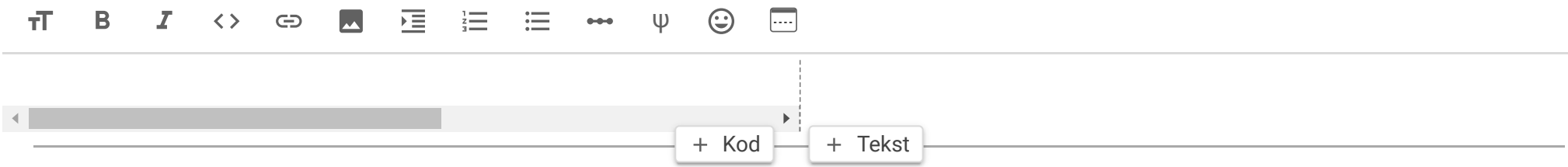
FrozenLake - generacja epizodu

```
import gym
import numpy as np
import random

env = gym.make("FrozenLake-v0", map_name='4x4', is_slippery=False)
```

Funkcja generująca politykę stochastyczną:

```
def create_random_sto_policy(env):
    policy = {}
    for key in range(0, env.observation_space.n):
        p = {}
        for action in range(0, env.action_space.n):
            p[action] = 1 / env.action_space.n
        policy[key] = p
    return policy
```



Testujemy:

```
policy = create_random_sto_policy(env)
policy
```

```
     {0: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
```

```
  1: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  2: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  3: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  4: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  5: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  6: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  7: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  8: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  9: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  10: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  11: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  12: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  13: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  14: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25},
  15: {0: 0.25, 1: 0.25, 2: 0.25, 3: 0.25}}
```

Funkcja generująca epizod:

```
def generate_episode(env, policy):
    env.reset()
    episode = []
    finished = False

    while not finished:
        s = env.s

        timestep = []
        timestep.append(s)

        n = random.uniform(0, sum(policy[s].values()))

        top_range = 0
        for prob in policy[s].items():
            top_range += prob[1]
            if n < top_range:
                action = prob[0]
                break
```

```
        #observation, reward, done, info
        _, reward, finished, _ = env.step(action)

        timestep.append(action)
        timestep.append(reward)

        episode.append(timestep)

    return episode
```

Testujemy:

```
print("LEFT = 0 DOWN = 1 RIGHT = 2 UP = 3")
for i in range(100):
  print("Epizod ",i,": ",generate_episode(env, policy))
```

```
LEFT = 0 DOWN = 1 RIGHT = 2 UP = 3
Epizod  0 :  [[0, 3, 0.0], [0, 0, 0.0], [0, 1, 0.0], [4, 1, 0.0], [8, 1, 0.0]]
Epizod  1 :  [[0, 1, 0.0], [4, 2, 0.0]]
Epizod  2 :  [[0, 3, 0.0], [0, 3, 0.0], [0, 1, 0.0], [4, 2, 0.0]]
Epizod  3 :  [[0, 3, 0.0], [0, 0, 0.0], [0, 1, 0.0], [4, 3, 0.0], [0, 2, 0.0], [1, 1, 0.0]]
Epizod  4 :  [[0, 0, 0.0], [0, 0, 0.0], [0, 1, 0.0], [4, 0, 0.0], [4, 1, 0.0], [8, 3, 0.0], [4, 0, 0.0], [4, 0, 0.0], [4, 1,
Epizod  5 :  [[0, 2, 0.0], [1, 0, 0.0], [0, 0, 0.0], [0, 1, 0.0], [4, 0, 0.0], [4, 1, 0.0], [8, 1, 0.0]]
Epizod  6 :  [[0, 0, 0.0], [0, 0, 0.0], [0, 0, 0.0], [0, 0, 0.0], [0, 0, 0.0], [0, 0, 0.0], [0, 2, 0.0], [1, 1, 0.0]]
Epizod  7 :  [[0, 2, 0.0], [1, 0, 0.0], [0, 1, 0.0], [4, 1, 0.0], [8, 0, 0.0], [8, 2, 0.0], [9, 1, 0.0], [13, 2, 0.0], [14, 0
Epizod  8 :  [[0, 3, 0.0], [0, 0, 0.0], [0, 1, 0.0], [4, 2, 0.0]]
Epizod  9 :  [[0, 1, 0.0], [4, 0, 0.0], [4, 1, 0.0], [8, 3, 0.0], [4, 1, 0.0], [8, 3, 0.0], [4, 1, 0.0], [8, 0, 0.0], [8, 3,
Epizod  10 :  [[0, 0, 0.0], [0, 1, 0.0], [4, 3, 0.0], [0, 3, 0.0], [0, 0, 0.0], [0, 0, 0.0], [0, 1, 0.0], [4, 0, 0.0], [4, 0,
Epizod  11 :  [[0, 3, 0.0], [0, 2, 0.0], [1, 0, 0.0], [0, 2, 0.0], [1, 3, 0.0], [1, 3, 0.0], [1, 1, 0.0]]
Epizod  12 :  [[0, 0, 0.0], [0, 1, 0.0], [4, 3, 0.0], [0, 3, 0.0], [0, 3, 0.0], [0, 1, 0.0], [4, 2, 0.0]]
Epizod  13 :  [[0, 0, 0.0], [0, 3, 0.0], [0, 3, 0.0], [0, 0, 0.0], [0, 0, 0.0], [0, 0, 0.0], [0, 2, 0.0], [1, 1, 0.0]]
Epizod  14 :  [[0, 3, 0.0], [0, 3, 0.0], [0, 1, 0.0], [4, 3, 0.0], [0, 1, 0.0], [4, 0, 0.0], [4, 2, 0.0]]
Epizod  15 :  [[0, 3, 0.0], [0, 3, 0.0], [0, 1, 0.0], [4, 3, 0.0], [0, 1, 0.0], [4, 2, 0.0]]
Epizod  16 :  [[0, 0, 0.0], [0, 1, 0.0], [4, 1, 0.0], [8, 0, 0.0], [8, 3, 0.0], [4, 3, 0.0], [0, 3, 0.0], [0, 1, 0.0], [4, 2,
Epizod  17 :  [[0, 1, 0.0], [4, 0, 0.0], [4, 1, 0.0], [8, 1, 0.0]]
Epizod  18 :  [[0, 2, 0.0], [1, 2, 0.0], [2, 1, 0.0], [6, 2, 0.0]]
```

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Epizod  19 :  [[0, 0, 0.0], [0, 3, 0.0], [0, 0, 0.0], [0, 1, 0.0], [4, 3, 0.0], [0, 0, 0.0], [0, 0, 0.0], [0, 3, 0.0], [0, 3,
Epizod  20 :  [[0, 2, 0.0], [1, 1, 0.0]]
Epizod  21 :  [[0, 2, 0.0], [1, 3, 0.0], [1, 3, 0.0], [1, 1, 0.0]]
Epizod  22 :  [[0, 0, 0.0], [0, 1, 0.0], [4, 2, 0.0]]
Epizod  23 :  [[0, 2, 0.0], [1, 0, 0.0], [0, 3, 0.0], [0, 2, 0.0], [1, 3, 0.0], [1, 1, 0.0]]
Epizod  24 :  [[0, 3, 0.0], [0, 3, 0.0], [0, 2, 0.0], [1, 1, 0.0]]
Epizod  25 :  [[0, 1, 0.0], [4, 2, 0.0]]
Epizod  26 :  [[0, 0, 0.0], [0, 3, 0.0], [0, 1, 0.0], [4, 3, 0.0], [0, 1, 0.0], [4, 0, 0.0], [4, 2, 0.0]]
Epizod  27 :  [[0, 1, 0.0], [4, 0, 0.0], [4, 2, 0.0]]
Epizod  28 :  [[0, 2, 0.0], [1, 2, 0.0], [2, 0, 0.0], [1, 3, 0.0], [1, 0, 0.0], [0, 0, 0.0], [0, 1, 0.0], [4, 1, 0.0], [8, 0,
Epizod  29 :  [[0, 2, 0.0], [1, 3, 0.0], [1, 0, 0.0], [0, 2, 0.0], [1, 1, 0.0]]
Epizod  30 :  [[0, 3, 0.0], [0, 2, 0.0], [1, 0, 0.0], [0, 1, 0.0], [4, 2, 0.0]]
Epizod  31 :  [[0, 1, 0.0], [4, 2, 0.0]]
Epizod  32 :  [[0, 1, 0.0], [4, 0, 0.0], [4, 3, 0.0], [0, 3, 0.0], [0, 0, 0.0], [0, 2, 0.0], [1, 2, 0.0], [2, 0, 0.0], [1, 2,
Epizod  33 :  [[0, 2, 0.0], [1, 2, 0.0], [2, 0, 0.0], [1, 1, 0.0]]
Epizod  34 :  [[0, 0, 0.0], [0, 3, 0.0], [0, 2, 0.0], [1, 3, 0.0], [1, 3, 0.0], [1, 1, 0.0]]
Epizod  35 :  [[0, 3, 0.0], [0, 2, 0.0], [1, 0, 0.0], [0, 2, 0.0], [1, 1, 0.0]]
Epizod  36 :  [[0, 1, 0.0], [4, 1, 0.0], [8, 3, 0.0], [4, 2, 0.0]]
Epizod  37 :  [[0, 3, 0.0], [0, 0, 0.0], [0, 2, 0.0], [1, 0, 0.0], [0, 0, 0.0], [0, 3, 0.0], [0, 1, 0.0], [4, 0, 0.0], [4, 1,
Epizod  38 :  [[0, 0, 0.0], [0, 2, 0.0], [1, 0, 0.0], [0, 1, 0.0], [4, 1, 0.0], [8, 1, 0.0]]
Epizod  39 :  [[0, 3, 0.0], [0, 2, 0.0], [1, 0, 0.0], [0, 2, 0.0], [1, 3, 0.0], [1, 0, 0.0], [0, 2, 0.0], [1, 1, 0.0]]
Epizod  40 :  [[0, 2, 0.0], [1, 3, 0.0], [1, 1, 0.0]]
Epizod  41 :  [[0, 0, 0.0], [0, 1, 0.0], [4, 3, 0.0], [0, 3, 0.0], [0, 2, 0.0], [1, 2, 0.0], [2, 2, 0.0], [3, 3, 0.0], [3, 3,
Epizod  42 :  [[0, 2, 0.0], [1, 2, 0.0], [2, 1, 0.0], [6, 1, 0.0], [10, 2, 0.0]]
Epizod  43 :  [[0, 2, 0.0], [1, 2, 0.0], [2, 0, 0.0], [1, 1, 0.0]]
Epizod  44 :  [[0, 2, 0.0], [1, 3, 0.0], [1, 2, 0.0], [2, 0, 0.0], [1, 2, 0.0], [2, 0, 0.0], [1, 1, 0.0]]
Epizod  45 :  [[0, 3, 0.0], [0, 2, 0.0], [1, 0, 0.0], [0, 3, 0.0], [0, 1, 0.0], [4, 1, 0.0], [8, 1, 0.0]]
Epizod  46 :  [[0, 0, 0.0], [0, 2, 0.0], [1, 3, 0.0], [1, 2, 0.0], [2, 3, 0.0], [2, 1, 0.0], [6, 2, 0.0]]
Epizod  47 :  [[0, 1, 0.0], [4, 1, 0.0], [8, 2, 0.0], [9, 3, 0.0]]
Epizod  48 :  [[0, 1, 0.0], [4, 2, 0.0]]
Epizod  49 :  [[0, 0, 0.0], [0, 3, 0.0], [0, 3, 0.0], [0, 2, 0.0], [1, 3, 0.0], [1, 1, 0.0]]
Epizod  50 :  [[0, 2, 0.0], [1, 3, 0.0], [1, 0, 0.0], [0, 3, 0.0], [0, 3, 0.0], [0, 2, 0.0], [1, 2, 0.0], [2, 2, 0.0], [3, 0,
Epizod  51 :  [[0, 3, 0.0], [0, 2, 0.0], [1, 2, 0.0], [2, 3, 0.0], [2, 2, 0.0], [3, 3, 0.0], [3, 3, 0.0], [3, 0, 0.0], [2, 2,
Epizod  52 :  [[0, 2, 0.0], [1, 2, 0.0], [2, 0, 0.0], [1, 3, 0.0], [1, 0, 0.0], [0, 3, 0.0], [0, 1, 0.0], [4, 2, 0.0]]
Epizod  53 :  [[0, 0, 0.0], [0, 1, 0.0], [4, 3, 0.0], [0, 3, 0.0], [0, 2, 0.0], [1, 2, 0.0], [2, 2, 0.0], [3, 3, 0.0], [3, 1,
Epizod  54 :  [[0, 1, 0.0], [4, 2, 0.0]]
Epizod  55 :  [[0, 3, 0.0], [0, 2, 0.0], [1, 1, 0.0]]
```

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