JÖNKÖPING UNIVERSITY

School of Engineering

MODELLING IN PYTHON

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WHAT IS MODELLING?

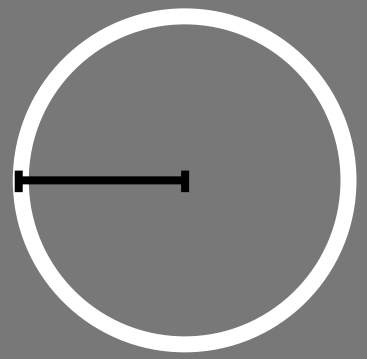
Representing data.

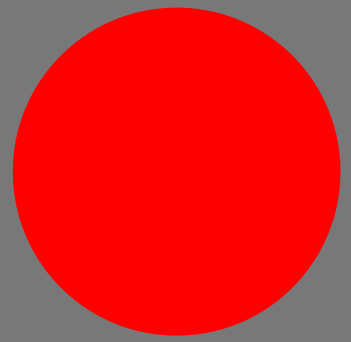
- Represent the age of a human?
  - Use an integer.
  - `age = 10`
- Represent the name of a human?
  - Use a string.
  - `name = "Alice"`
- Represent whether a human is dead or alive?
  - Use a boolean.
  - `alive = True`

WHAT IS MODELLING?

Representing data.

- Represent a circle?
  - Use an integer.
  - `radius = 10`
- Represent a circle with a color?
  - Use multiple values.
  - `circle_radius = 10`
  - `circle_color = "red"`





GROUPING DATA

Use dicts to group data together.

```
human = {
   'name': "Alice",
   'age': 10,
   'city': "Atlanta"
}
print_human(human)
```

```
human_name = "Alice"
human_age = 10
human_city = "Atlanta"
print_human(human_name, human_age, human_city)
```

GROUPING DATA

Use dicts to group data together.

```
date = {
  'year': 2016,
  'month': 3,
  'day': 16
}
print_date(date)
```

```
date_year = 2016
date_month = 3
date_day = 16
print_date(date_year, date_month, date_day)
```

DICTIONARIES VS LISTS

```
human = {
  'name': "Alice",
  'age': 10,
  'city': "Atlanta"
}
```

```
human = [
  "Alice",
  10,
  "Atlanta"
]
```

```
def print_human(human):
  print(
    human['name']+" comes from "+
    human['city']+" and is "+
    str(human['age'])+" years old."
  )
```

```
def print_human(human):
  print(
    human[0]+" comes from "+
    human[2]+" and is "+
    str(human[1])+" years old."
  )
```

GENERAL GUIDELINES

Use a dict to represent a single entity.

```
human = {
  'name': "Alice",
  'age': 10,
  'city': "Atlanta"
}
```

```
humans = [
  {'name': "Alice", 'age': 10, 'city': "Atlanta"},
  {'name': "Belle", 'age': 15, 'city': "Bilbao"},
  {'name': "Clair", 'age': 20, 'city': "Chicago"}
]
```

Use a list to represent a collection of entities.

PROGRAM STRUCTURE

The data

```
ages = [43, 47, 10, 7, 3]
```

Computations

```
def average(numbers):
  return sum(numbers)/len(numbers)
```

User Interface

```
print("Average age: "+str(average(ages)))
```

COMPLEX DATA

```
house = {
  "city": "Jönköping",
  "color": "yellow"
}
```

```
room = {
  "name": "Living Room",
  "side-length-1": 5,
  "side-length-2": 10
}
```

```
house = {
  "city": "Jönköping",
  "color": "yellow",
  "rooms": [
    {"name": "Living Room", "side-length-1": 7, "side-length-2": 8},
    {"name": "Kitchen",     "side-length-1": 5, "side-length-2": 5}
  ]
}
```

COMPLEX DATA

```
get_total_area(house)
```

```
def get_total_area(house):
  area = 0
  for room in house["rooms"]:
    area += room["side-length-1"]*room["side-length-2"]
  return area
```

```
house = {
  "city": "Jönköping",
  "color": "yellow",
  "rooms": [
    {"name": "Living Room", "side-length-1": 7, "side-length-2": 8},
    {"name": "Kitchen",     "side-length-1": 5, "side-length-2": 5}
  ]
}
```

COMPLEX DATA

```
folder = {
  "name": "images",
  "files": [
    {"name": "me.jpeg",  "size": 2048},
    {"name": "you.png",  "size": 4096},
    {"name": "dad.jpeg", "size": 4096}
  ]
}
```

```
folder = {
  "name": "images"
}
```

```
file = {
  "name": "me.jpeg",
  "size": 2048
}
```

COMPLEX DATA

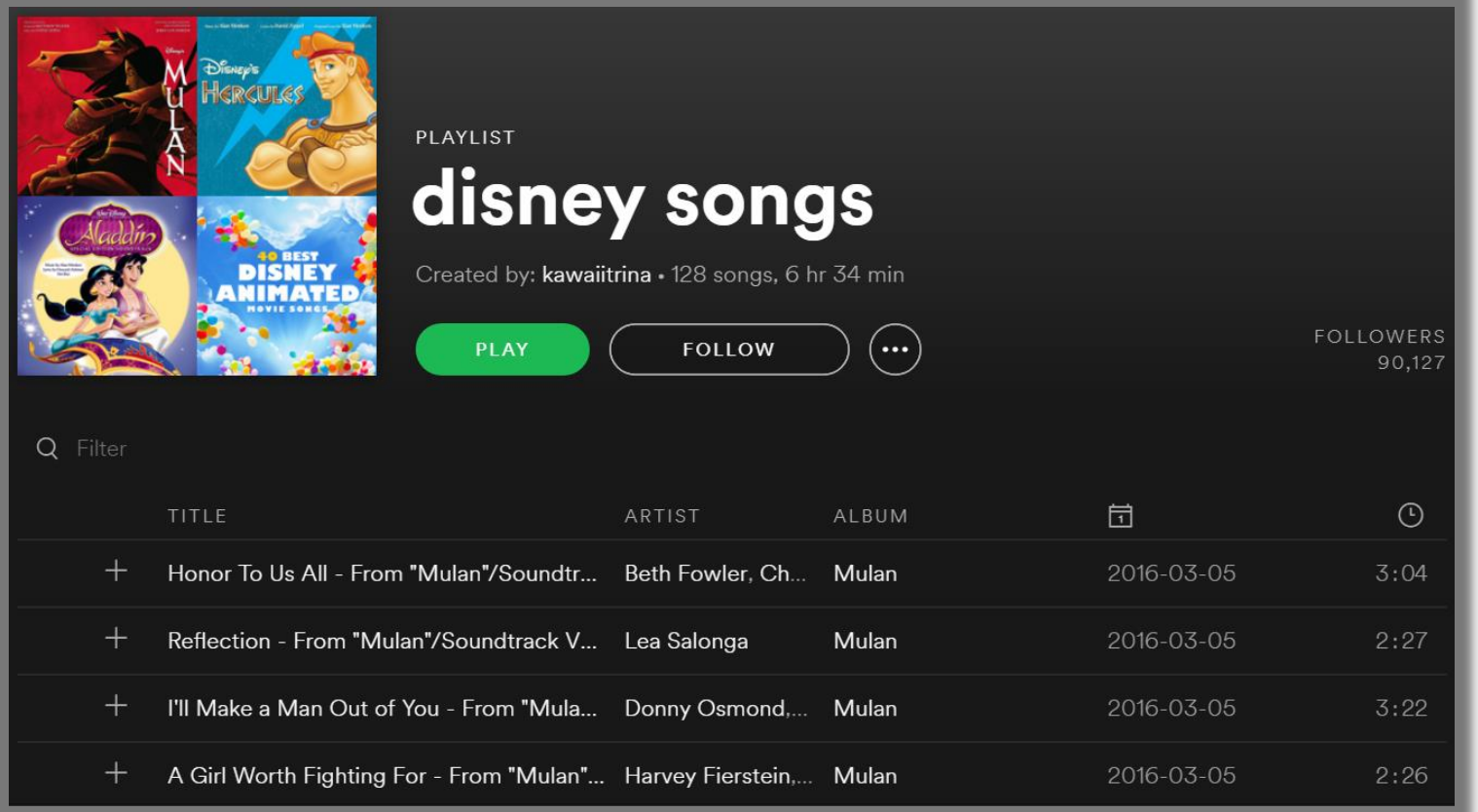
```
get_files_with_extension(folder, ".jpeg")
```

```
folder = {
  "name": "images",
  "files": [
    {"name": "me.jpeg",  "size": 2048},
    {"name": "you.png",  "size": 4096},
    {"name": "dad.jpeg", "size": 4096}
  ]
}
```

```
def get_files_with_extension(folder, ext):
  files = []
  for file in folder["files"]:
    if file["name"].endswith(ext):
      files.append(file)
  return files
```

MODELING EXAMPLES

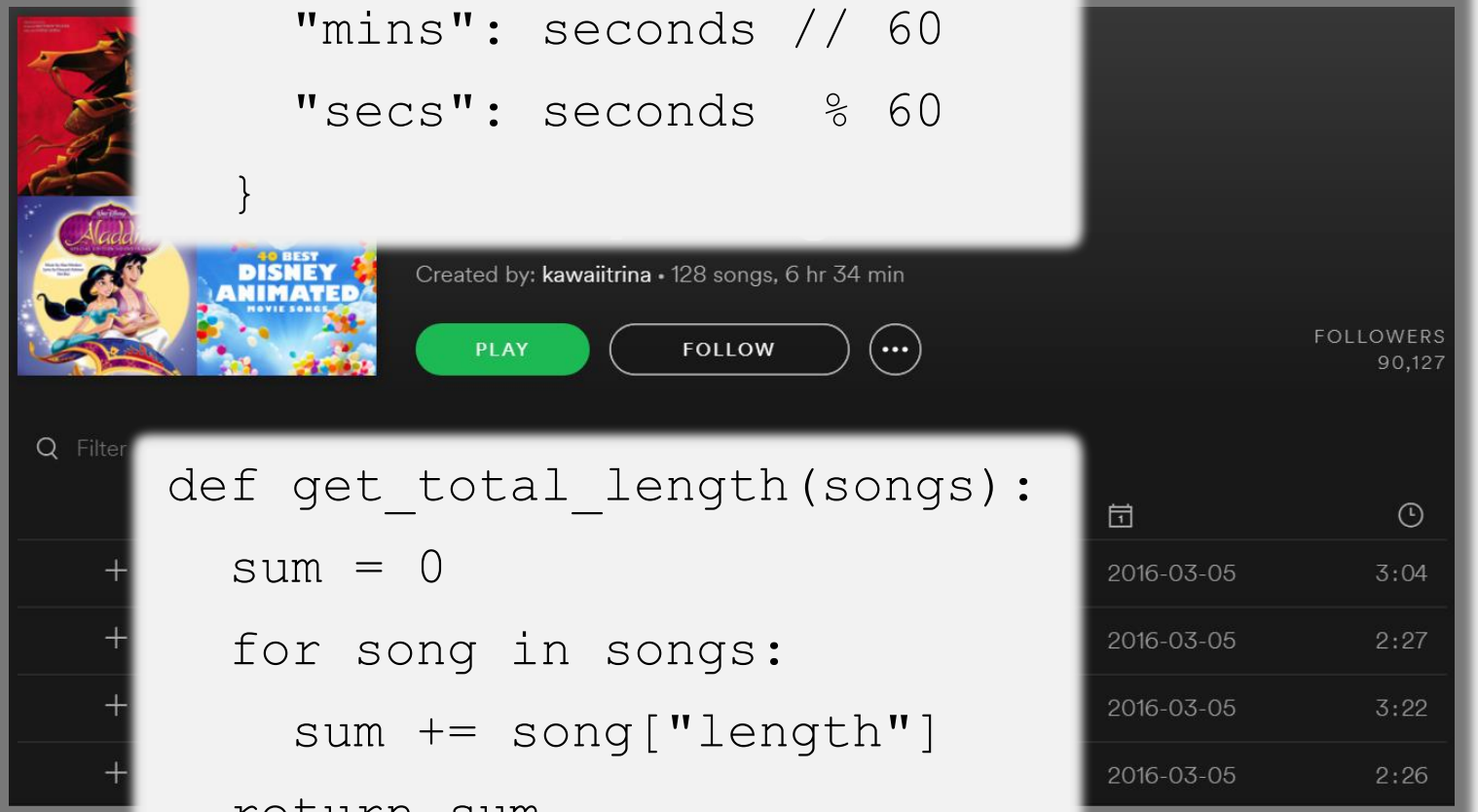
A playlist on Spotify.




```
songs = [
  {"title": "Honor To...",
   "length": 184},
  {"title": "Reflecti...",
   "length": 147},
  {"title": "I'll Mak...",
   "length": 202},
  {"title": "A Girl W...",
   "length": 146},
  # ...
]
```

MODELING EXAMPLES

```
def get_in_units(seconds):
  return {
    "mins": seconds // 60
    "secs": seconds  % 60
  }
```

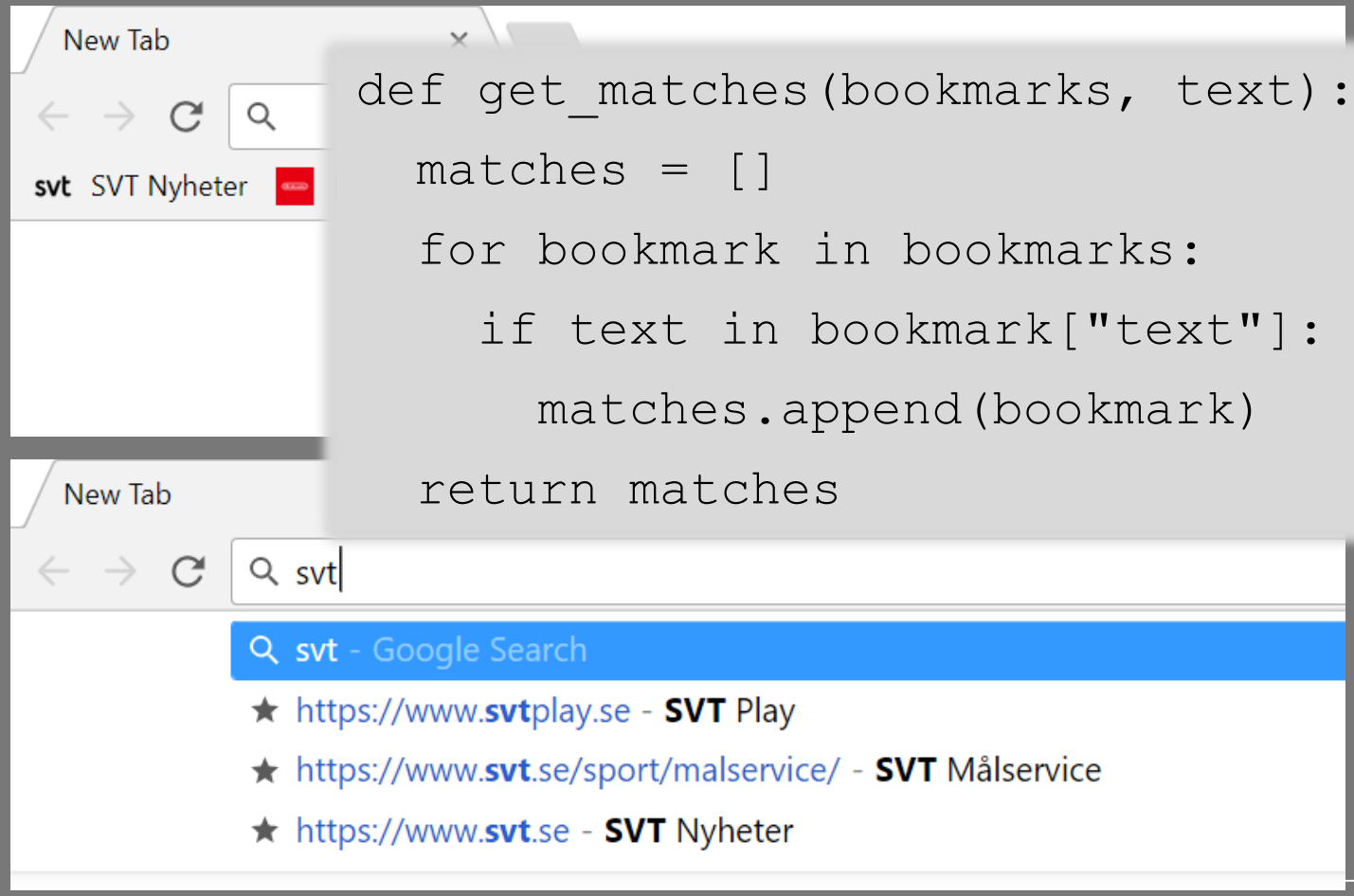



```
def get_total_length(songs):
  sum = 0
  for song in songs:
    sum += song["length"]
  return sum
```

```
songs = [
  {"title": "Honor To...",
   "length": 184},
  {"title": "Reflecti...",
   "length": 147},
  {"title": "I'll Mak...",
   "length": 202},
  {"title": "A Girl W...",
   "length": 146},
  # ...
]
```

MODELING EXAMPLES

Bookmarks in a web browser.




```
def get_matches(bookmarks, text):
  matches = []
  for bookmark in bookmarks:
    if text in bookmark["text"]:
      matches.append(bookmark)
  return matches
```

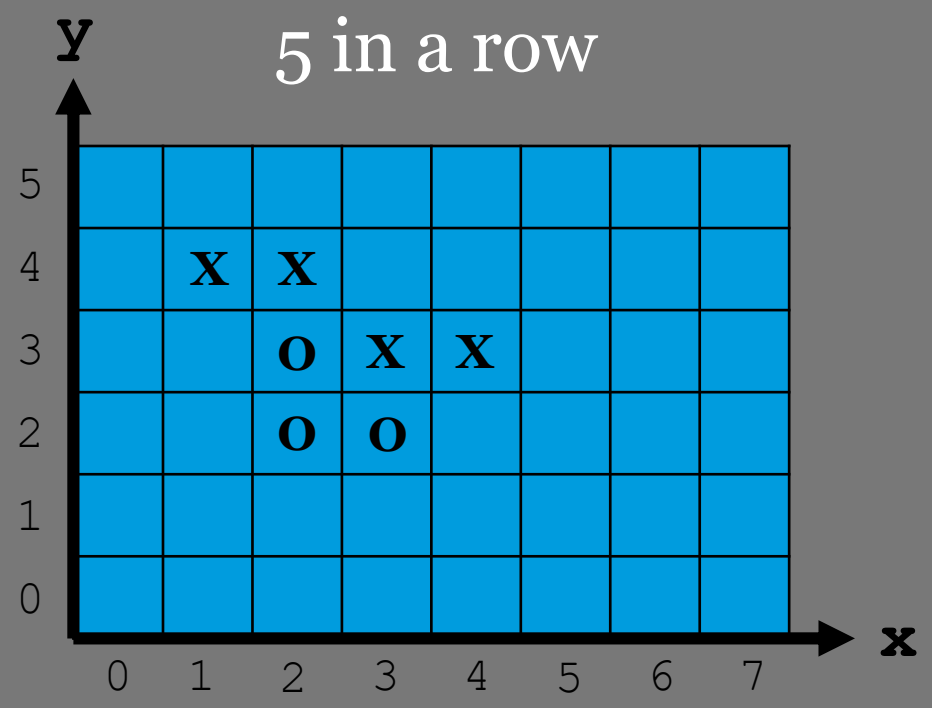
```
bookmarks = [
  {"text": "SVT Nyhet..."
   "url": "https://www..."},
  {"text": "Nintendo",
   "url": "https://nin..."},
  {"text": "SVT Play",
   "url": "https://www..."},
  {"text": "Jönköping...",
   "url": "https://ju.se"},
  {"text": "SVT Målser...",
   "url": "https://www..."}
]
```

MODELLING

5 in a row

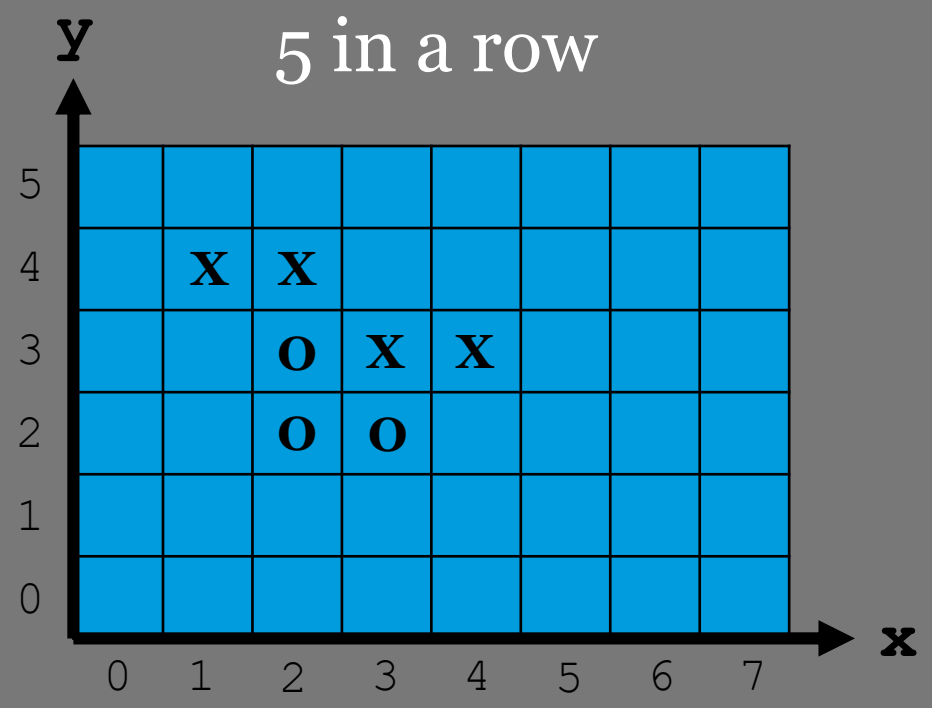
	X	X					
		O	X	X			
		O	O				

MODELLING



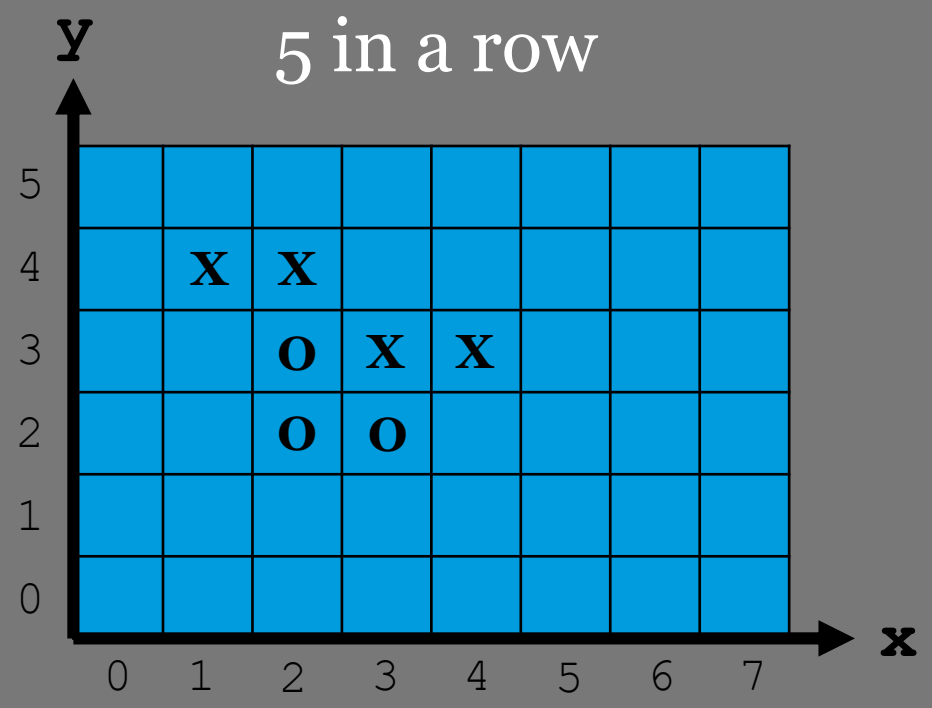

```
game = {
  'width': 8,
  'height': 6,
  'moves': [
    {'x': 1, 'y': 4, 'player': 'X'},
    {'x': 2, 'y': 3, 'player': 'O'},
    {'x': 2, 'y': 4, 'player': 'X'},
    {'x': 2, 'y': 2, 'player': 'O'},
    {'x': 3, 'y': 3, 'player': 'X'},
    {'x': 3, 'y': 2, 'player': 'O'},
    {'x': 4, 'y': 3, 'player': 'X'}
  ]
}
```

MODELLING



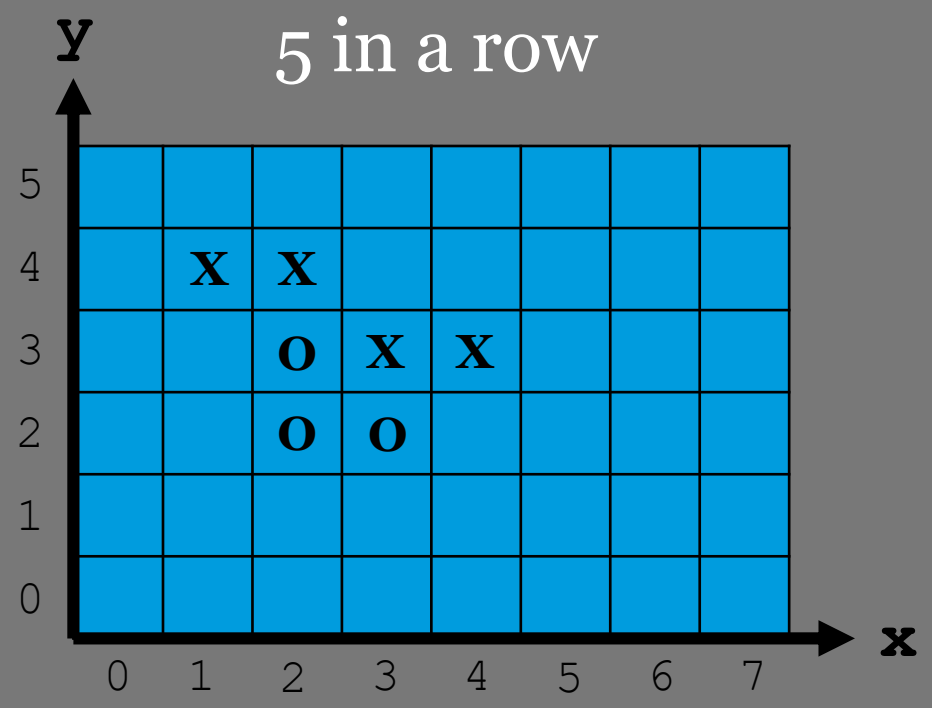

```
game = {
  'width': 8,
  'height': 6,
  'x-moves': [
    {'x': 1, 'y': 4},
    {'x': 2, 'y': 4},
    {'x': 3, 'y': 3},
    {'x': 4, 'y': 3}
  ],
  'o-moves': [
    {'x': 2, 'y': 3},
    {'x': 2, 'y': 2},
    {'x': 3, 'y': 2}
  ]
}
```

MODELLING




```
game = {
  'width': 8,
  'height': 6,
  'board': [
    [' ', ' ', ' ', ' ', ' ', ' ', ' ', ' '],
    [' ', 'X', 'X', ' ', ' ', ' ', ' ', ' '],
    [' ', ' ', 'O', 'X', 'X', ' ', ' ', ' '],
    [' ', ' ', 'O', 'O', ' ', ' ', ' ', ' '],
    [' ', ' ', ' ', ' ', ' ', ' ', ' ', ' '],
    [' ', ' ', ' ', ' ', ' ', ' ', ' ', ' ']
  ]
}
```

MODELLING




```
game = {
  'width': 8,
  'height': 6,
  'board': {
    (1, 4): 'X',
    (2, 3): 'O',
    (2, 4): 'X',
    (2, 2): 'O',
    (3, 3): 'X',
    (3, 2): 'O',
    (4, 3): 'X'
  }
}
```