

# C3\_solution

reinforcement learning study

2021 2 4

## Exercise 1

Transition Matrix :

$$P = \begin{pmatrix} 1/2 & 1/2 & 0 \\ 1/2 & 1/4 & 1/4 \\ 0 & 1/3 & 2/3 \end{pmatrix}$$

Transition Diagram :

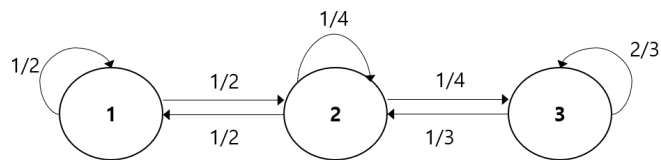


Figure 1: Example 1 Transition Diagram

## Remark

- A state  $i$  is said to be recurrent if, starting from  $i$ , the probability of getting back to  $i$  is 1
- A state  $i$  is said to be transient if, starting from  $i$ , the probability of getting back to  $i$  is less than 1

recurrent state : {1,2,3} ,All states communicate, all states recurrent

## Exercise 2

Transition Matrix :

$$P = \begin{pmatrix} 1 & 0 & 0 \\ 1/4 & 1/2 & 1/4 \\ 0 & 0 & 1 \end{pmatrix}$$

Transition Diagram :

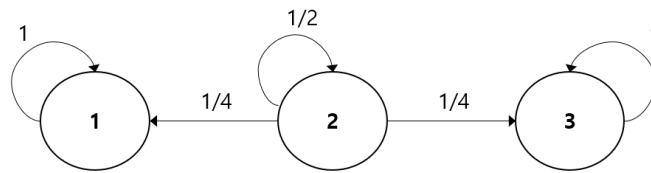


Figure 2: Example 2 Transition Diagram

### Remark

- A state  $i$  is said to be recurrent if, starting from  $i$ , the probability of getting back to  $i$  is 1
- A state  $i$  is said to be transient if, starting from  $i$ , the probability of getting back to  $i$  is less than 1
- A state  $i$  is said to be absorbing state, as a special case of recurrent state, if  $P_{ii} = 1$  (You can never leave the state  $i$  if you get there)

recurrent state :  $\{1,3\}$

transient state :  $\{2\}$

absorbing state :  $\{1,3\}$

### Exercise 3

Transition Matrix :

$$P = \begin{pmatrix} 1 & 0 & 0 \\ 1/3 & 1/2 & 1/6 \\ 0 & 0 & 1 \end{pmatrix}$$

Transition Diagram :

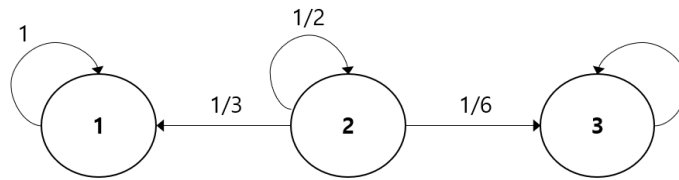


Figure 3: Example 3 Transition Diagram

#### Remark

- A state  $i$  is said to be recurrent if, starting from  $i$ , the probability of getting back to  $i$  is 1
- A state  $i$  is said to be transient if, starting from  $i$ , the probability of getting back to  $i$  is less than 1
- A state  $i$  is said to be absorbing state, as a special case of recurrent state, if  $P_{ii} = 1$  (You can never leave the state  $i$  if you get there)

recurrent state :  $\{1,3\}$

transient state :  $\{2\}$

absorbing state :  $\{1,3\}$

## Exercise 4

Transition Matrix :

$$P = \begin{pmatrix} 1/2 & 1/2 & 0 & 0 \\ 1/2 & 1/2 & 0 & 0 \\ 1/4 & 1/4 & 1/4 & 1/4 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Transition Diagram :

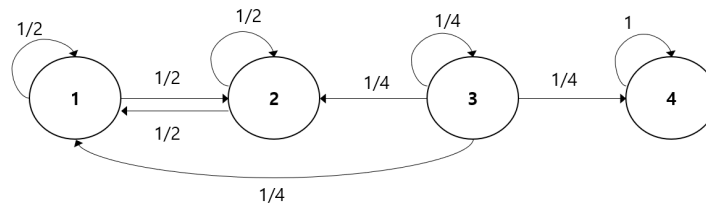


Figure 4: Example 4 Transition Diagram

### Remark

- A state  $i$  is said to be recurrent if, starting from  $i$ , the probability of getting back to  $i$  is 1
- A state  $i$  is said to be transient if, starting from  $i$ , the probability of getting back to  $i$  is less than 1
- A state  $i$  is said to be absorbing state, as a special case of recurrent state, if  $P_{ii} = 1$  (You can never leave the state  $i$  if you get there)

recurrent state :  $\{1,2,4\}$

transient state :  $\{3\}$

absorbing state :  $\{4\}$