Module 3: Behavioral Synthesis
Lecture 3.12: Resource Sharing

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Resource Sharing: Overview

- We need to determine the structure that will implement the behavior in accordance with the derived schedule.
- This is called **resource sharing**.
- Resource sharing = **allocation** + **binding** or **assignment**
  - NOTE: If resource-constrained scheduling was performed, the allocation has been fixed. Otherwise, allocation is also performed during resource sharing.
- Resource sharing profoundly impacts the quality of the RTL circuit generated:
  - Area
  - Timing (clock period)
  - Power
Resource Sharing: Sub-Problems

- Resource sharing consists of three important sub-problems:
  - **Functional unit binding**: Map operations in the scheduled behavior to functional unit instances.
  - **Register binding**: Map variables in the scheduled behavior to register instances.
  - **Interconnect generation**: Define the interconnect structures between the FUs and registers.
Resource Sharing: Basic Constraints

• Rules for resource sharing
  – Operations that are not executed in the same cycle / control state may share the same functional unit
  – Operations that are in mutually exclusive control paths may share a functional unit
  – Variables that do not have overlapping lifetimes may share a register
  – Variables that are defined and used in mutually exclusive control paths may share a register
Resource Sharing: Impact on Area

• If the number of resources is not pre-determined (e.g., time-constrained scheduling)
  – Resource sharing directly impacts the number of FUs and registers

• For a fixed resource allocation (e.g., pre-determined for resource-constrained scheduling)
  – The primary impact of resource sharing (binding) is on the interconnect (multiplexers / buses + wires)

Example: