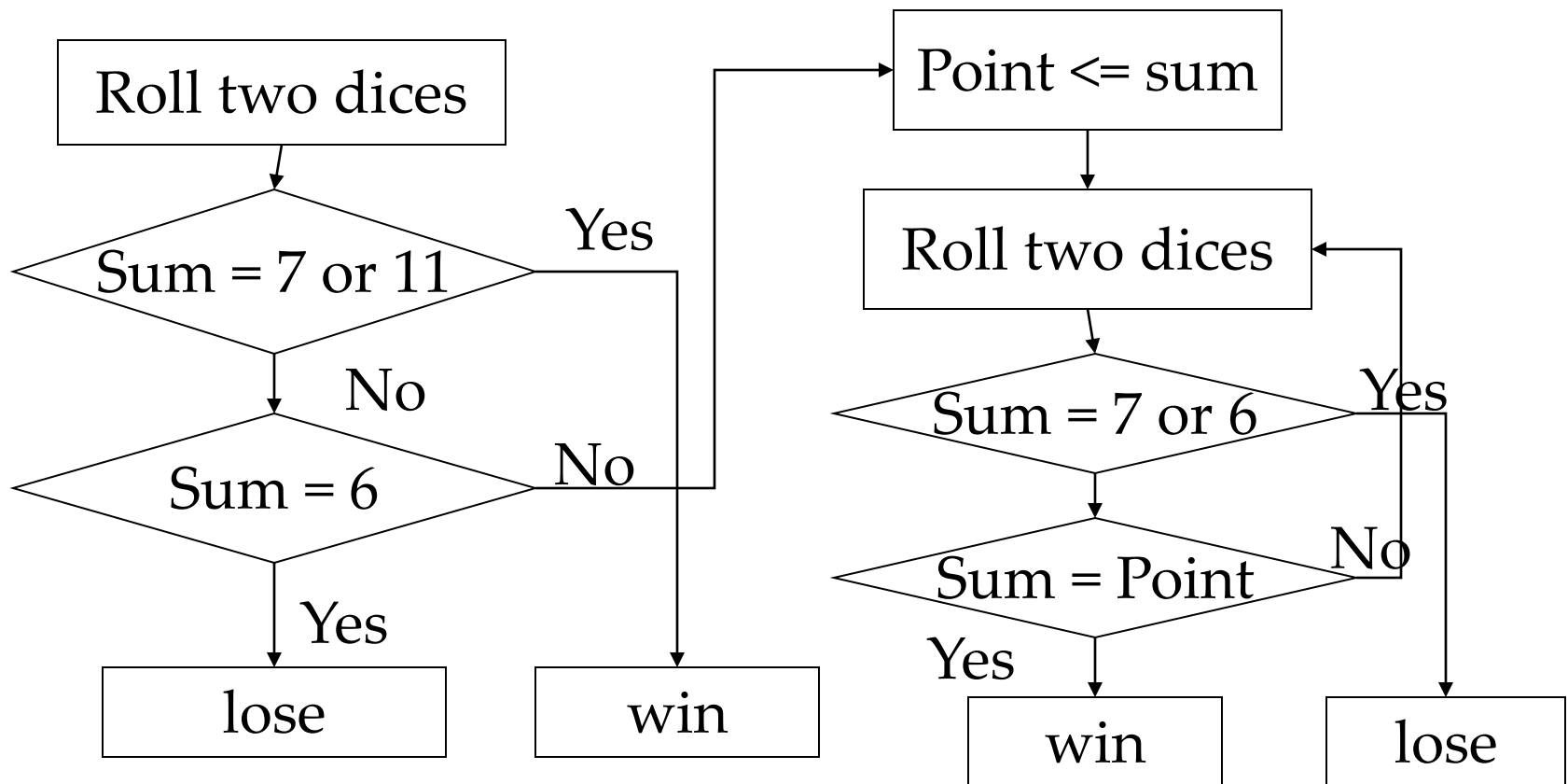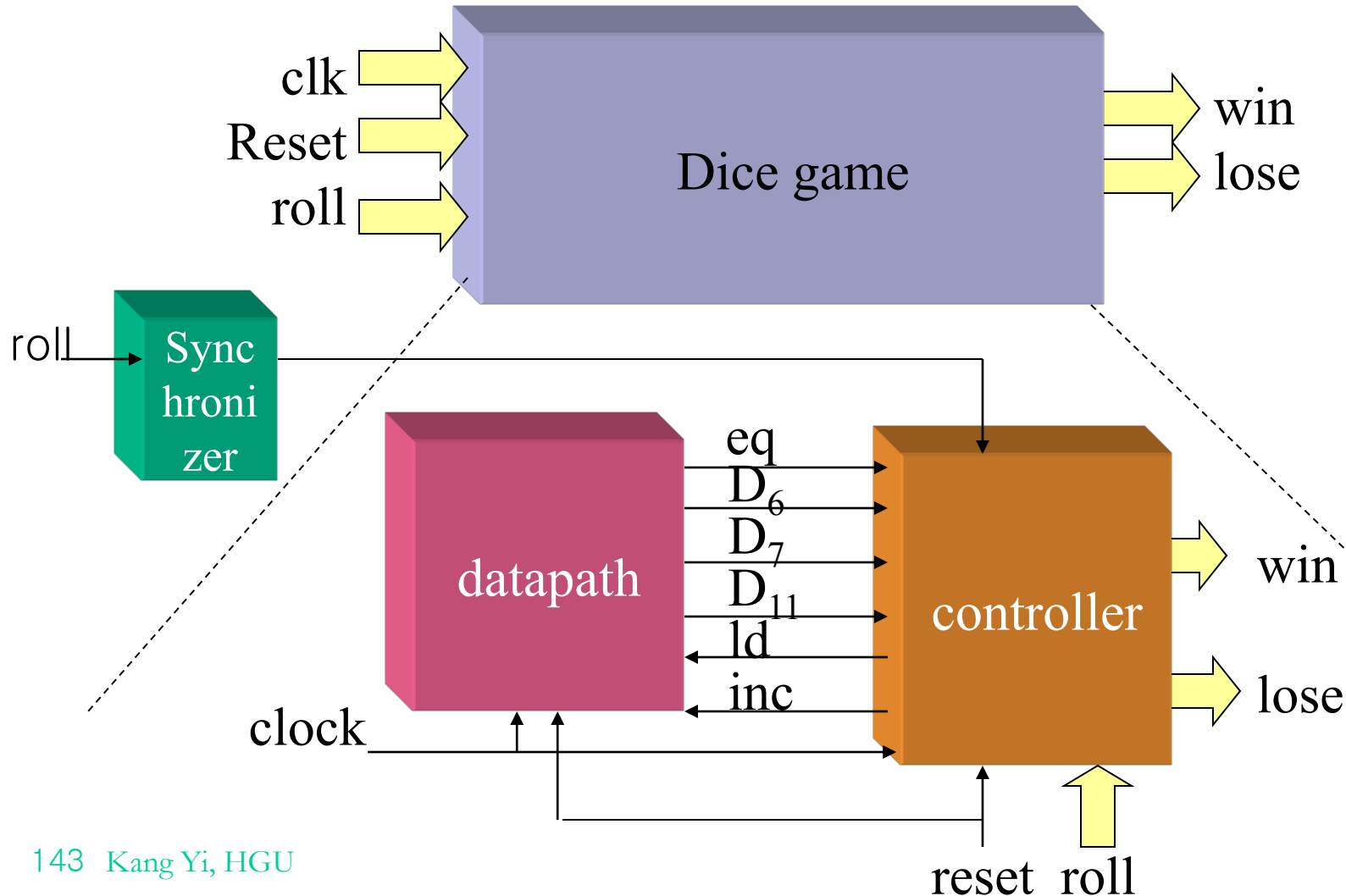# Exercises

1. Design a Dice Game Machine. The game is played with 2 dices. The controller inputs are X, clock, and reset. The outputs are Win, Lose, Dice0[2:0], and Dice1[1:0]. The Flowchart for the game is as follows.
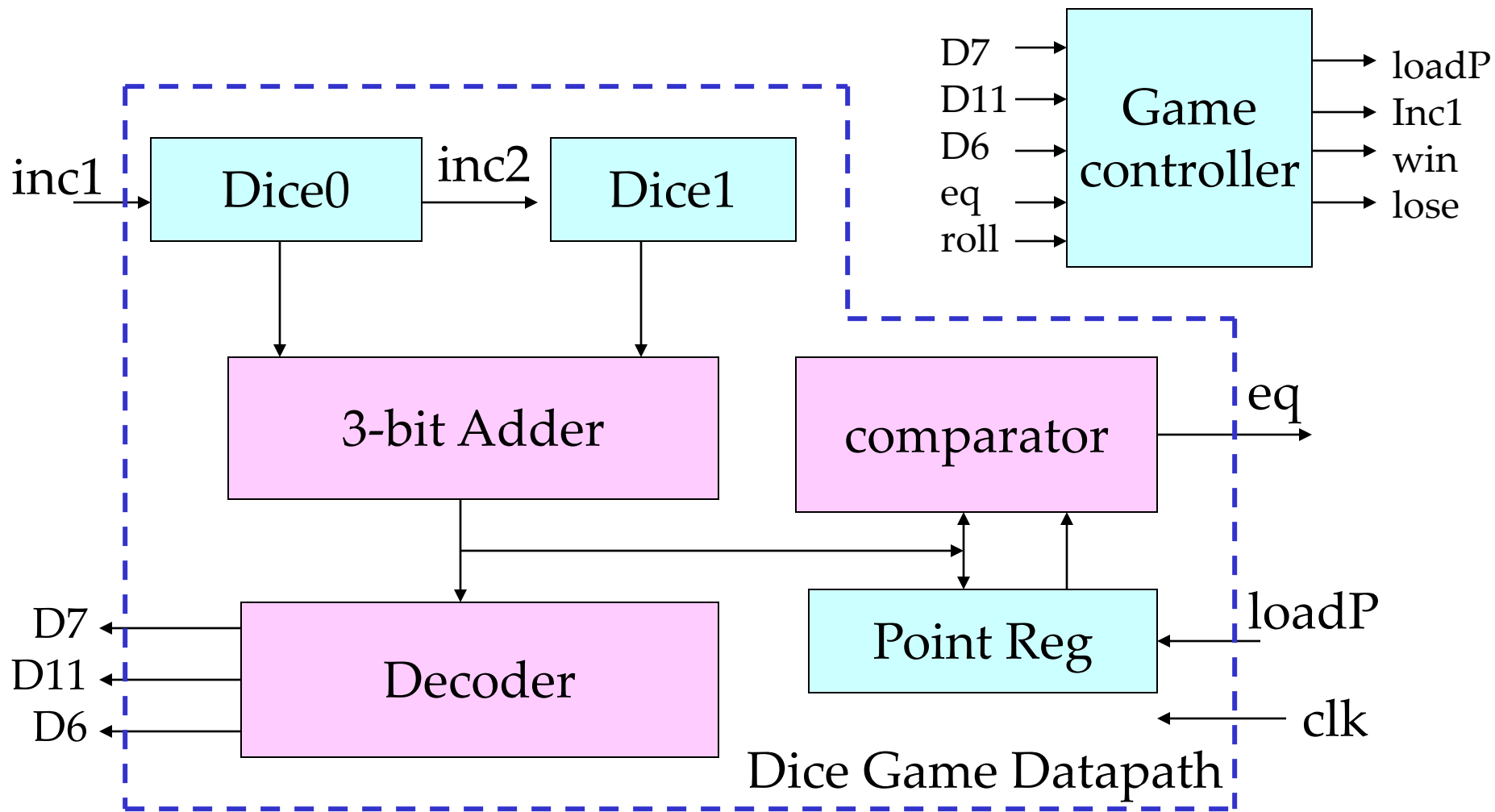
Hints for the Ans (1)
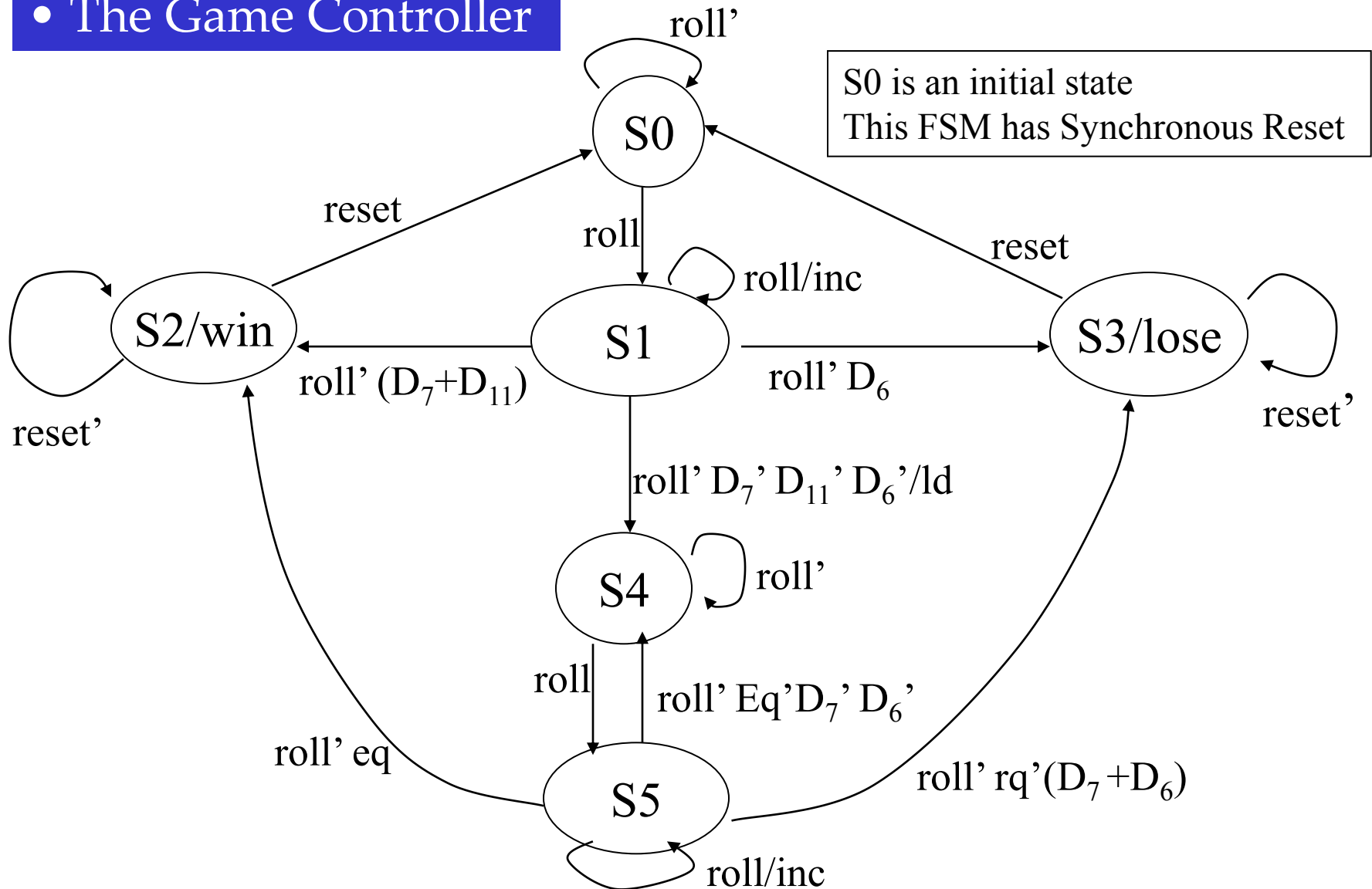
- The Top-Level Submodules

Hints for the Ans (2)

- The Datapath and Control Signals

Dice Game Datapath

Hints for the Ans (3)

- The Game Controller

S0 is an initial state
This FSM has Synchronous Reset

roll'

S0

reset

roll

reset

S2/win

roll/inc

S1

S3/lose

reset'

roll' (D_7+D_{11})

roll' D_6

reset'

roll' D_7' D_{11}' D_6'/ld

S4

roll'

roll

roll' Eq'D_7' D_6'

roll' eq

roll' rq'(D_7+D_6)

S5

roll/inc

Hints (Synchronizer Design)

- Sometimes Asynchronous Inputs are unavoidable (e.g. User Inputs: roll)
- Asynchronous Inputs : Signals from different Clock Domain
- Synchronizer Objectives : Synchronization & DeBouncing

Clock domain B

Clock domain A

Asynchronous Inputs

X

A

Y

System core logic

Clock B

Clock A

Clock A

X

A

Y