Problem 2

October 25, 2023

[1]:
```
import numpy as np
from numpy.linalg import matrix_power
```

0.1 a.

Give a similar description of $(A_n)^2$

$n = 3$

[2]:
```
A = np.array([[0, 1, 1], [1, 0, 1], [1, 1, 0]])
matrix_power(A, 2)
```

[2]:
```
array([[2, 1, 1],
       [1, 2, 1],
       [1, 1, 2]])
```

$n = 5$

[3]:
```
A = np.array(
    [
        [0, 1, 1, 1, 1],
        [1, 0, 1, 1, 1],
        [1, 1, 0, 1, 1],
        [1, 1, 1, 0, 1],
        [1, 1, 1, 1, 0],
    ]
)
matrix_power(A, 2)
```

[3]:
```
array([[4, 3, 3, 3, 3],
       [3, 4, 3, 3, 3],
       [3, 3, 4, 3, 3],
       [3, 3, 3, 4, 3],
       [3, 3, 3, 3, 4]])
```

$n = 11$

[4]:
```
A = np.array(
    [
        [0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1],
```

```
        [1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1],
        [1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1],
        [1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1],
        [1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1],
        [1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1],
        [1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1],
        [1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1],
        [1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1],
        [1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1],
        [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0],
    ]
)
matrix_power(A, 2)
```

[4]:
```
array([[10,  9,  9,  9,  9,  9,  9,  9,  9,  9,  9],
       [ 9, 10,  9,  9,  9,  9,  9,  9,  9,  9,  9],
       [ 9,  9, 10,  9,  9,  9,  9,  9,  9,  9,  9],
       [ 9,  9,  9, 10,  9,  9,  9,  9,  9,  9,  9],
       [ 9,  9,  9,  9, 10,  9,  9,  9,  9,  9,  9],
       [ 9,  9,  9,  9,  9, 10,  9,  9,  9,  9,  9],
       [ 9,  9,  9,  9,  9,  9, 10,  9,  9,  9,  9],
       [ 9,  9,  9,  9,  9,  9,  9, 10,  9,  9,  9],
       [ 9,  9,  9,  9,  9,  9,  9,  9, 10,  9,  9],
       [ 9,  9,  9,  9,  9,  9,  9,  9,  9, 10,  9],
       [ 9,  9,  9,  9,  9,  9,  9,  9,  9,  9, 10]])
```