



# Lab02 Merge Sort

---

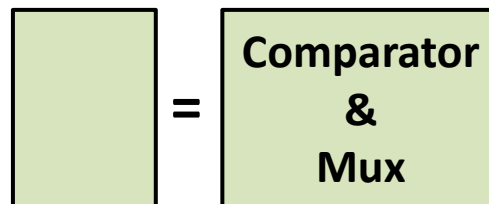
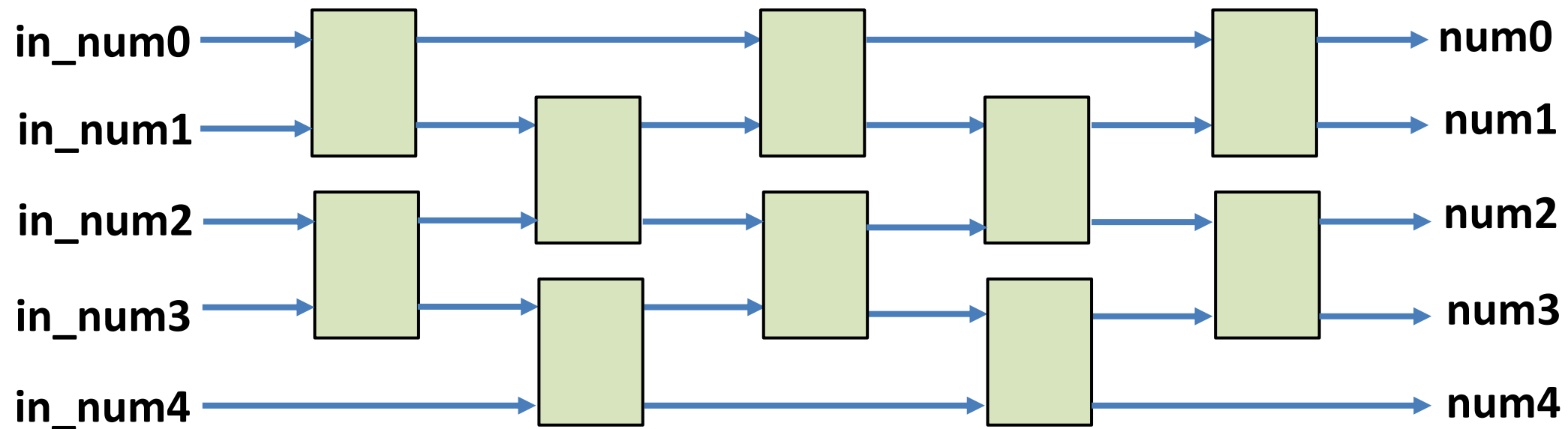
# Sorting

- 輸入五個數字{in\_num0, in\_num1, in\_num2, in\_num3, in\_num4}
- 將五個數字由小至大進行排序之後，輸出中位數 out\_num
- Ex: 輸入數字: 5, 4, 1, 3, 2 → 輸出: 3
  - Bubble sort, Merge sort

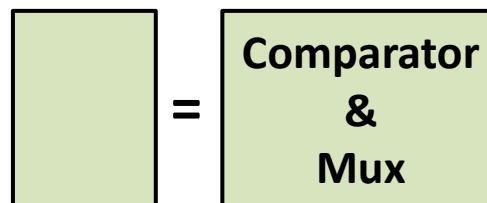
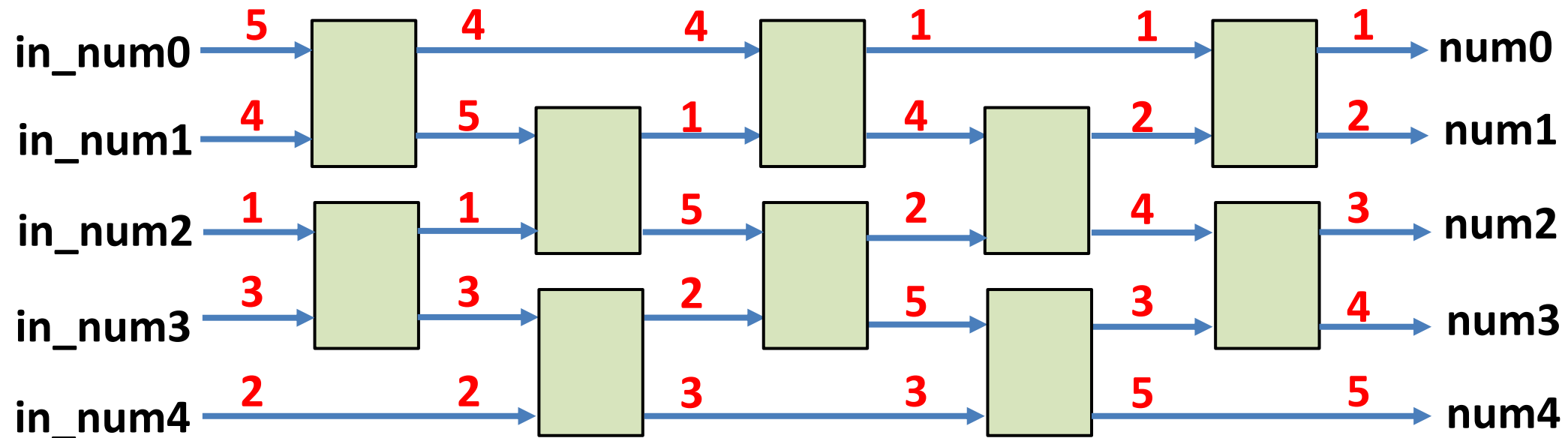
# Sorting

- 氣泡排序法 (Bubble sort)
  - Easy for software
  - Use recursive function, for loop
- 合併排序法 (Merge sort)
  - Easy for hardware
  - Use comparator

# 參考架構 (Merge Sort)



# 參考架構 (Merge Sort)



# Sort.sv

Input Signal	Bit width	Definition
in_num0	6	Random 6-bit numbers
in_num1	6	
in_num2	6	
in_num3	6	
in_num4	6	

Input Signal	Bit width	Definition
out_num	6	Median of the input numbers

# Directory

- 00\_TESTBED
  - TESTBED.sv
  - PATTERN.sv
- 01\_RTL
  - 01\_run
  - 09\_clean\_up
  - Sort.sv
- 02\_SYN
  - 01\_run\_dc
  - 09\_clean\_up
- 03\_GATE
  - 01\_run
  - 09\_clean\_up
- 09\_UPLOAD
  - 01\_upload
  - 02\_download

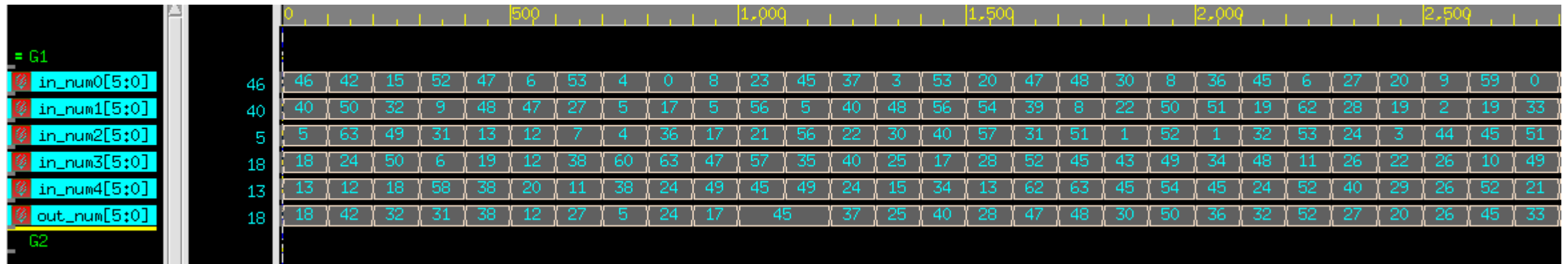
# Command

- `tar -xvf ~dcsta01/Lab02.tar`
- `cd Lab02/01_RTL/`



# RTL simulation

- cd Lab01/01\_RTL/
- ./01\_run (電路模擬)
- ./09\_clean\_up (清除波型檔)
- Verdi & (看波型)
  - 範例波型



# Synthesis

- `cd ../02_SYN/`
- `./01_run_dc` (合成電路)
- `./09_clean_up` (清除合成結果)
  - 合成結果: (不能有Error、要有Area report、Timing report slack met、不能有Latch)

# Synthesis

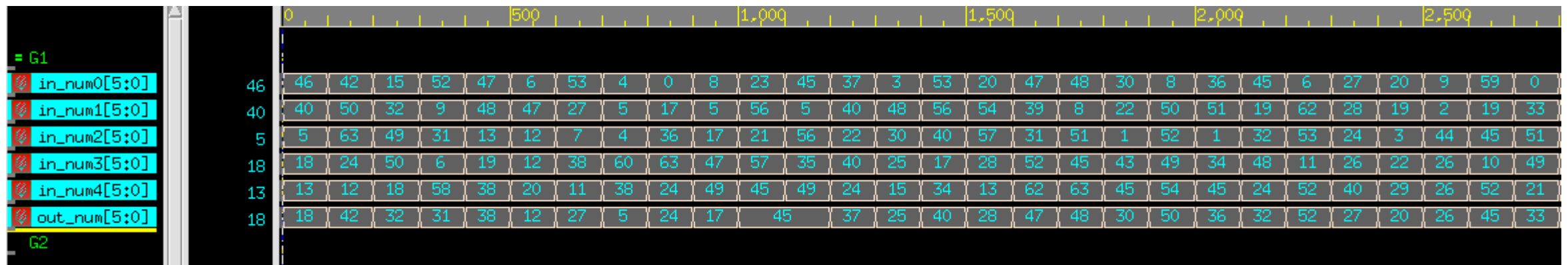
- 合成的timing report中的 slack必須 $\geq 0$  (MET)
- 如果出現timing violation  $\rightarrow$  Demo Fail ! (slack  $< 0$ )

max_delay	10.00	10.00
output external delay	0.00	10.00
data required time		10.00
-----		
data required time		10.00
data arrival time		-9.78
-----		
slack (MET)		0.22

- 記得檢查是否合成出Latch和error
  - 可以在syn.log用ctrl+F尋找關鍵字latch、error
- 如果出現latch 、error  $\rightarrow$  Demo Fail

# Gate-level simulation

- cd Lab01/03\_GATE/
- ./01\_run (電路模擬)
- ./09\_clean\_up (清除波型檔)
- Verdi & (看波型)
  - 範例波型



# Grading policy

- Pass the RTL & Synthesis & Gate-level simulation: 100%
  - 合成結果: (沒有Error、有Area report、Timing report slack met、沒有latch)
- Demo2 打7折

# Upload

- `cd ../09_UPLOAD/`
- `./01_upload` (上傳code)
- `./02_download [argument]` (下載上傳結果)
  - `[argument] = demo1 or demo2`
  - 檢查是否上傳成功&正確
- Demo1: 3/9, 16:25:00, Demo2: 3/9, 23:59:59

# MobaXterm Available Server

