

# Computer Organization, Spring 2020

## Lab 0: Tutorial for ModelSim PE Student Edition Simulator

**Due: 2020/03/12**

### 1. Goal

The purpose of this Lab is to familiar with ModelSim Simulator Tool.

### 2. Attached Files

Part 1: acs1.v, acs4.v, chip\_core.v, clkgen.v, controller.v, spu.v and system.v.

Part 2: multiplication.txt;

### 3. Lab Description

#### Part 1

##### Step 1:

Go to [https://www.mentor.com/company/higher\\_ed/modelsim-student-edition](https://www.mentor.com/company/higher_ed/modelsim-student-edition)


#### ModelSim PE Student Edition

Free download of industry leading ModelSim® HDL simulator for use by students in their academic coursework.

[Download Student Edition](#)

##### Step 2:

Fill in your Information and accept the term of condition.

Sign in with LinkedIn / 

AutoFill your information

First Name ●

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Last Name ●

小明

Email ●

huangxiaoming@gmail.com

Phone ●

09xxxxxxxx

Company ●

NCTU

Primary job function ●

Student

Address 1 ●

NCTU

Address 2

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Please Provide Your City ●

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If any provision of this Agreement is held by a court of competent jurisdiction to be void, invalid, unenforceable or illegal, such provision shall be severed from this Agreement and the remaining provisions will remain in full force and effect.

18. MISCELLANEOUS.

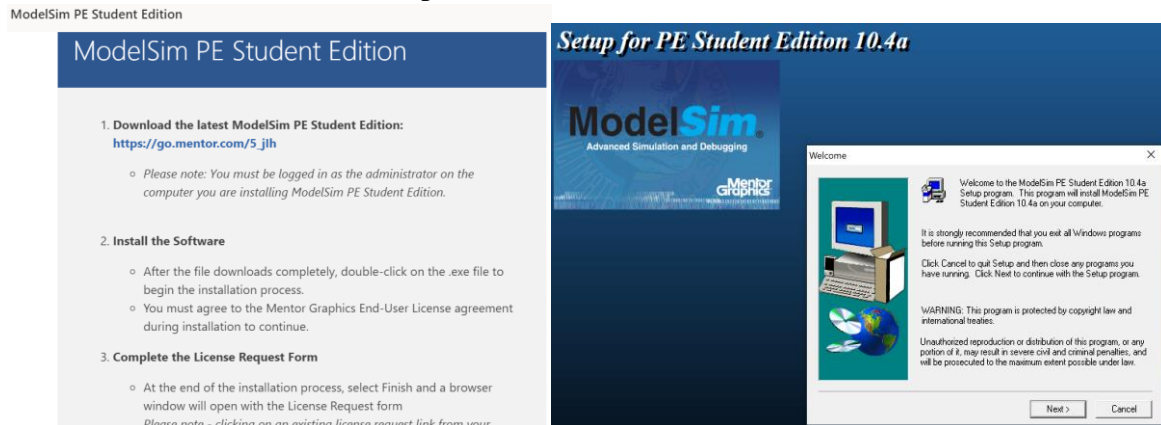
This Agreement contains the parties' entire understanding relating to its subject matter and supersedes all prior or contemporaneous agreements. Any translation of this Agreement is provided to comply with local legal requirements only. In the event of a dispute between the English and any non-English versions, the English version of this Agreement shall govern to the extent not prohibited by local law in the applicable jurisdiction. This Agreement may only be modified in writing, signed by an authorized representative of each party. Waiver of terms or excuse of breach must be in writing and shall not constitute subsequent consent, waiver or excuse.

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I Accept This Agreement

### Step 3:

#### Download and Install modelsim-pe\_student\_edition.exe



### Step 4:

Fill in the form then follow the instruction given in your email.

#### ModelSim PE Student Edition – License Request

Please complete the form below to have a license file emailed to you.

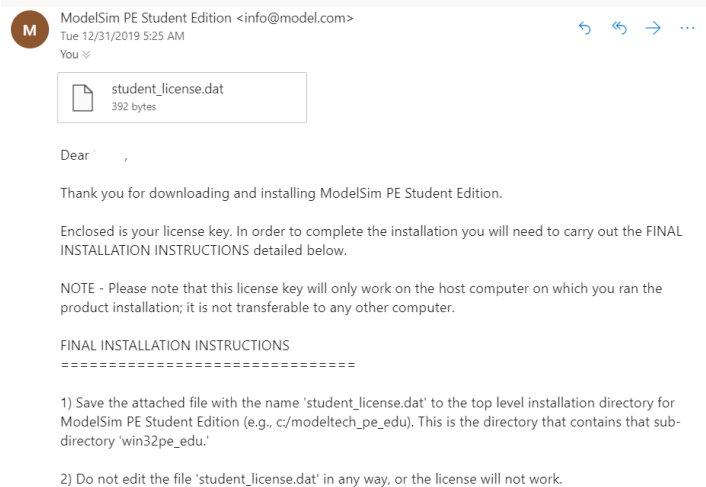
First Name *	Last Name *
<input type="text"/>	<input type="text"/>
Email *	Phone * (No Dashes or Spaces)
<input type="text"/>	<input type="text"/>
Email (Please Re-enter your email) *	<small>Please verify your email is correct, as the ModelSim Student Edition license file will be emailed to you.</small>
<input type="text"/>	
Address *	Address 2
<input type="text"/>	<input type="text"/>
City *	State/Province (US or Canada Only)
<input type="text"/>	<input type="text"/>
Country *	Zip/PostCode *
<input type="text" value="UNITED STATES"/>	<input type="text"/>

#### Please tell us about yourself

Please specify your University, College, School, or Institute: \*

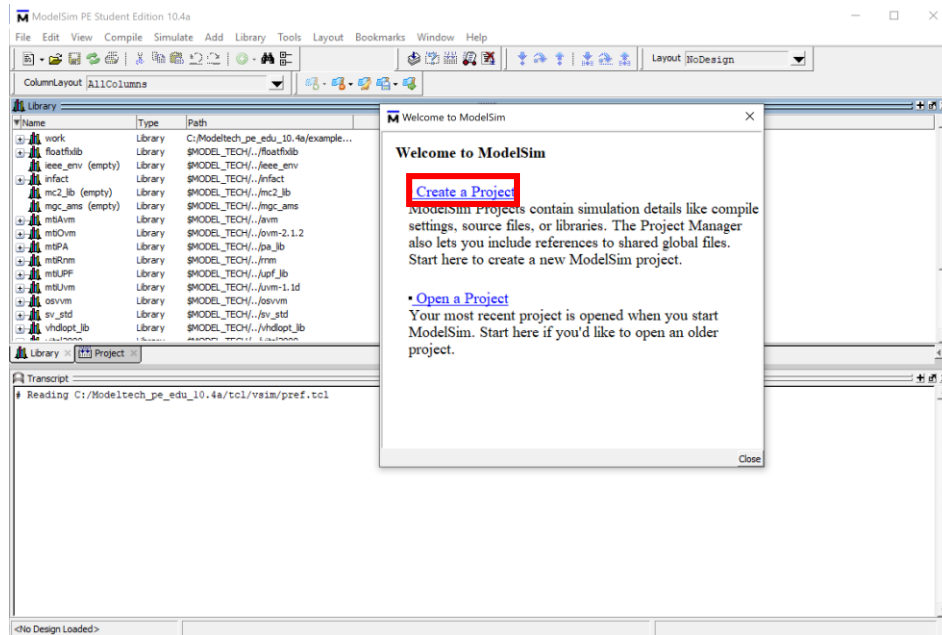
Are you a Student or Instructor? \*

#### ModelSim Student Edition License



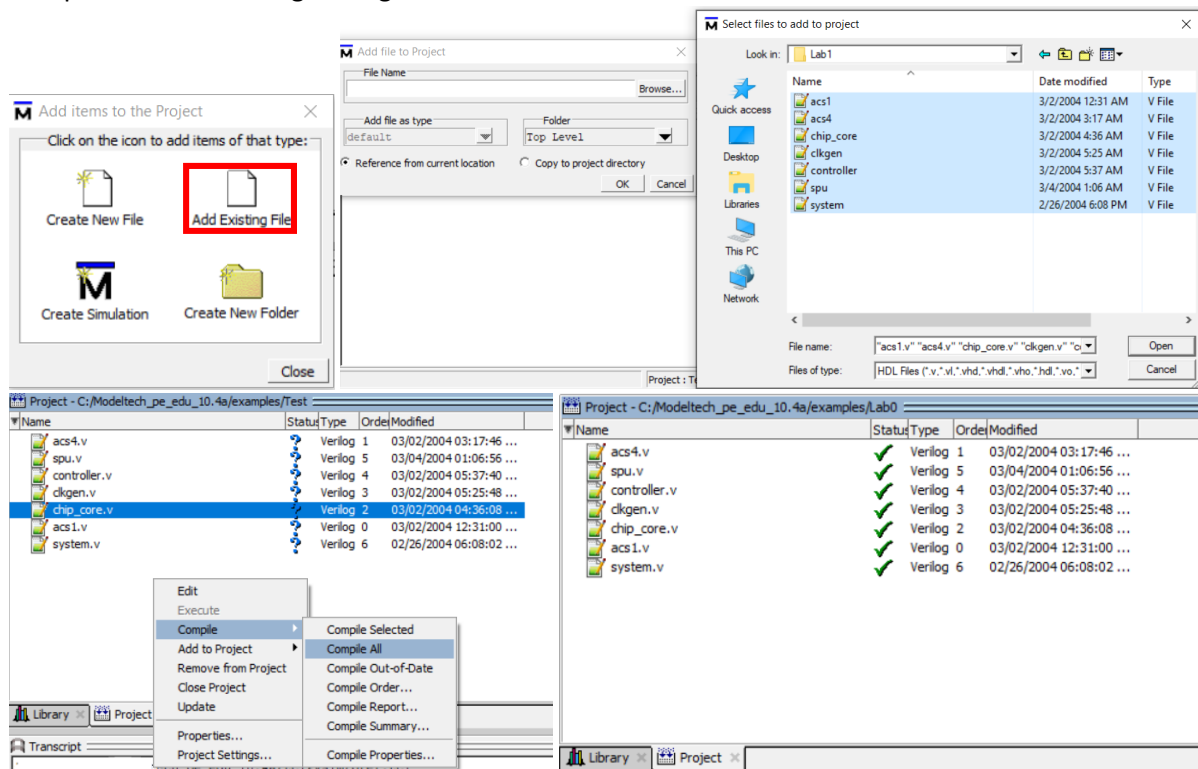
**Step 5:**

Run ModelSim PE Student Edition 10.4a.exe and create a project.

**Step 6:**

Add the following existing file to the project.

Compile all the following verilog file.

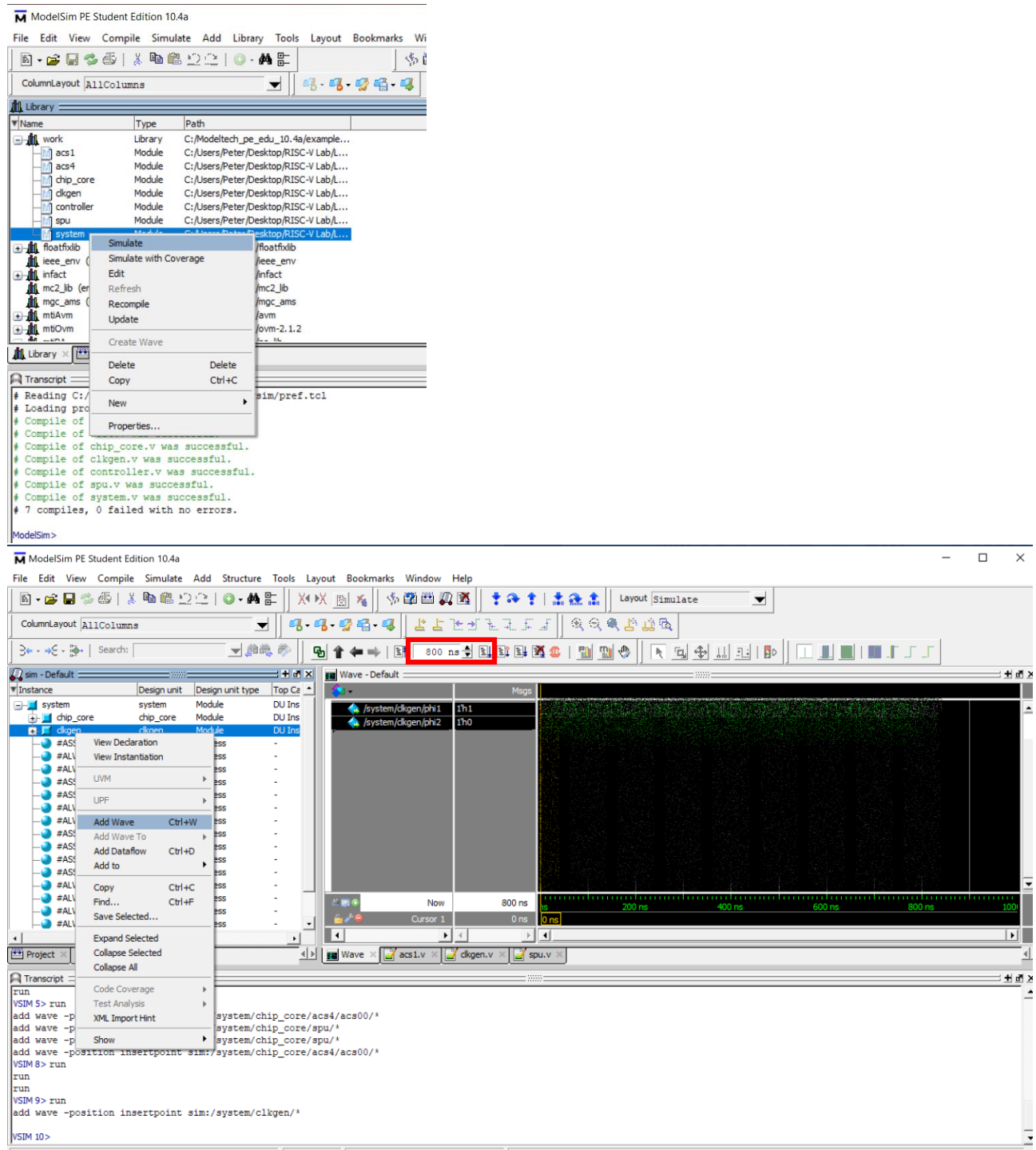


**Step 7:**

Go to library and simulate the system.v file.

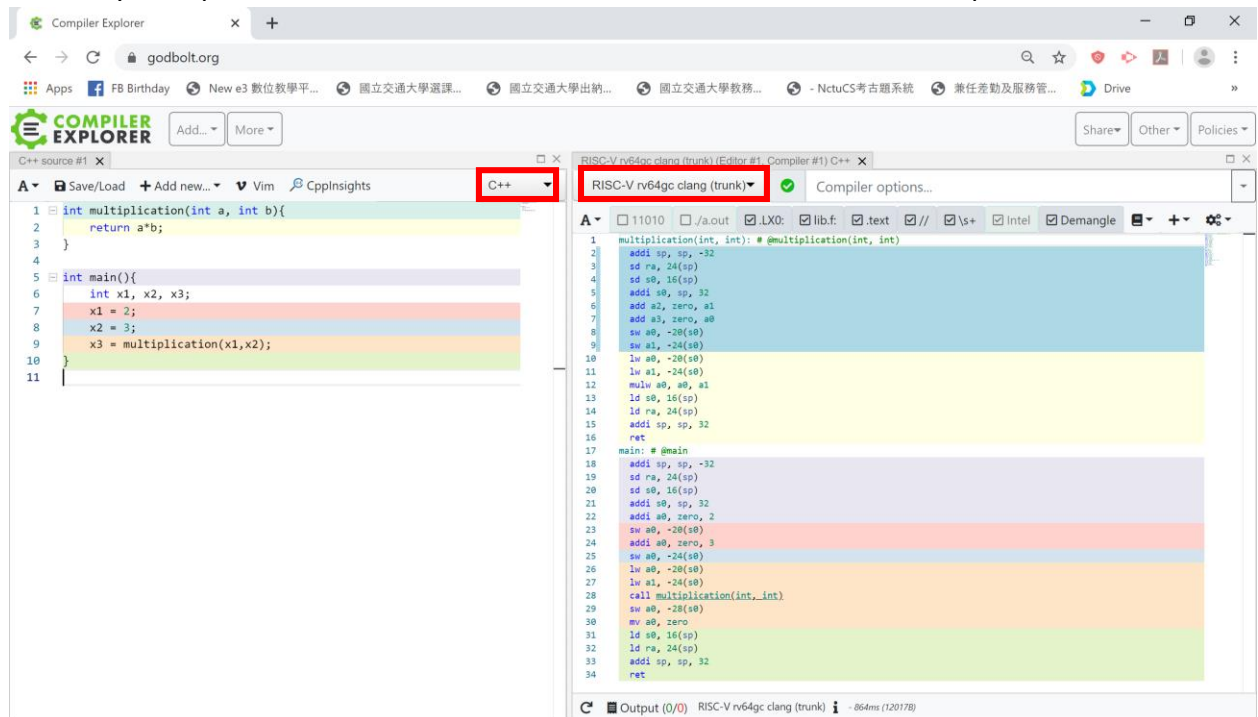
Add the wave diagram of clkgen and run for a 800ns then screenshot the result.

Paste the result in the report.



## Part 2:

Go to <https://godbolt.org/> and convert the multiplication.txt to RISC-V based assembly code. Try to explain what each line of the RISC-V instruction does in the report.



The screenshot shows the Compiler Explorer interface. On the left, the C++ source code is displayed:

```
1 int multiplication(int a, int b){
2     return a*b;
3 }
4
5 int main(){
6     int x1, x2, x3;
7     x1 = 2;
8     x2 = 3;
9     x3 = multiplication(x1,x2);
10 }
11
```

On the right, the RISC-V assembly code generated by the compiler is shown:

```
1 multiplication(int, int): # @multiplication(int, int)
2     addi sp, sp, -32
3     sd ra, 24(sp)
4     sd s0, 16(sp)
5     addi s0, sp, 32
6     add a2, zero, a1
7     add a3, zero, a0
8     sw a0, -20(s0)
9     sw a1, -24(s0)
10    lw a0, -20(s0)
11    lw a1, -24(s0)
12    mulw a0, a0, a1
13    ld s0, 16(sp)
14    ld ra, 24(sp)
15    addi sp, sp, 32
16    ret
17
18 main: # @main
19     addi sp, sp, -32
20     sd ra, 24(sp)
21     sd s0, 16(sp)
22     addi s0, sp, 32
23     addi a0, zero, 2
24     sw a0, -20(s0)
25     addi a0, zero, 3
26     sw a0, -24(s0)
27     lw a1, -24(s0)
28     call multiplication(int, int)
29     sw a0, -20(s0)
30     mv a0, zero
31     ld s0, 16(sp)
32     ld ra, 24(sp)
33     addi sp, sp, 32
34     ret
```

## 4. Grade

- (1) Report(100%)
- (2) Late submission: 10 percent penalty per day
- (3) No plagiarism, or you will get 0 point.

## 5. Hand in

- (1) Zip your folder and name it as "ID.zip" (e.g. 0816001.zip) before uploading to newe3. Other filenames and formats such as \*.rar and \*.7z are NOT accepted! Multiple submissions are accepted, and the version with the latest time stamp will be graded.
- (2) Please include ONLY your report (\*.docx or \*.pdf) in the zipped folder.

## 6. Q&A

For any questions regarding Lab 0, please contact

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