

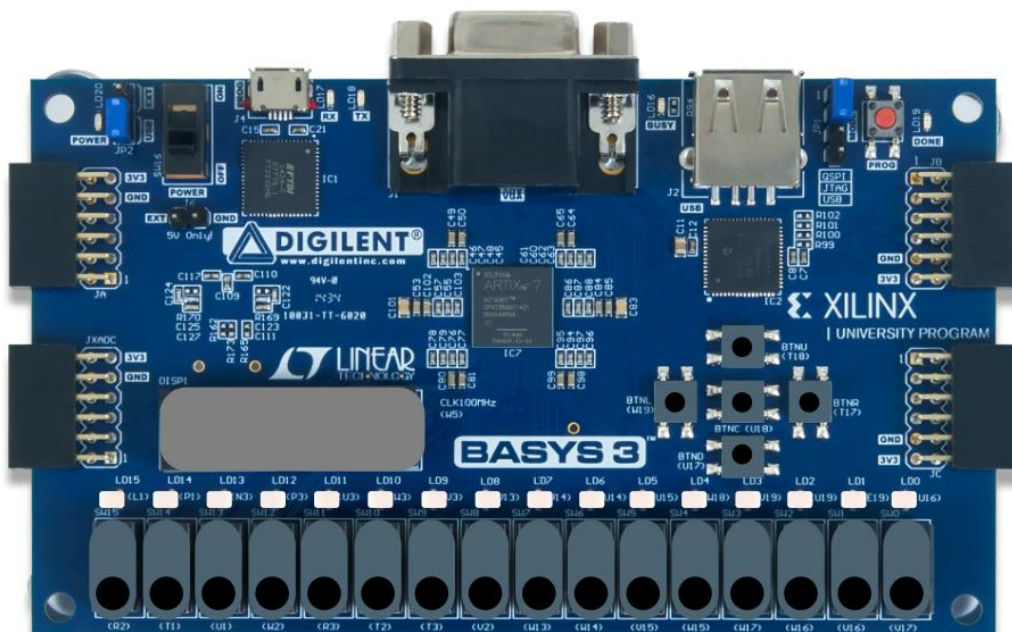
**TASK:** Remove all `nop` instructions in the example from **Error! Reference source not found.** Generate the trace with the RVfpga-Trace simulator, analyse the simulation on RVfpga-Pipeline, and then compute the IPC by using the Performance Counters while executing the program on the board (remember that you must uncomment all instructions in the main function, in file *Test.c*).

<code>clk=</code>							
<code>dec_i0_pc_d_ext[31:0]=</code>	00000424	00000428	0000042C	00000430	00000434	00000438	0000043C
<code>dec_i0_instr_d[31:0]=</code>	01EE8EB3	01DE0E33	FFFF8F93	00300E13	00200E93	00100F13	FE0F94E3
<code>dec_i0_rs2_bypass_en_d[3:0]=</code>	1	4	0				1
<code>dec_i0_result_r[31:0]=</code>	00000001	00000003	00000006	0000FFF0	00000003	00000002	00000001
<code>lsu_result_m[31:0]=</code>	00000000						
<code>exu_i0_result_x[31:0]=</code>	0000FFF1	00000003	00000006	0000FFF0	00000003	00000002	00000001
<code>lsu_nonblock_load_data[31:0]=</code>	00000000						
<code>i0_rs2_bypass_data_d[31:0]=</code>	00000001	00000003	00000000				00000001
<code>i0_rs1_d[31:0]=</code>	00000002	00000003	0000FFF1	00000000		0000FFF0	00000002
<code>i0_rs2_d[31:0]=</code>	00000001	00000003	FFFFFFFF	00000003	00000002	00000001	00000000
<code>result[31:0]=</code>	00000003	00000006	0000FFF0	00000003	00000002	00000001	0000FFF0
<code>i0_inst_x[31:0]=</code>	FE0F94E3	01EE8EB3	01DE0E33	FFFF8F93	00300E13	00200E93	00100F13
<code>exu_i0_result_x[31:0]=</code>	0000FFF1	00000003	00000006	0000FFF0	00000003	00000002	00000001
<code>i0_inst_r[31:0]=</code>	00100F13	FE0F94E3	01EE8EB3	01DE0E33	FFFF8F93	00300E13	00200E93
<code>wen0=</code>							
<code>waddr0[4:0]=</code>	1E	09	1D	1C	1F	1C	1D
<code>wd0[31:0]=</code>	00000001	00000003	00000006	0000FFF0	00000003	00000002	00000001

Cycles = 526278  
Instructions = 459345  
BrCom = 65620  
BrMis = 65600

7 SEGMENT DISPLAYS:

0 0 0 0



- The forwarding logic allows the dependent instruction to not stall. However, there is 1 bubble due to the branch. So, the number of cycles = 7 instructions + 1 bubble.
- The number of cycles is as expected  $0xffff * 8 = 524280$

**Exercise 1:** In the example from **Error! Reference source not found.**, analyse and explain similar situations where you replace the dependent `add` instruction for other dependent instructions, such as:

- `add t4,t4,t5`  
`mul t3,t3,t4`
- `add t4,t4,t5`  
`div t3,t3,t4`
- `add t4,t4,t5`  
`lw t3, 0(t4)`

Solution not provided for this exercise.