De La Salle University
Department of Software Technology

CCDSTRU Project Specifications
Term 2, AY 2023–2024
Due: **Apr 1, 2024 (M) before 0800**

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

Applicable Sets

$\mathbf{U} : \{x \in \mathbf{Z}^+ \mid x < 3\}$

$\mathbf{T} : \{x \in \mathbf{Z}^+ \mid x < 7\}$

$\mathbf{C} : \mathbf{U} \times \mathbf{U}$

$\mathbf{F} : \mathbf{T} \times \mathbf{T}$

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

$\mathbf{P} : \{\{(1,1),(2,2)\},\{(1,2),(2,1)\}\}$

$\mathbf{S} : \{\{(1,1),(1,3),(2,2),(3,1),(3,3)\},$
$\{(4,4),(4,6),(5,5),(6,4),(6,6)\},$
$\{(1,5),(2,4),(2,5),(2,6),(3,5)\},$
$\{(4,1),(4,3),(5,1),(5,3),(6,1),(6,3)\}\}$

System Variables

$good \in \mathbf{V}$ $over \in \mathbf{V}$ $next \in \mathbf{V}$

$C_1, C_2 \subseteq \mathbf{C}$ $F_1, F_2, F_3 \subseteq \mathbf{F}$

System Facts

$F_3 = \mathbf{F} - (F_1 \cup F_2)$

$over \leftrightarrow ((|F_3| = 0) \vee \exists x\,(x \in \mathcal{P}(C_1) \wedge |x| > 0 \wedge x \in \mathbf{P}) \vee \exists x\,(x \in \mathcal{P}(C_2) \wedge |x| > 0 \wedge x \in \mathbf{P}))$

System Initialization

$good = \text{false}$ $C_1 = \varnothing$ $F_1 = \varnothing$

$next = \text{false}$ $C_2 = \varnothing$ $F_2 = \varnothing$

System States and Behavior

`NextPlayerMove`($pos \in \mathbf{F}$)

$(a, b) = pos$

$c = \left\lfloor \frac{a-1}{3} \right\rfloor + 1$

$d = \left\lfloor \frac{b-1}{3} \right\rfloor + 1$

$(\neg over \wedge next \wedge pos \in F_3) \rightarrow (good = \neg good \wedge\ F_1 = F_1 \cup \{pos\})$

$(\neg over \wedge \neg next \wedge pos \in F_3) \rightarrow (good = \neg good \wedge\ F_2 = F_2 \cup \{pos\})$

$(\neg over \wedge good \wedge next \wedge |\mathcal{P}(F_1) \cap \mathbf{S}| > |C_1|) \rightarrow C_1 = C_1 \cup \{(c, d)\}$

$(\neg over \wedge good \wedge \neg next \wedge |\mathcal{P}(F_2) \cap \mathbf{S}| > |C_2|) \rightarrow C_2 = C_2 \cup \{(c, d)\}$

$(\neg over \wedge good) \rightarrow good = \neg good$

`GameOver`($over$)

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

$(over \wedge next \wedge \exists x\,(x \in \mathcal{P}(C_1) \wedge |x| > 0 \wedge x \in \mathbf{P})) \rightarrow result = \text{“A wins”}$

$(over \wedge \neg next \wedge \exists x\,(x \in \mathcal{P}(C_2) \wedge |x| > 0 \wedge x \in \mathbf{P})) \rightarrow result = \text{“B wins”}$

$\neg over \rightarrow (next = \neg next)$