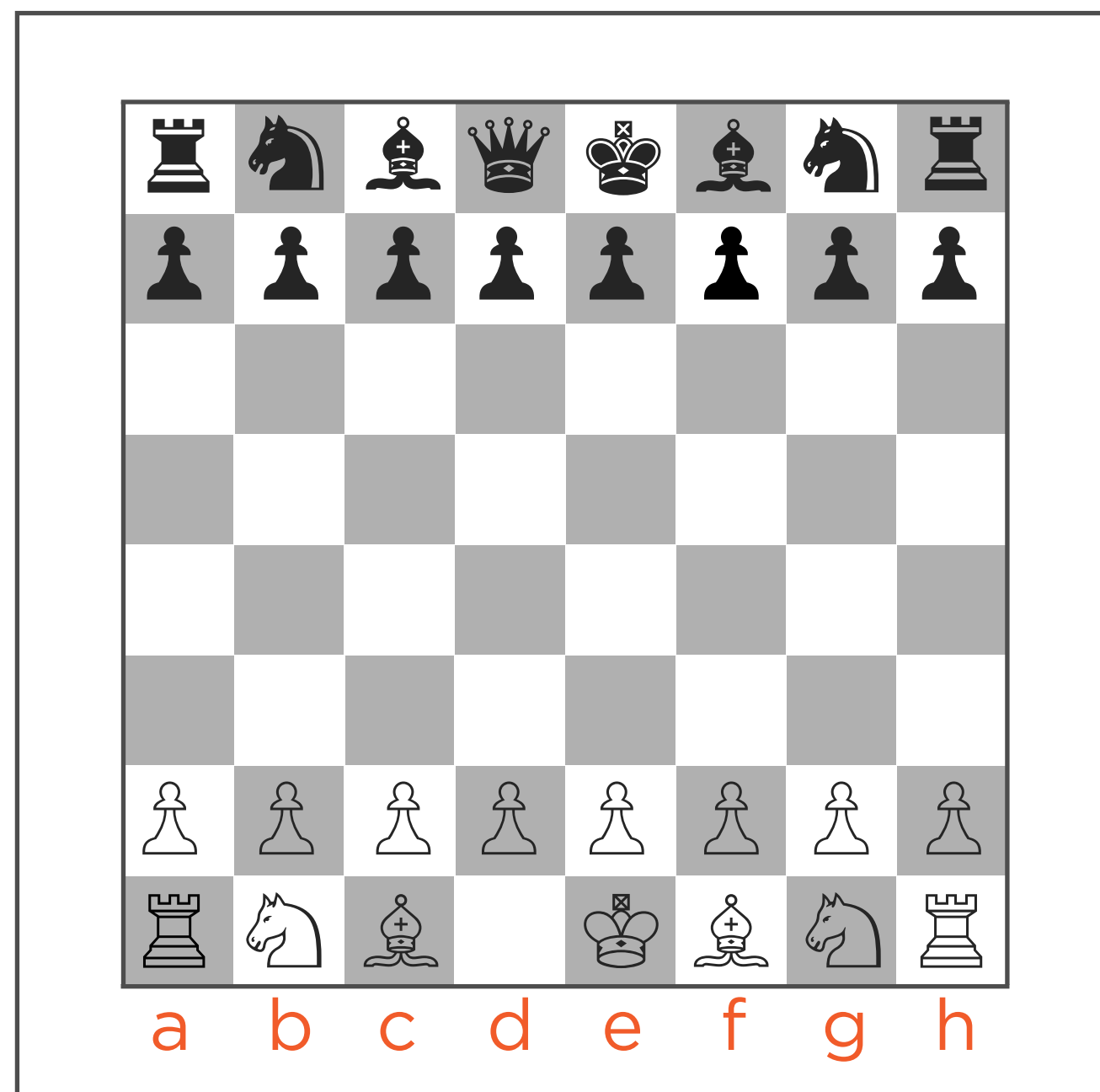
# Sixty-Four Positions, Thirty-Two Pieces



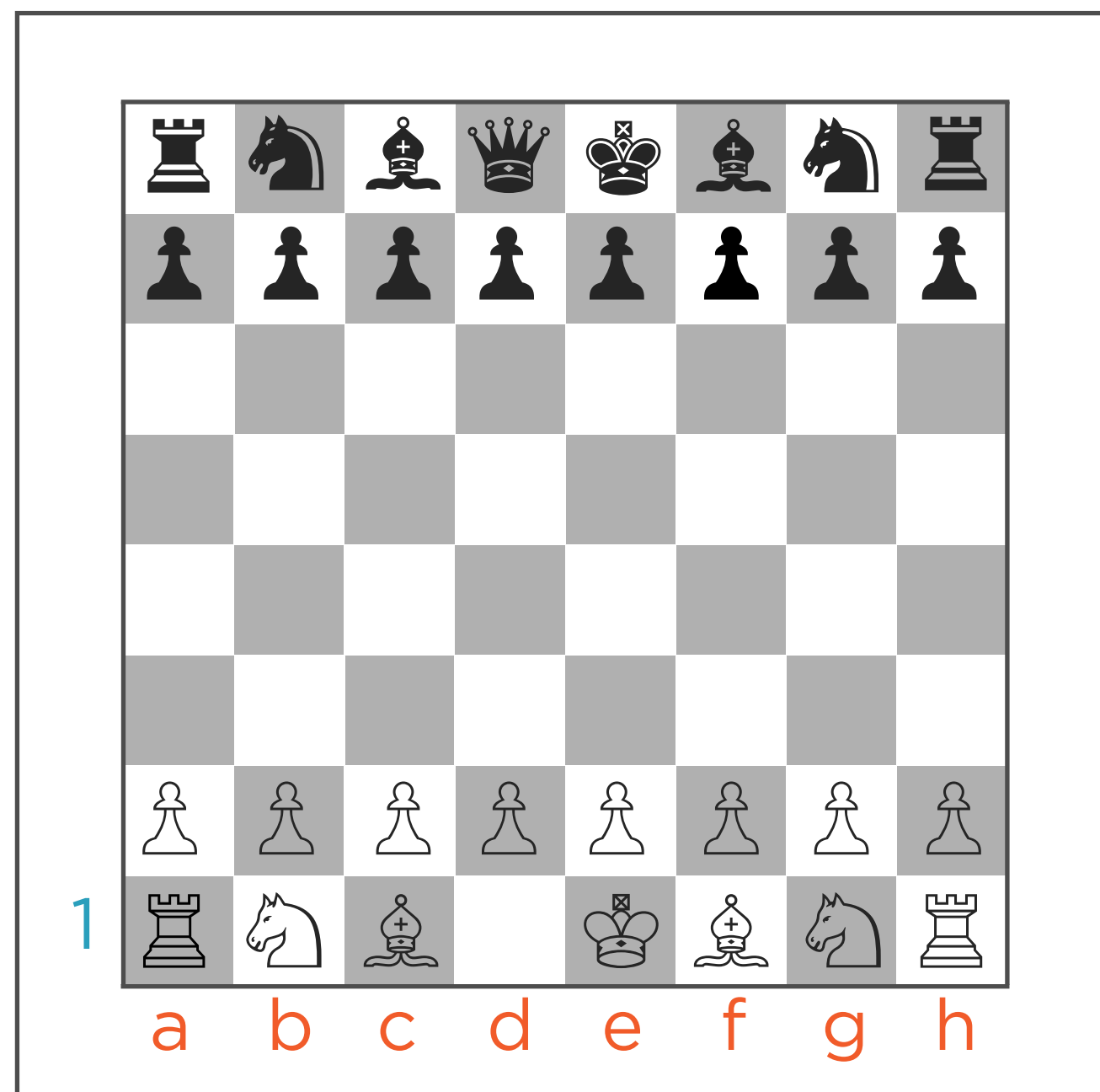
# Sixty-Four Positions, Thirty-Two Pieces



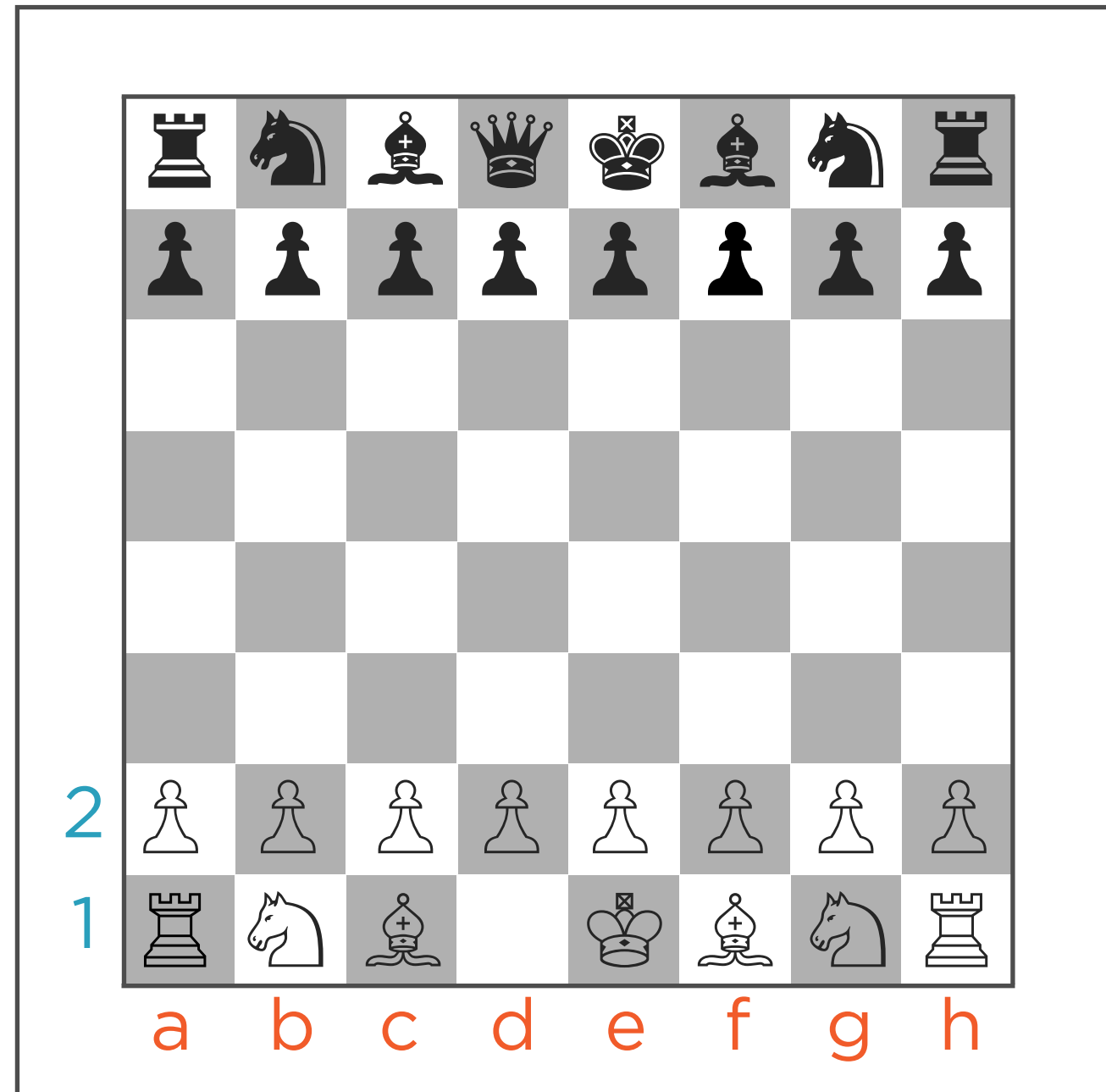
# Sixty-Four Positions, Thirty-Two Pieces



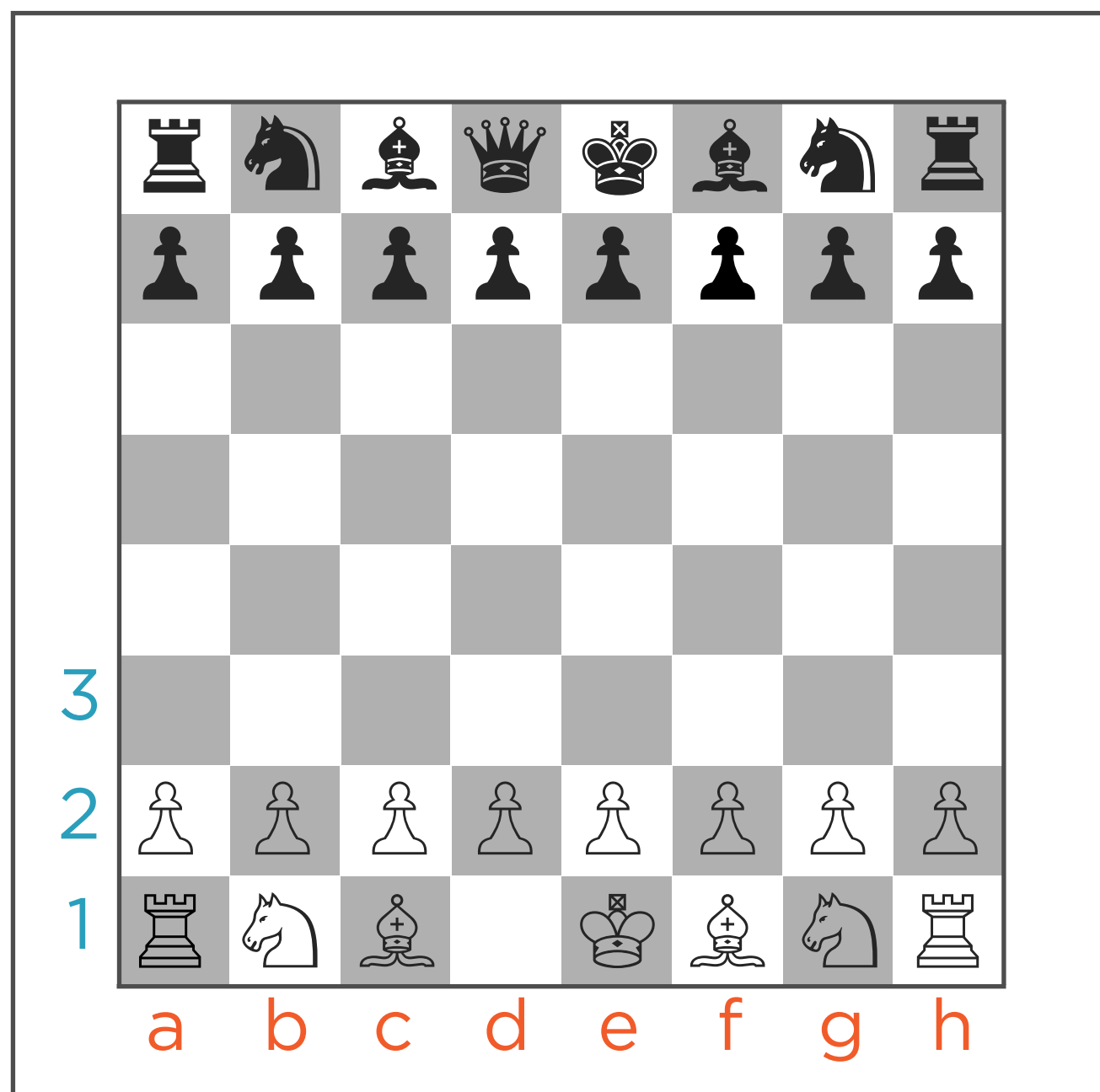
# Sixty-Four Positions, Thirty-Two Pieces



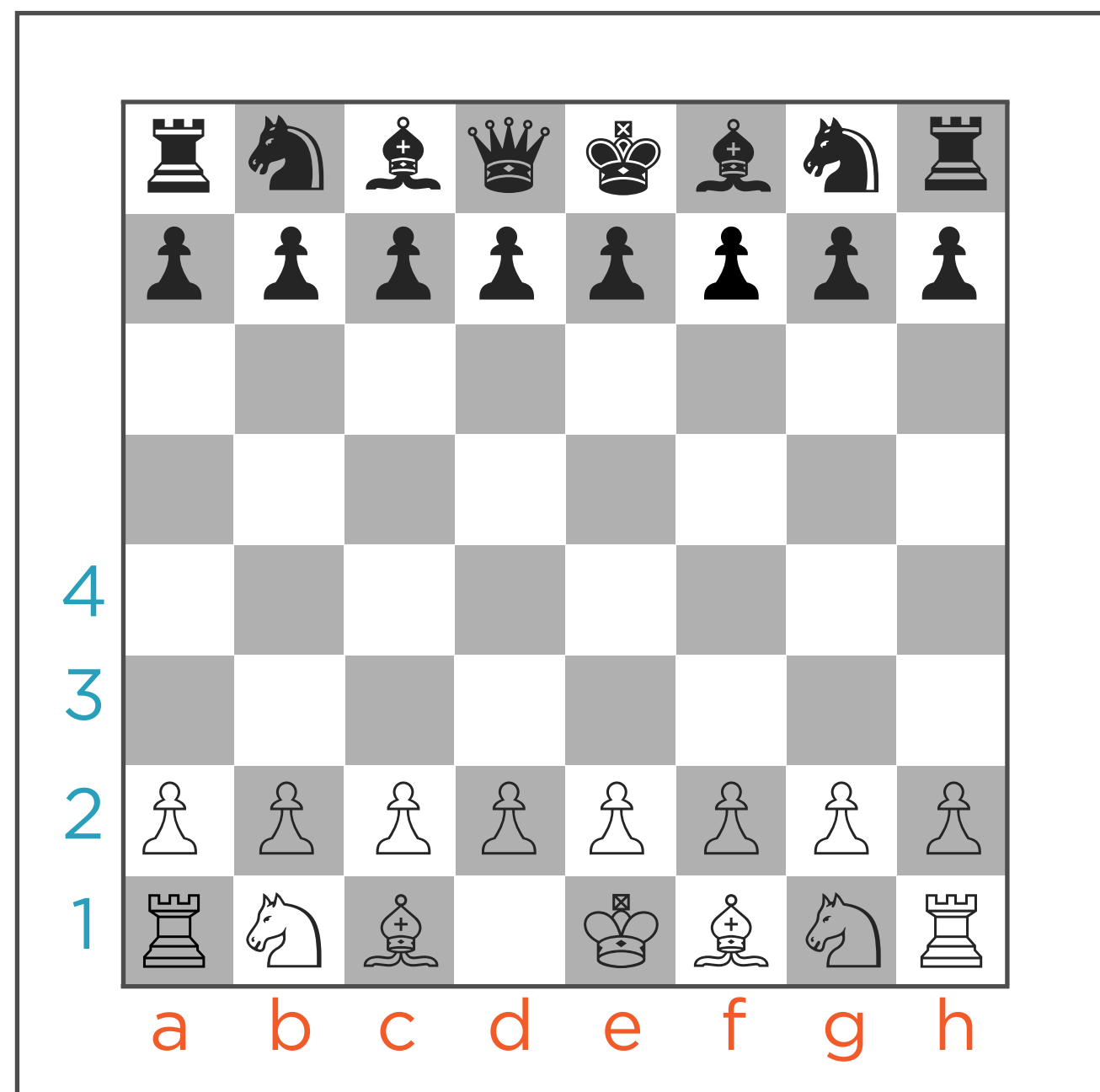
# Sixty-Four Positions, Thirty-Two Pieces



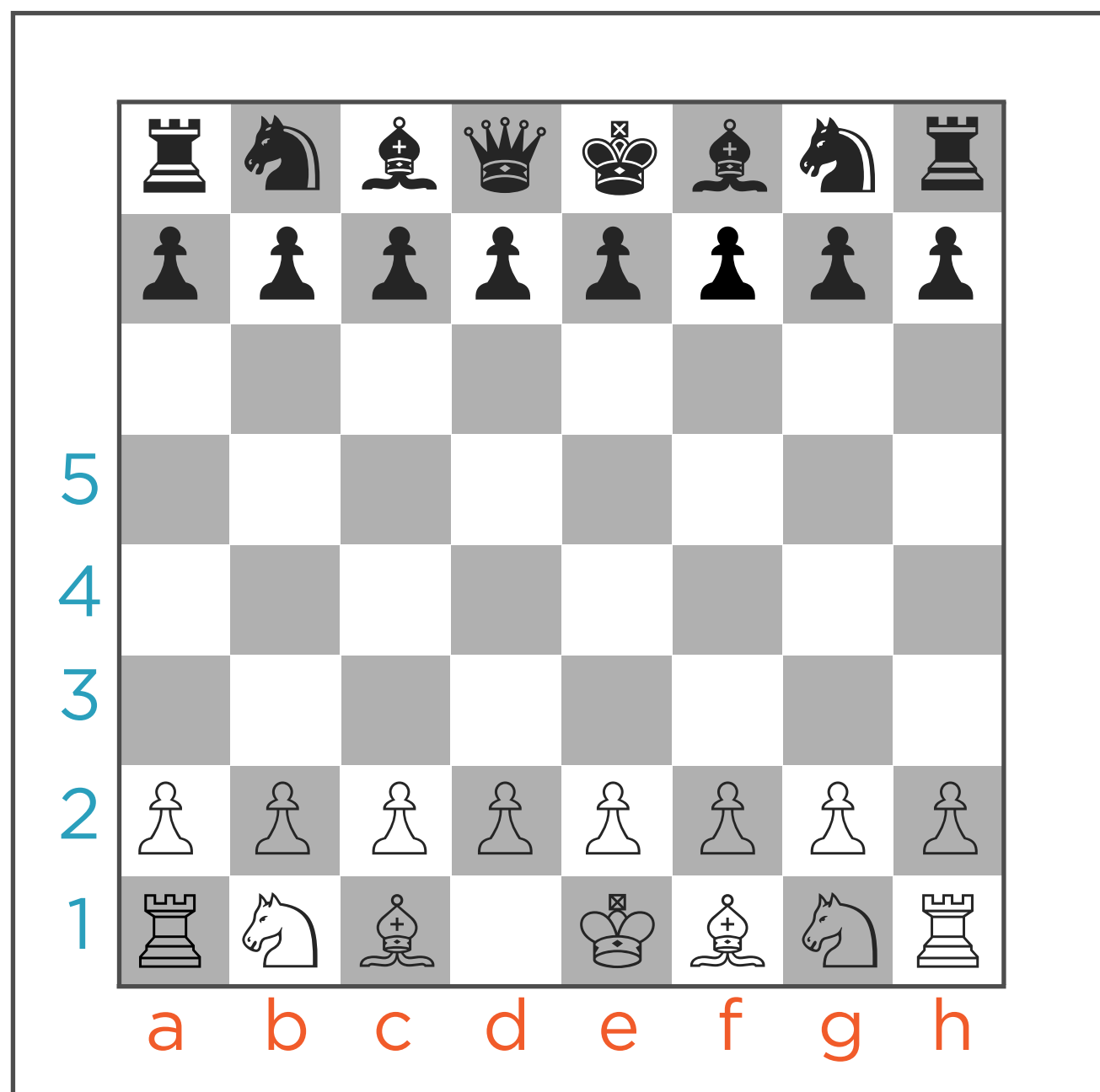
# Sixty-Four Positions, Thirty-Two Pieces



# Sixty-Four Positions, Thirty-Two Pieces

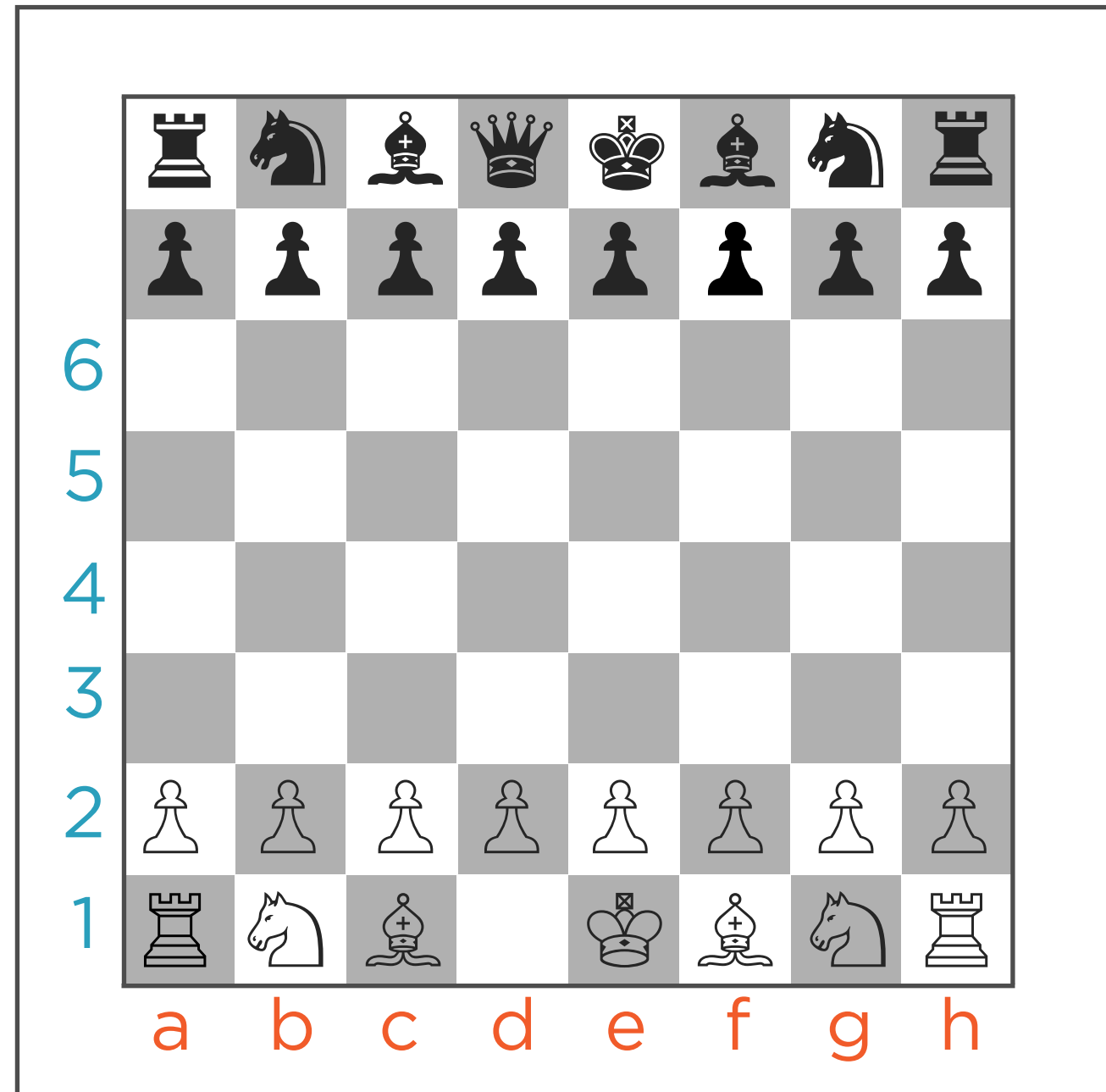


# Sixty-Four Positions, Thirty-Two Pieces

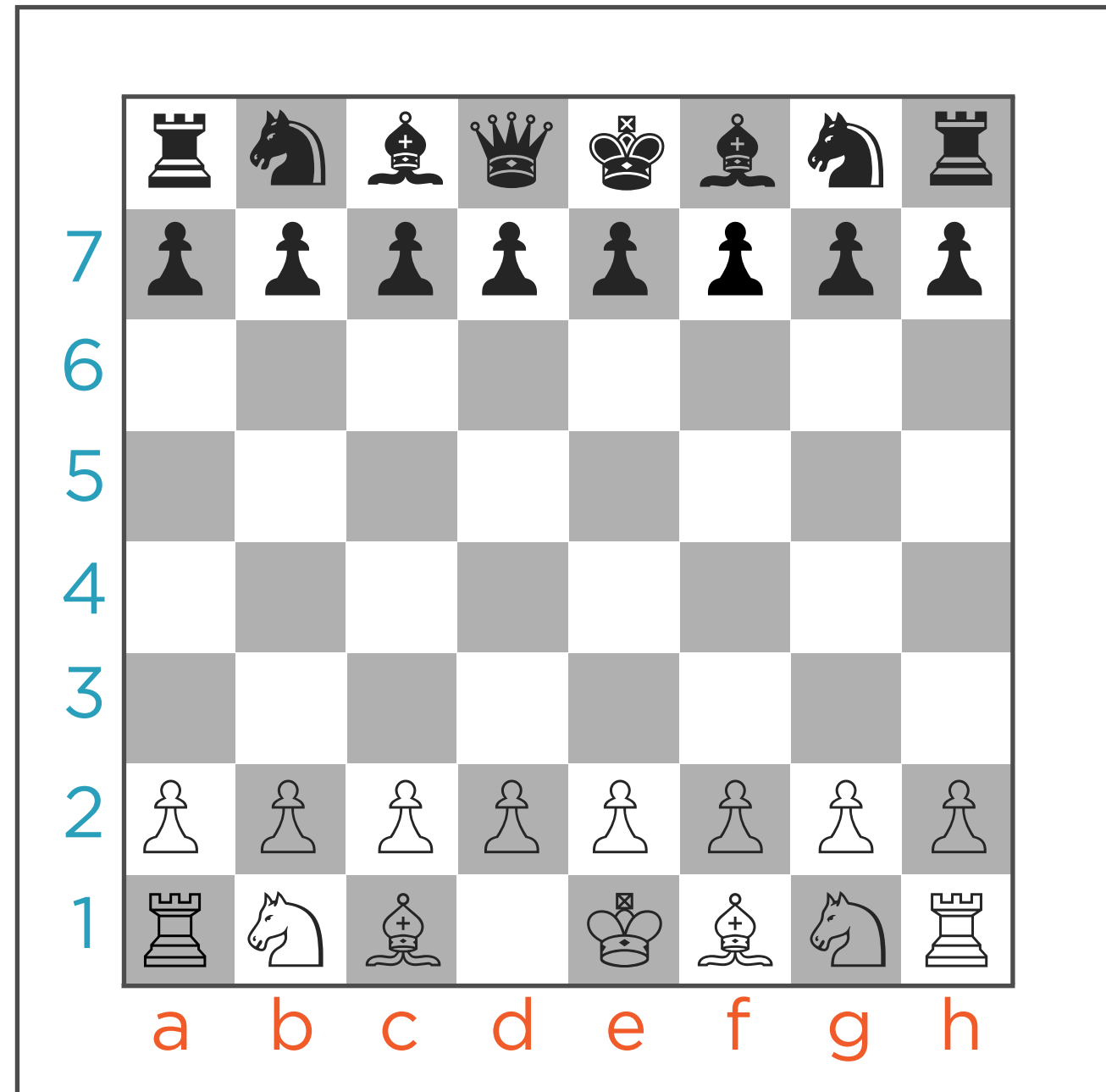




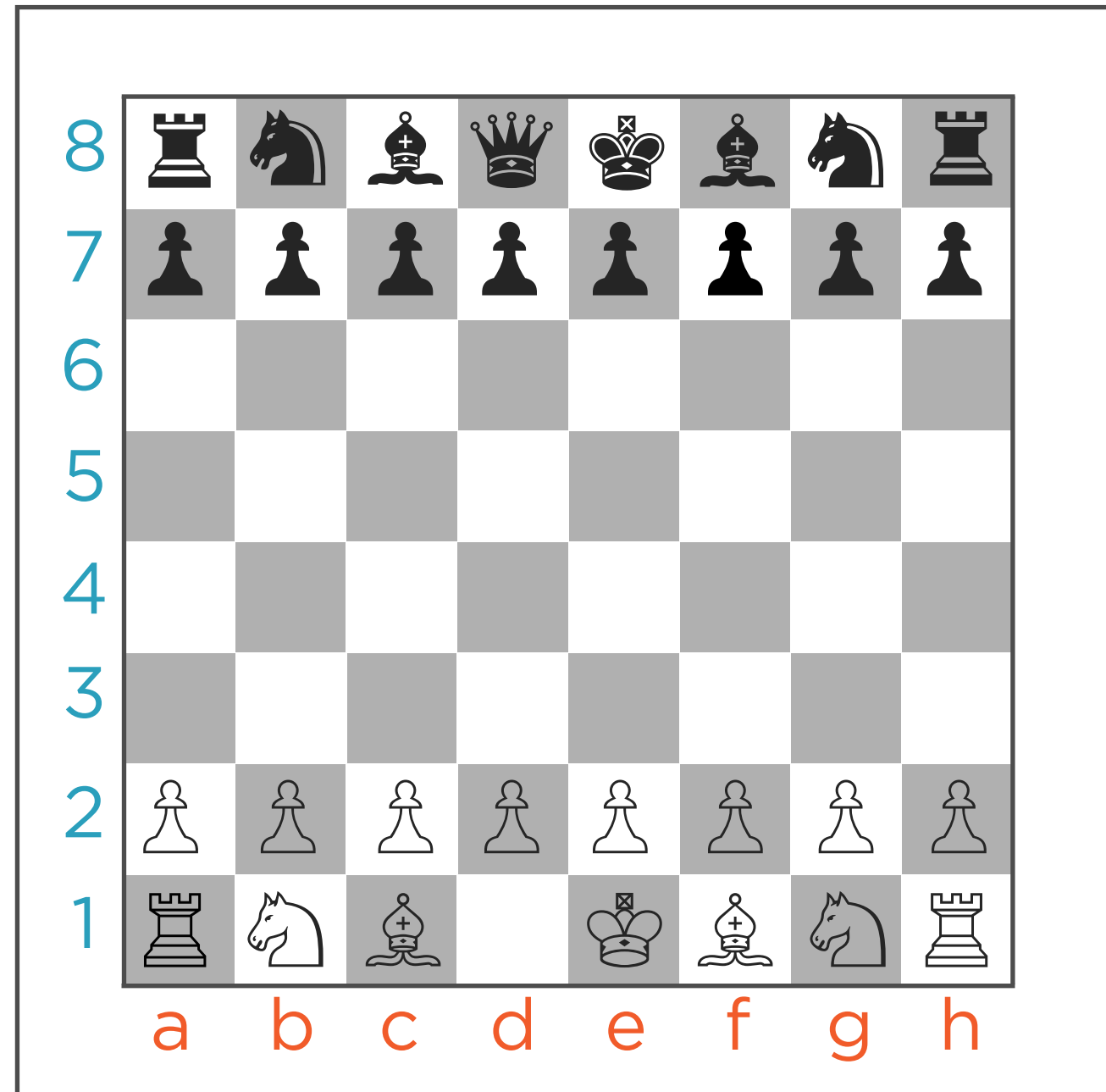
# Sixty-Four Positions, Thirty-Two Pieces



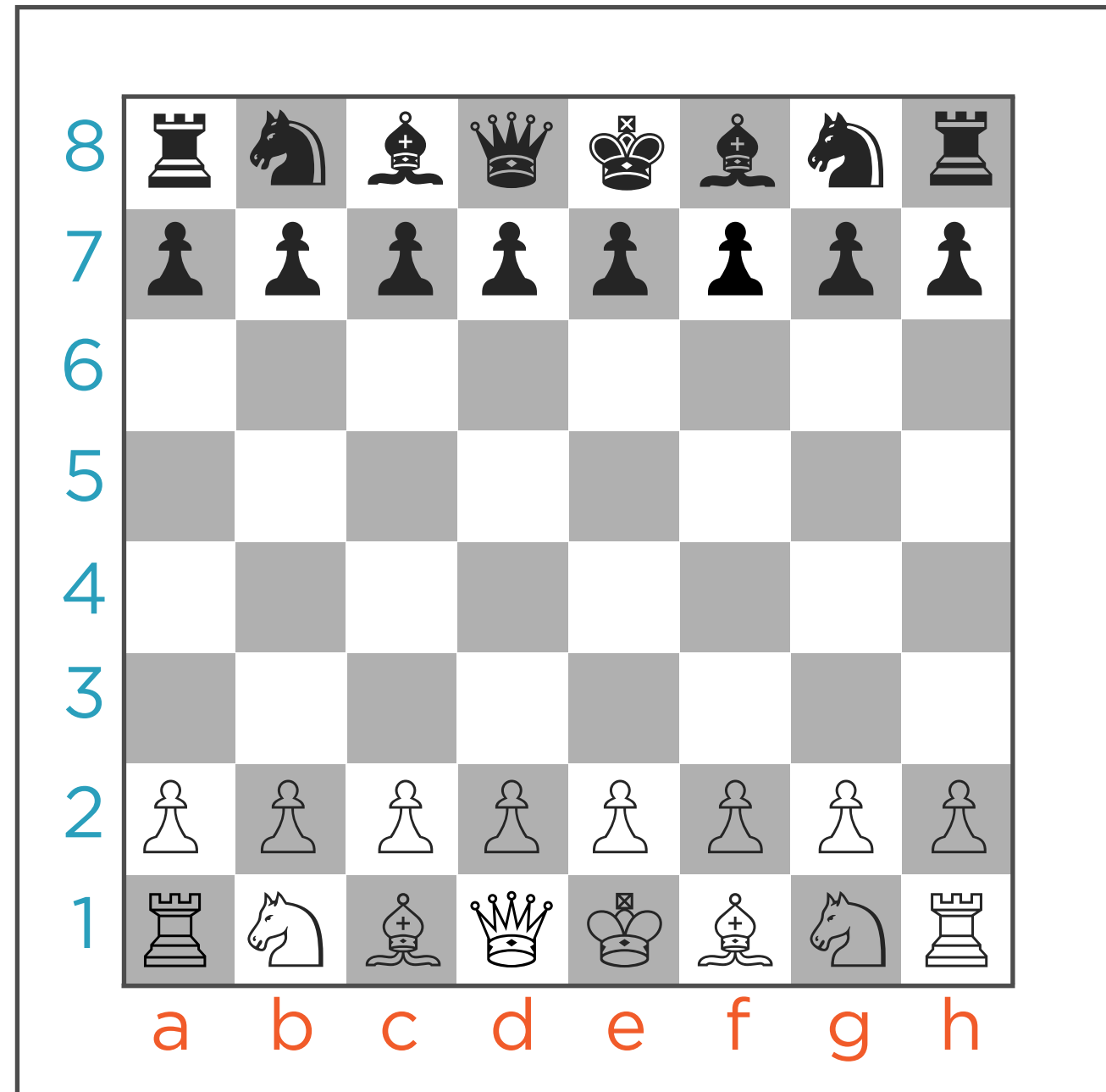
# Sixty-Four Positions, Thirty-Two Pieces



# Sixty-Four Positions, Thirty-Two Pieces



# Sixty-Four Positions, Thirty-Two Pieces



# Interning

Only use for **immutable**  
value types

# Summary

# Summary

# Summary

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



# Summary

Static method `__new__()` allocates new instances

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

# Summary

Static method `__new__()` allocates new instances

`__new__()` is implicitly a class-method

**`object.__new__()` is the ultimate allocator**