De La Salle University
Department of Software Technology

CCDSTRU Project Specifications
Term 2, AY 2022–2023
Due: **Apr 11, 2023 (T) 0800**

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

Applicable Sets

$\mathbf{A} : \{x \in \mathbf{Z}^+ \mid x < 4\}$

$\mathbf{S} : \mathbf{A} \times \mathbf{A}$

$\mathbf{V} : \{\text{true}, \text{false}\}$

$\mathbf{P} : \{x \in \mathbf{Z}^+ \mid x < 10\}$

$\mathbf{T} : \{1\} \times \mathbf{A}$

$\mathbf{M} : \{2\} \times \mathbf{A}$

$\mathbf{B} : \{3\} \times \mathbf{A}$

$\mathbf{L} : \mathbf{A} \times \{1\}$

$\mathbf{C} : \mathbf{A} \times \{2\}$

$\mathbf{R} : \mathbf{A} \times \{3\}$

$\mathbf{F} : \{x \in \mathcal{P}(S) \mid |x| = 3\} - \{\{(1,1),(2,2),(3,3)\}, \{(1,3),(2,2),(3,1)\}\}$

System Variables

$Occ, Free \subseteq \mathbf{S}$

$One, Two, Three, Four, Five, Six \subseteq \mathbf{P}$

$Peg \subseteq \mathbf{P}$

$W \subseteq \mathcal{P}(\mathbf{P})$

$ok \in \mathbf{V}$

$turn \in \mathbf{V}$

$over \in \mathbf{V}$

$next \in \mathbf{V}$

System Facts

$Free = \mathbf{S} - Occ$

$Peg = \mathbf{P} - (One \cup Two \cup Three \cup Four \cup Five \cup Six)$

$W = \{One\} \cup \{Two\} \cup \{Three\} \cup \{Four\} \cup \{Five\} \cup \{Six\}$

$over \leftrightarrow \left(\exists w \left(w \in \mathbf{W} \wedge |w| = 3 \wedge \sum_{a \in w} a < 15 \right) \vee \forall w \left(w \in \mathbf{W} \wedge |w| = 3 \wedge \sum_{a \in w} a = 15 \right) \right)$

System Initialization

$ok = \text{false}$

$next = \text{false}$

$turn = \text{true}$

$One = \varnothing$

$Two = \varnothing$

$Three = \varnothing$

$Four = \varnothing$

$Five = \varnothing$

$Six = \varnothing$

$Peg = \mathbf{P}$

System States and Behavior

NextPlayerMove($peg \in \mathbf{P}, pos \in \mathbf{S}$)

$peg \in Peg \land pos \in Free$	$\rightarrow$	$ok = \neg ok$
		$\land\, Occ = Occ \cup \{pos\}$
$ok \land pos \in \mathbf{T}$	$\rightarrow$	$One = One \cup \{peg\}$
		$\land\, next = \neg next$
$ok \land pos \in \mathbf{M}$	$\rightarrow$	$Two = Two \cup \{peg\}$
		$\land\, next = \neg next$
$ok \land pos \in \mathbf{B}$	$\rightarrow$	$Three = Three \cup \{peg\}$
		$\land\, next = \neg next$
$ok \land next \land pos \in \mathbf{L}$	$\rightarrow$	$Four = Four \cup \{peg\}$
		$\land\, next = \neg next$
		$\land\, ok = \neg ok$
$ok \land next \land pos \in \mathbf{C}$	$\rightarrow$	$Five = Five \cup \{peg\}$
		$\land\, next = \neg next$
		$\land\, ok = \neg ok$
$ok \land next \land pos \in \mathbf{R}$	$\rightarrow$	$Six = Six \cup \{peg\}$
		$\land\, next = \neg next$
		$\land\, ok = \neg ok$

GameOver($over$)

$result \in \{\text{B wins, A wins}\}$

$over \land turn \land \exists w\, (w \in \mathbf{W} \land |w| = 3 \land \sum_{a \in w} a < 15)$	$\rightarrow$	$result = \text{B wins}$
$over \land \neg turn \land \exists w\, (w \in \mathbf{W} \land |w| = 3 \land \sum_{a \in w} a < 15)$	$\rightarrow$	$result = \text{A wins}$
$over \land turn \land \forall w,\, (w \in \mathbf{W} \land |w| = 3 \land \sum_{a \in w} a = 15)$	$\rightarrow$	$result = \text{A wins}$
$over \land \neg turn \land \forall w,\, (w \in \mathbf{W} \land |w| = 3 \land \sum_{a \in w} a = 15)$	$\rightarrow$	$result = \text{B wins}$
$\neg over$	$\rightarrow$	$turn = \neg turn$