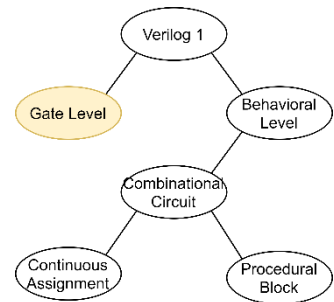# Lab 4
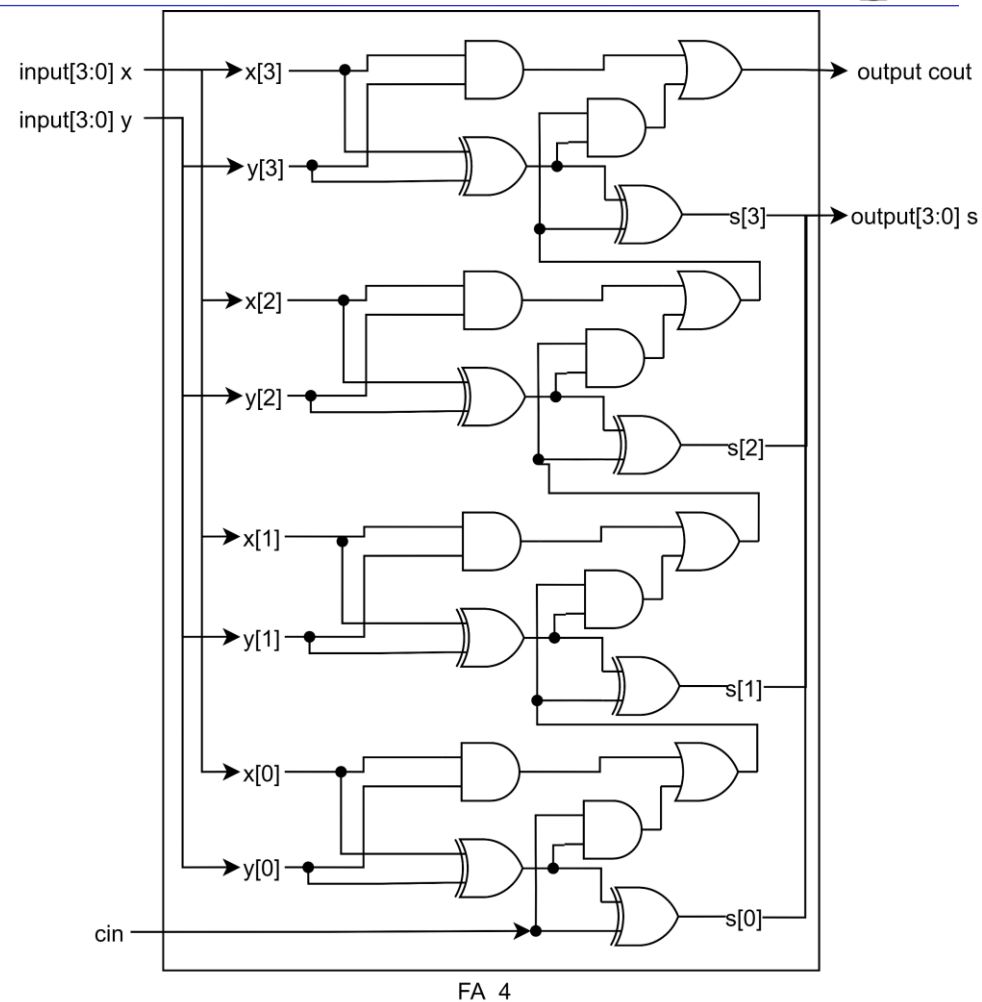# Introduction to Verilog - 1
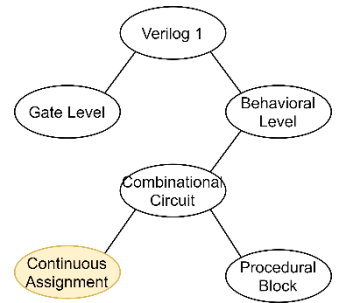# Exercises & Report Format

Speaker: Parker Wei

Exercise 1 - Gate-level 4-bit Adder

- In ~~Exercise1/adder_4.v~~ Ex1/Adder.v, you need to finish your own module named ~~FA_4~~ Adder in gate-level model, which would perform {cout, s} = x + y + cin

  - Two 4-bit inputs x and y

  - One 1-bit input cin

  - One 4-bit output s

  - One 1-bit output cout

# Exercise 2 - Behavior 4-bit Adder

- In In ~~Exercise2/adder_4.v~~ Ex2/Adder.v, you need to finish your own module named ~~FA_4~~ Adder in behavioral model, which would perform {cout, s} = x + y + cin

  - Two 4-bit inputs x and y

  - One 1-bit input cin

  - One 4-bit output s

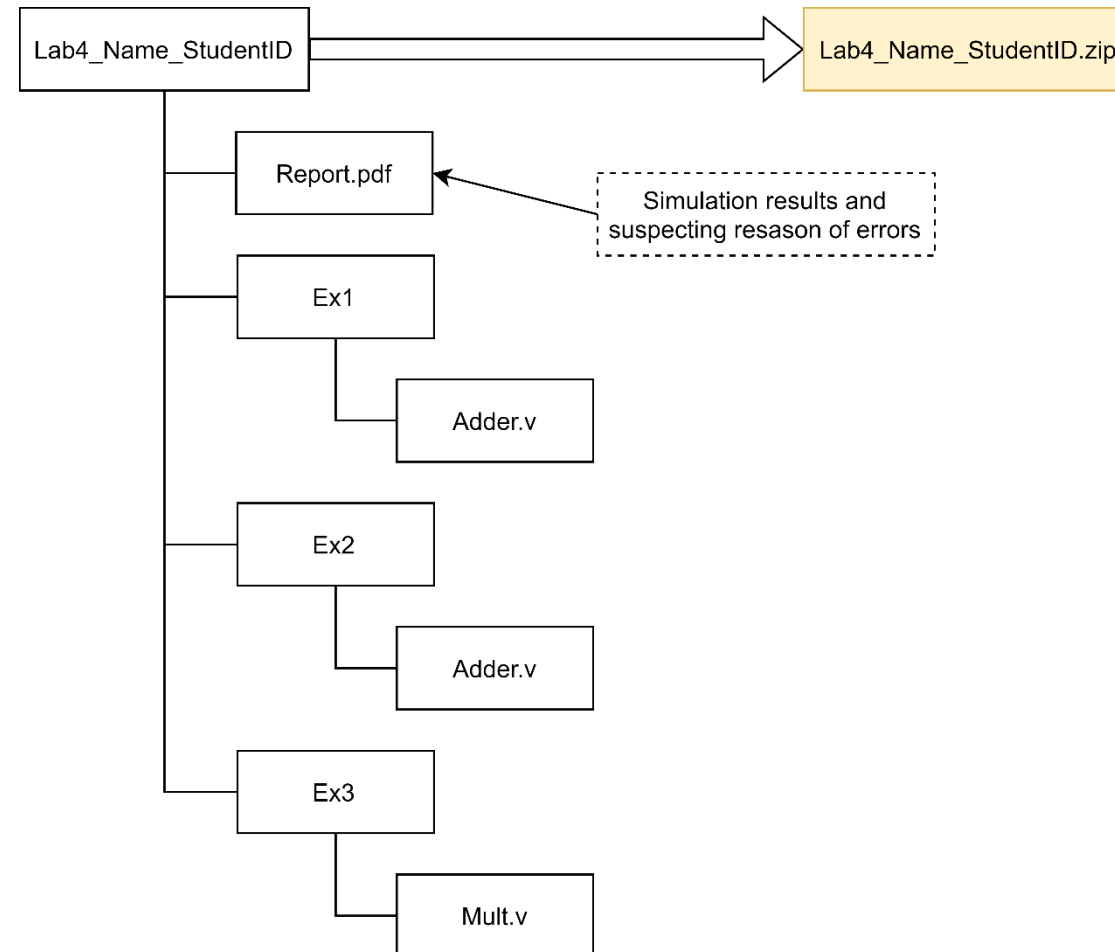 - One 1-bit output cout
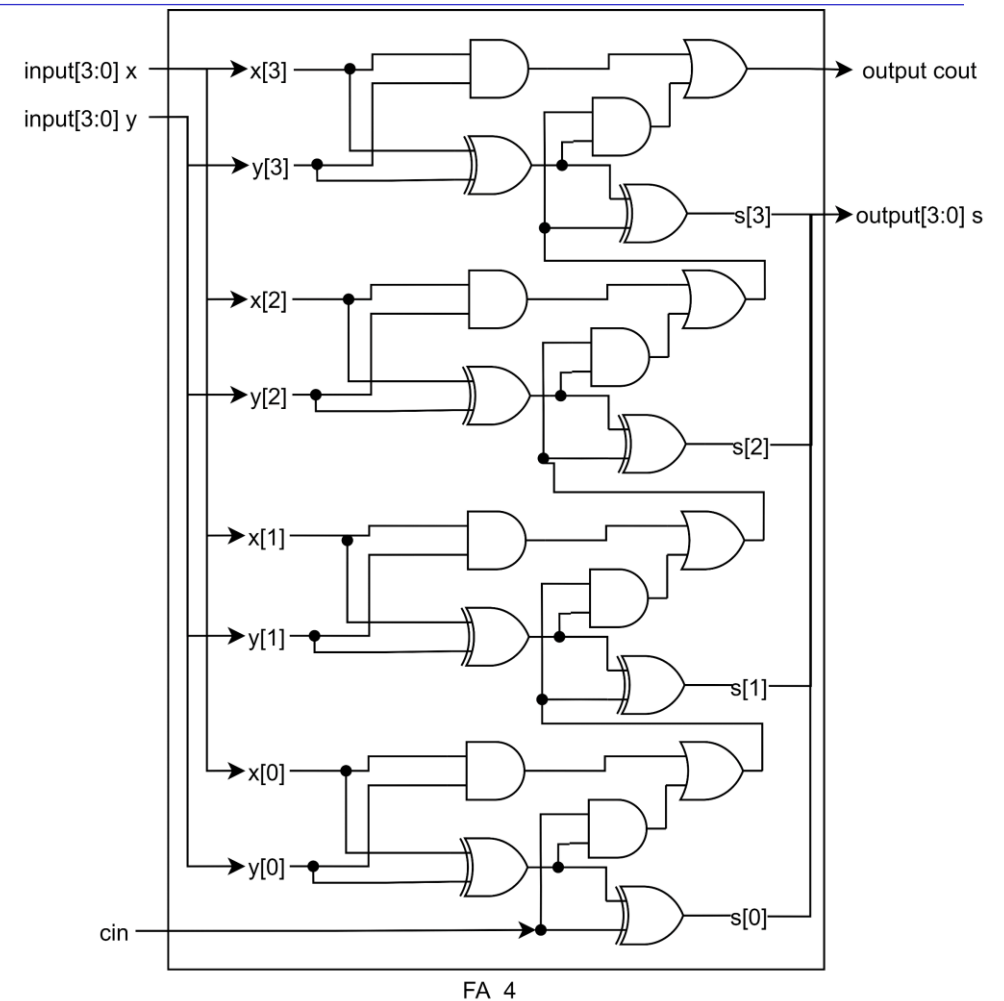
Exercise 3 - Multiplier

- Multiplier in combinational

  - Write a module named **Mult** in **Ex3/Mult.v**

  - One 4-bit **Multiplicand** input

  - One 4-bit **Multiplier** input

  - One 8-bit **Product** output

  - Perform **Multiplicand * Multiplier = Product**
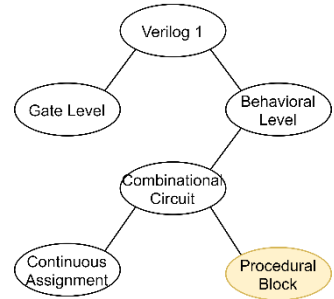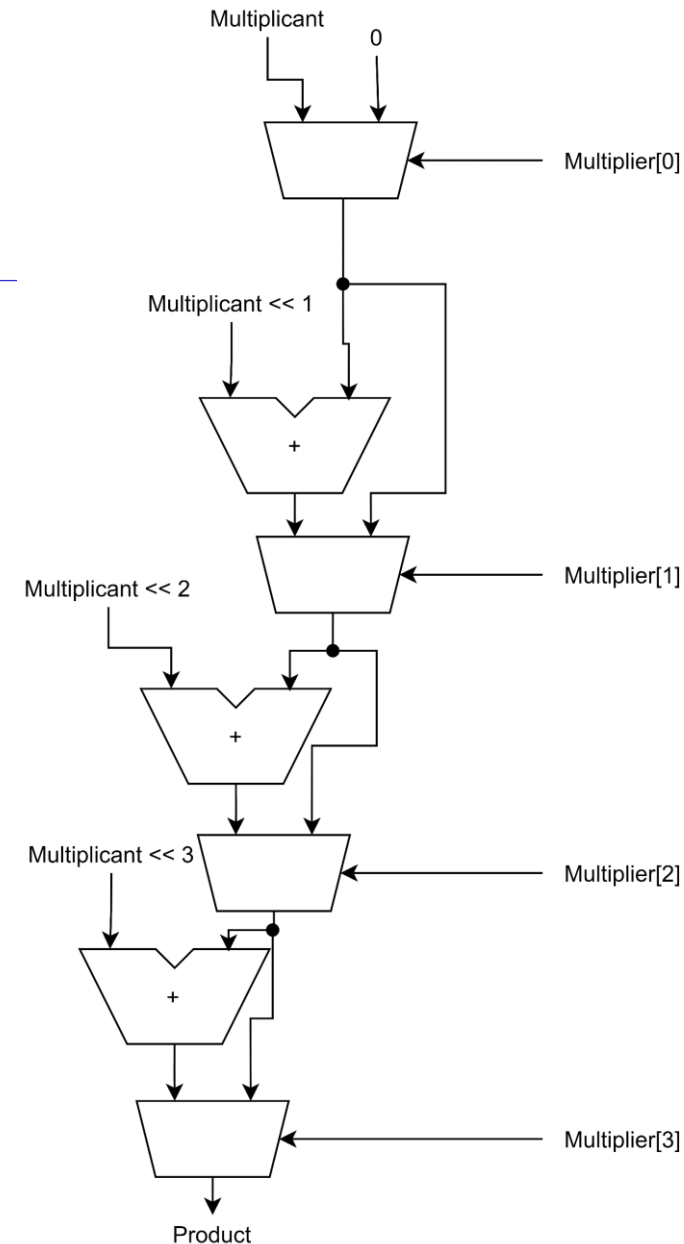
Report Format

How to Run the Test Bench - 1

- After extracting Lab4, you should see three folders.

名稱	修改日期	類型
Ex1	2021/11/2 下午 10:25	檔案資料夾
Ex2	2021/11/2 下午 10:25	檔案資料夾
Ex3	2021/11/2 下午 10:25	檔案資料夾

- In which, taking Ex1 for example, you might see these files.

	修改日期	類型	
work	2021/11/2 下午 10:28	檔案資料夾	
Adder.v	2021/11/2 下午 10:28	V 檔案	0 KB
Ex1.cr.mti	2021/11/2 下午 10:21	MTI 檔案	1 KB
Ex1.mpf	2021/11/2 下午 10:21	MPF 檔案	20 KB
tb.v	2021/11/2 下午 10:18	V 檔案	3 KB

6

How to Run the Test Bench - 2

- Start writing your code on **Adder.v** and **Mult.v**.

How to Run the Test Bench - 3

- After finishing your modules, open ModelSim.

- Choose to open file.
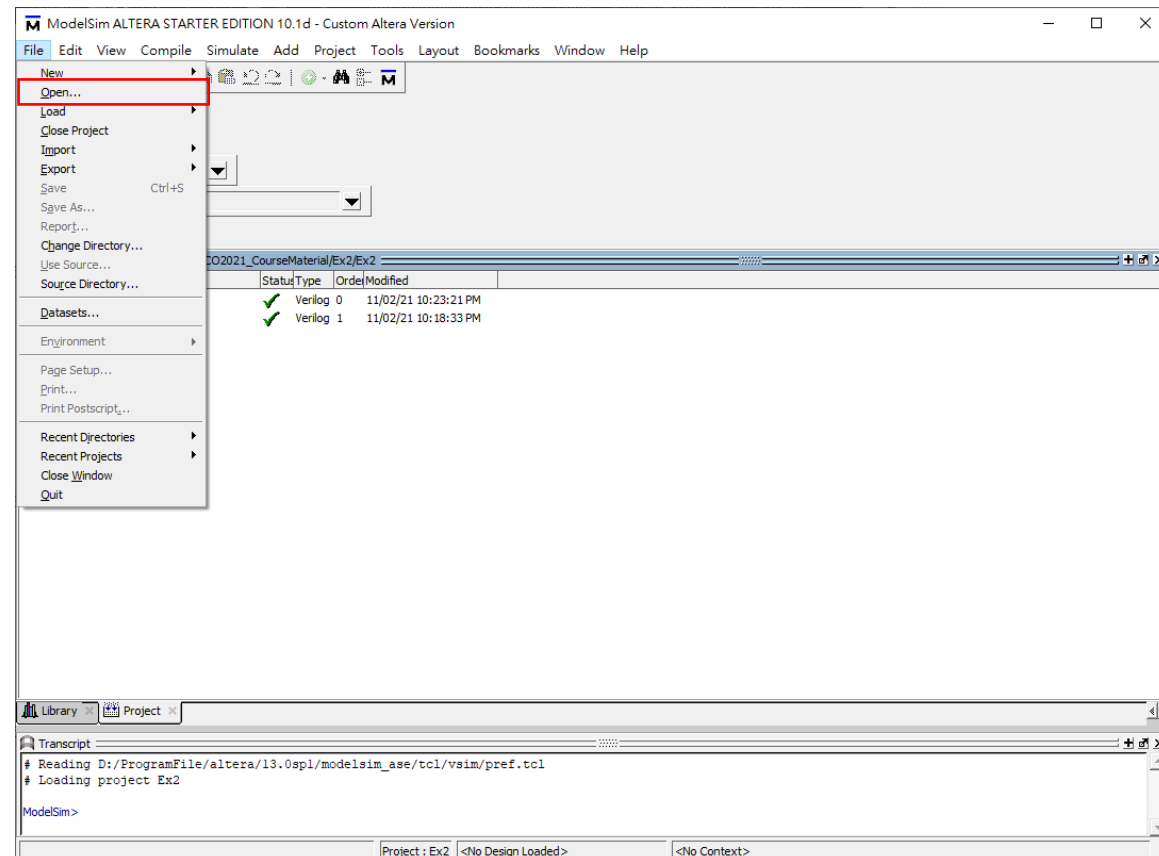
How to Run the Test Bench - 4

- Select file type "Project File (*.mpf)" in lower right corner, you can see Ex1/2/3.mpf in corresponding folder. Click it.
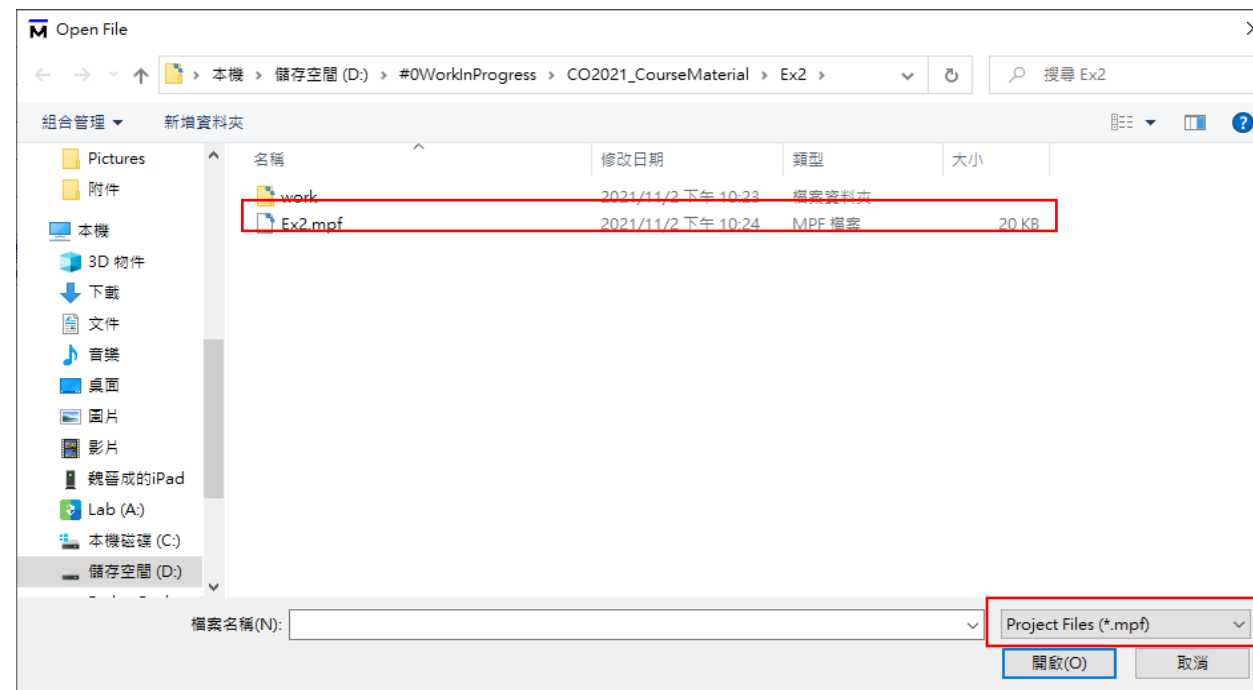
How to Run the Test Bench - 5

- Compile your module along with test bench.

How to Run the Test Bench - 6

- Start Simulation.

How to Run the Test Bench - 7

- Choose tb in work.

- Click OK.

How to Run the Test Bench - 8

• Run all~

How to Run the Test Bench - 9

- If something went wrong, the input and golden would be displayed on "Transcript" tab.

```
#  instead of cout: 0, s: 12
# Error:         15 +          5 +          0 should be cout: 1, s:          4
#  instead of cout: 0, s: 10
# Error:         15 +          5 +          1 should be cout: 1, s:          5
#  instead of cout: 0, s: 11
# Error:         15 +          6 +          0 should be cout: 1, s:          5
#  instead of cout: 0, s:  9
# Error:         15 +          6 +          1 should be cout: 1, s:          6
#  instead of cout: 0, s: 10
# Error:         15 +          7 +          0 should be cout: 1, s:          6
#  instead of cout: 0, s:  8
# Error:         15 +          7 +          1 should be cout: 1, s:          7
#  instead of cout: 0, s:  9
# Error:         15 +          8 +          0 should be cout: 1, s:          7
#  instead of cout: 0, s:  7
# Error:         15 +          8 +          1 should be cout: 1, s:          8
#  instead of cout: 0, s:  8
# Error:         15 +          9 +          0 should be cout: 1, s:          8
#  instead of cout: 0, s:  6
# Error:         15 +          9 +          1 should be cout: 1, s:          9
#  instead of cout: 0, s:  7
# Error:         15 +         10 +          0 should be cout: 1, s:          9
#  instead of cout: 0, s:  5
# Error:         15 +         10 +          1 should be cout: 1, s:         10
#  instead of cout: 0, s:  6
# Error:         15 +         11 +          0 should be cout: 1, s:         10
#  instead of cout: 0, s:  4
# Error:         15 +         11 +          1 should be cout: 1, s:         11
#  instead of cout: 0, s:  5
# Error:         15 +         12 +          0 should be cout: 1, s:         11
#  instead of cout: 0, s:  3
# Error:         15 +         12 +          1 should be cout: 1, s:         12
#  instead of cout: 0, s:  4
# Error:         15 +         13 +          0 should be cout: 1, s:         12
#  instead of cout: 0, s:  2
# Error:         15 +         13 +          1 should be cout: 1, s:         13
#  instead of cout: 0, s:  3
# Error:         15 +         14 +          0 should be cout: 1, s:         13
#  instead of cout: 0, s:  1
# Error:         15 +         14 +          1 should be cout: 1, s:         14
#  instead of cout: 0, s:  2
# Error:         15 +         15 +          0 should be cout: 1, s:         14
#  instead of cout: 0, s:  0
# Error:         15 +         15 +          1 should be cout: 1, s:         15
#  instead of cout: 0, s:  1
# Total Error:       480
```
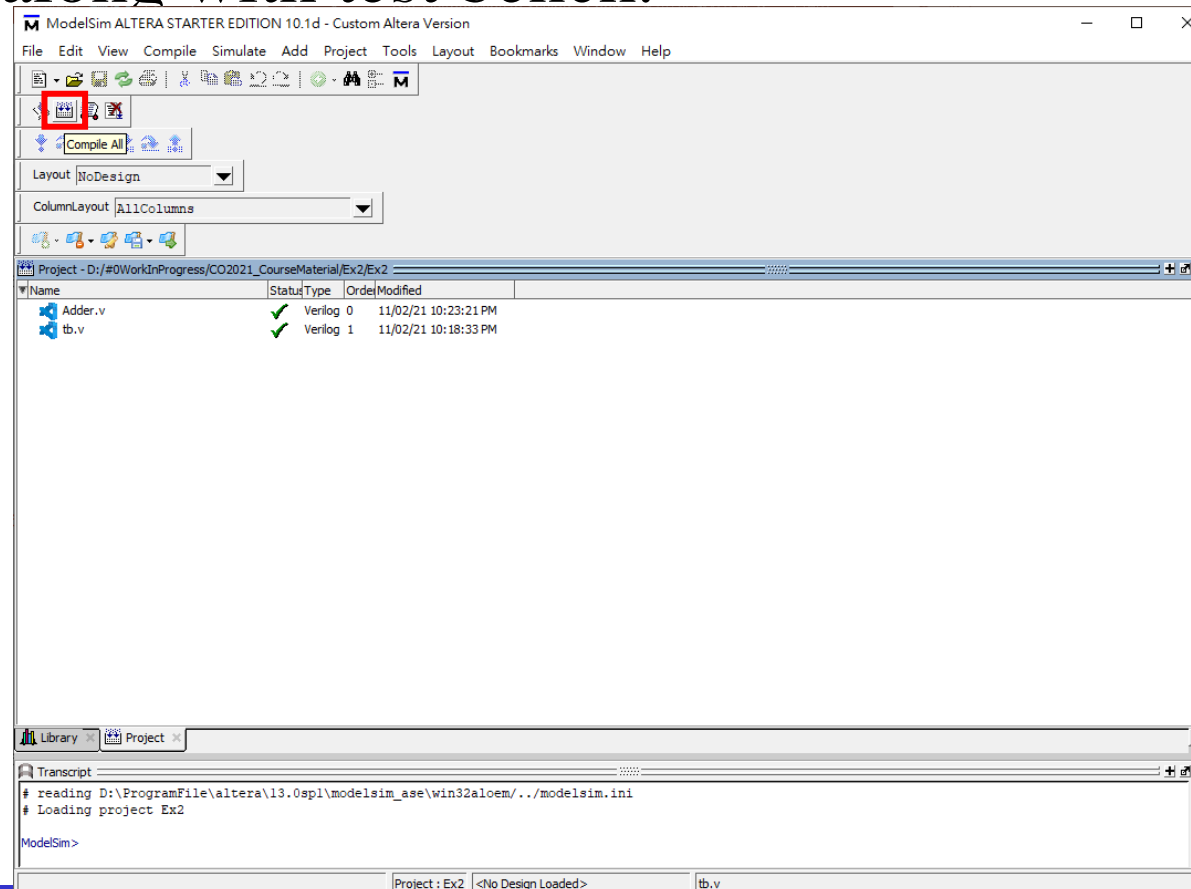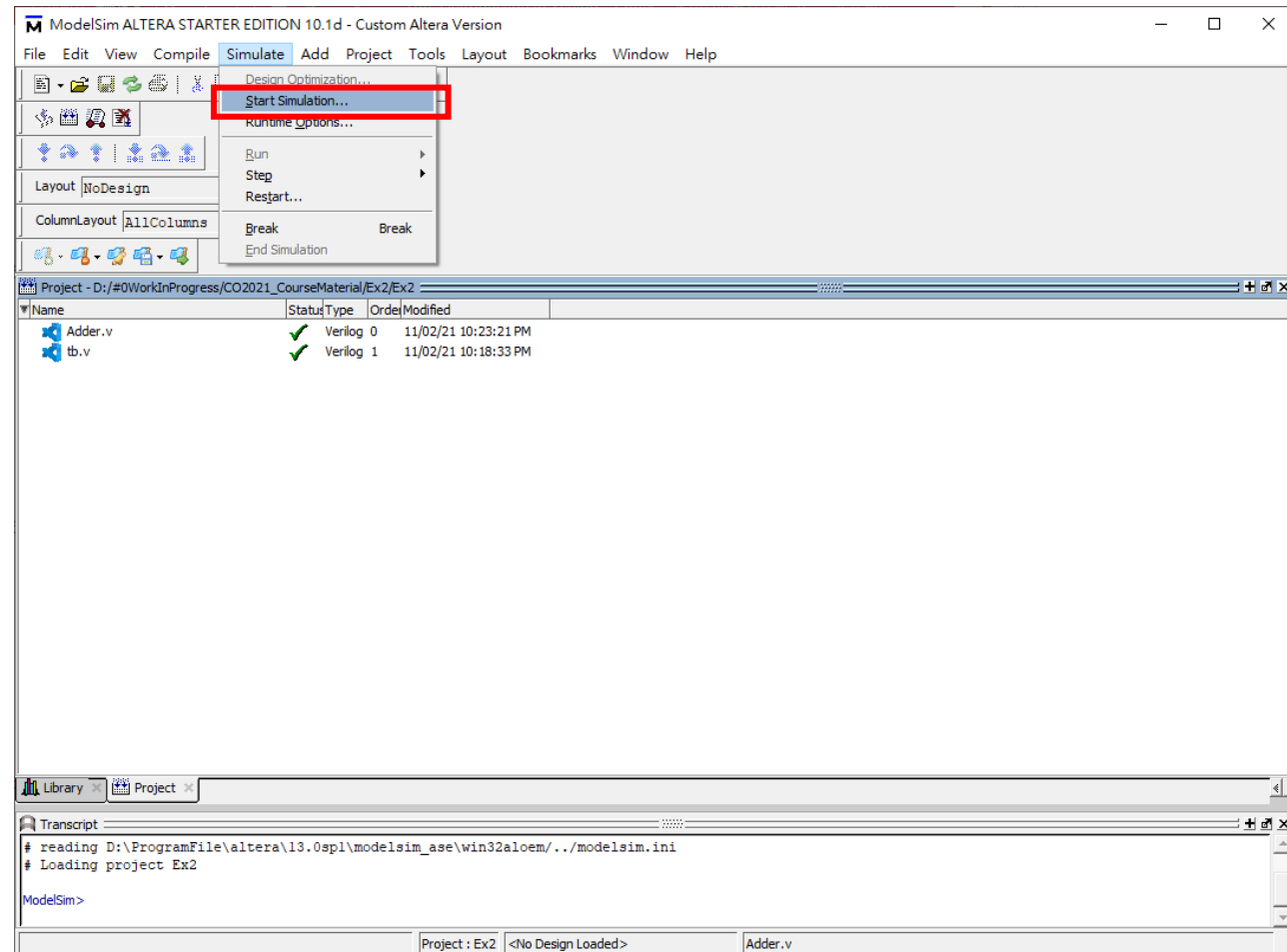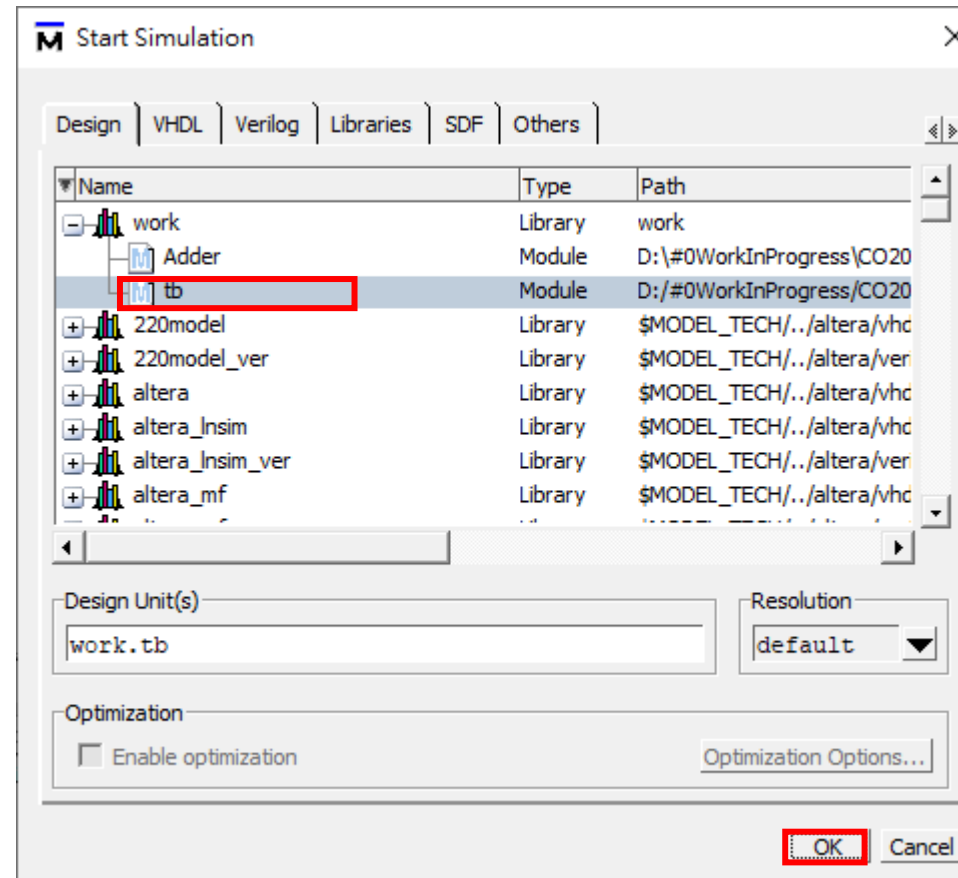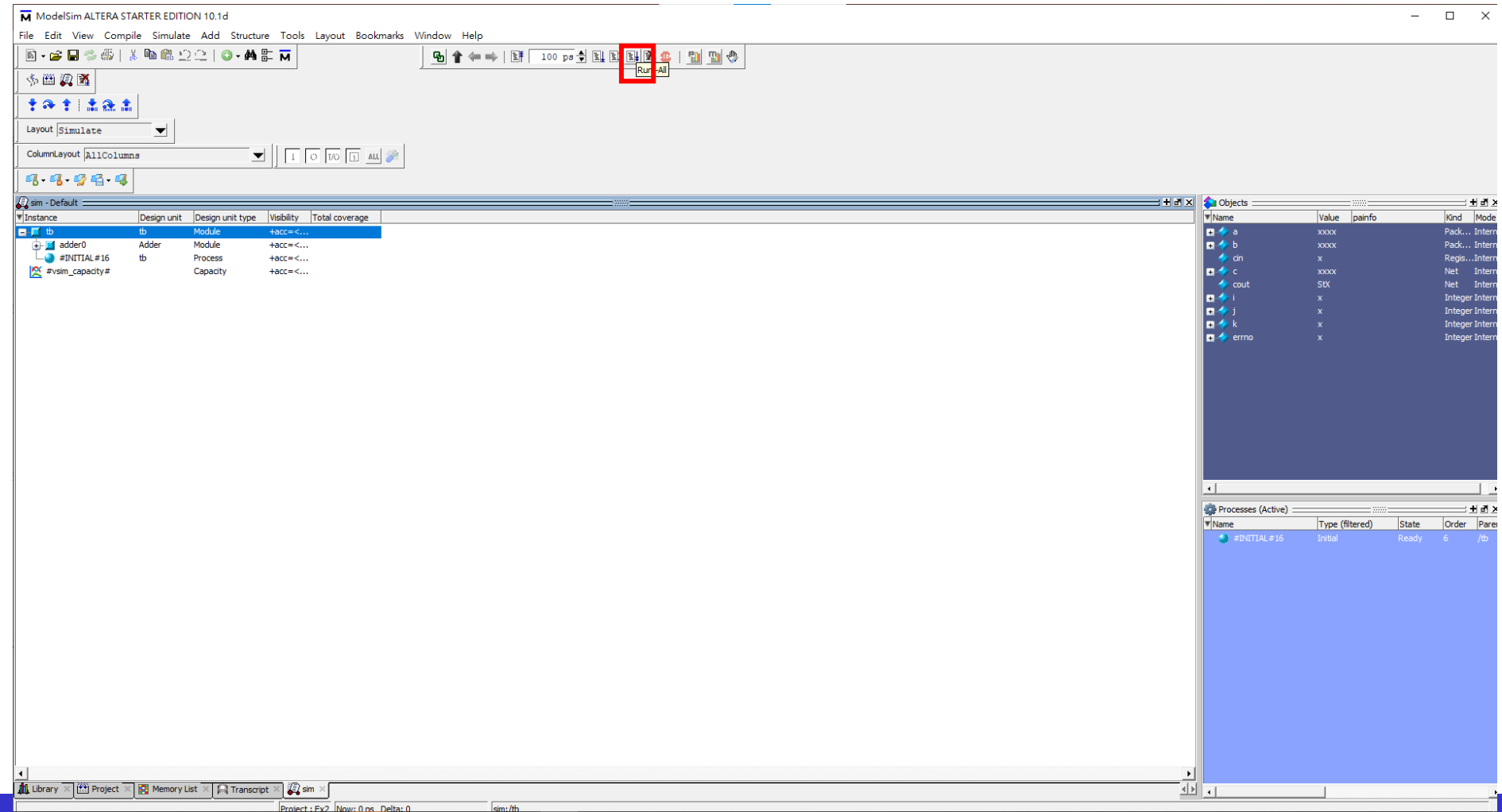
How to Run the Test Bench - 10

- If all data are correct, the outcome would be like this in tab "Transcript"