



## CCDSTRU Project Specifications

Term 2, AY 2020–2021

Due: **May 24, 2021 (M)** *on or before 0730*

Implement a computer program (either in C or Java) following the specifications of the system given below.

### Applicable Sets

- $\mathbf{A} : \{x \in \mathbb{Z}^+ \mid x \leq 4\}$
- $\mathbf{P} : \mathbf{A} \times \mathbf{A}$
- $\mathbf{B} : \{\text{true}, \text{false}\}$
- $\mathbf{W} : \{\{(1, 4), (2, 4), (3, 4)\}, \{(2, 2), (3, 3), (4, 4)\}, \{(2, 3), (3, 2), (4, 1)\}, \{(4, 2), (4, 3), (4, 4)\}\}$
- $\mathbf{H} : \{(1, 1), (1, 2), (1, 3), (2, 1), (3, 1)\}$

### System Variables

- $\mathbf{Ord}, \mathbf{Cha}, \mathbf{Free} \subseteq \mathbf{P}$
- $turn \in \mathbf{B}$
- $over \in \mathbf{B}$

### System Facts

- $\mathbf{Free} = \mathbf{P} - (\mathbf{Ord} \cup \mathbf{Cha})$
- $over \leftrightarrow (\mathbf{Cha} \in \mathbf{W} \vee \mathbf{Free} - \mathbf{H} = \emptyset)$

### System Initialization

- $turn = \text{true}$
- $\mathbf{Ord} = \emptyset$
- $\mathbf{Cha} = \emptyset$

### System States and Behavior

**NextPlayerMove** ( $pos \in \mathbf{P}$ )

$$(turn \wedge pos \notin \mathbf{H} \wedge pos \in \mathbf{Free}) \rightarrow \begin{aligned} &\mathbf{Cha} = \mathbf{Cha} \cup \{pos\} \\ &\wedge turn = \neg turn \end{aligned}$$

$$(\neg turn \wedge pos \in \mathbf{Free} \wedge |\mathbf{Ord}| < 4) \rightarrow \begin{aligned} &\mathbf{Ord} = \mathbf{Ord} \cup \{pos\} \\ &\wedge turn = \neg turn \end{aligned}$$

$$(\neg turn \wedge |\mathbf{Ord}| = 4 \wedge pos \in \mathbf{Ord}) \rightarrow \mathbf{Ord} = \mathbf{Ord} - \{pos\}$$

**GameOver** ( $over$ )

$$result \in \{\text{Ord wins}, \text{Cha wins}\}$$

$$\mathbf{Cha} \in \mathbf{W} \rightarrow result = \text{Cha Wins}$$

$$\mathbf{Free} - \mathbf{H} = \emptyset \rightarrow result = \text{Ord Wins}$$