

Exercise 7 (4 points) – Pipeline**APA course – 5 July 2017 – Part A (b)**

Consider an architecture where each instruction (unpipelined) takes 99 ns. Consider the pipeline implementation of instructions takes 108 ns, using 9 pipe stages.

- i) Compute the time required to execute 60 instructions without and with pipeline.
- ii) Compute the speedup of the pipelined solution with respect to the unpipelined one (for 60 instructions).

Exercise 1 (4 points) – Pipeline**APA course – 7 December 2018 – Part A**

Consider an architecture where each instruction (unpipelined) takes 82 ns. Consider the pipeline implementation of instructions takes 91 ns, using 7 pipe stages.

- i) Compute the time required to execute 80 instructions without and with pipeline.
- ii) Compute the speedup of the pipelined solution with respect to the unpipelined one (for 80 instructions).

Exercise 1 (3 + 2 points) – Instruction pipeline

APA course – 13 June 2017 – Part A

Consider the following loop expressed in a high level language:

```
for (i =0; i < N; i ++)  
{  
    vectA[i] = vectA[i] + 4;  
    vectB[i] = vectB[i] + 2;  
}
```

The program has been written in MIPS assembly code, assuming that registers \$t6 and \$t7 have been initialized with values 0 and 4N respectively. The symbols VECTA, VECTB and VECTC is a 16-bit constant.

Let us consider the loop executed by 5-stage pipelined MIPS processor WITHOUT any optimisation in the pipeline.

1. **Identify the Hazard Type** (Data Hazard or Control Hazard) in the last column.
2. In the first column **identify the number of stalls** to be inserted before each instruction (or between stages IF and ID of each instruction) necessary to solve the hazards.
3. For each hazard, add an ARROW to **indicate the pipeline stages involved in the hazard**.
4. **Specify if there is any hazard solved** by the insertion of stalls for other instructions.

Num. Stalls	INSTRUCTION	C1	C2	C3	C4	C5	C7	C6	C8	C9	C10	C11	C12	C13	C14	Hazard Type
	FOR: beq \$t6,\$t7,END	IF	ID	EX	ME	WB										
	lw \$t2,VECTA(\$t6)		IF	ID	EX	ME	WB									
	addi \$t2,\$t2,4			IF	ID	EX	ME	WB								
	sw \$t2,VECTA(\$t6)				IF	ID	EX	ME	WB							
	lw \$t3,VECTB(\$t6)					IF	ID	EX	ME	WB						
	addi \$t3,\$t3,2						IF	ID	EX	ME	WB					
	sw \$t3,VECTB(\$t6)							IF	ID	EX	ME	WB				
	addi \$t6,\$t6,4								IF	ID	EX	ME	WB			
	blt \$t6,\$t7,FOR									IF	ID	EX	ME	WB		