EXAMPLE 4

Instruction Memory's file: 5th_fig451_MemEx4/inst.rom

This Mips pipeline implementation can handle branchs (with "nop" put by compiler) and can't handle data hazards

The user should set initial register values (linear). No data values are required.

Description: A simple sequence of nine instructions with no data hazard.

ADD r1,r1,r1
NOP
NOP
SLT r2, r15, r1 // EXE HAZARD
NOP
NOP
BEQ r2,r0, -7 //EXE HAZARD
NOP
NOP

ADD r1,r1,r1 – type R instruction
opcode = 0 rs = 1 rt = 1 rd = 1 sh = 0 func = 32
000000 00001 00001 00001 00000 100000
0x00210820

NOP
0x00000000

NOP
0x00000000

SLT r2,r15,r1 – type R instruction
opcode = 0 rs = 15 rt = 1 rd = 2 sh = 0 func = 42
000000 01111 00001 00010 00000 101010
0x01E1102A

NOP
0x00000000

NOP
0x00000000

BEQ r2,r0,-7 – type I instruction
opcode = 4 rs = 2 rt = 0 imediate = -7
000100 00010 00000 1111111111111001
0x1040FFF9

NOP
0x00000000

NOP
0x00000000

The hexadecimal code example is:

```
ADD r1,r1,r1        – 0x00210820
NOP                 – 0x00000000
NOP                 – 0x00000000
SLT r2, r15, r1     – 0x01E1102A
NOP                 – 0x00000000
NOP                 – 0x00000000
BEQ r2,r0, -7       – 0x1040FFF9
NOP                 – 0x00000000
NOP                 – 0x00000000
```

Calculations check (with linear initial register values):

1. ADD r1,r1,r1 – R1 = 2
2. NOP
3. NOP
4. SLT r2, r15, r1 – R2 = 0
5. NOP
6. NOP
7. BEQ r2,r0, -7 – BACK TO THE FIRST INSTRUCTION
8. NOP
9. NOP
    1. ADD r1,r1,r1 – R1 = 4
    2. NOP
    3. NOP
    4. SLT r2, r15, r1 – R2 = 0
    5. NOP
    6. NOP
    7. BEQ r2,r0, -7 – BACK TO THE FIRST INSTRUCTION
    8. NOP
    9. NOP
        1. ADD r1,r1,r1 – R1 = 8
        2. NOP
        3. NOP
        4. SLT r2, r15, r1 – R2 = 0
        5. NOP
        6. NOP
        7. BEQ r2,r0, -7 – BACK TO THE FIRST INSTRUCTION
        8. NOP
        9. NOP
            1. ADD r1,r1,r1 – R1 = 16
            2. NOP
            3. NOP
            4. SLT r2, r15, r1 – R2 = 0
            5. NOP
            6. NOP
            7. BEQ r2,r0, -7 – BRANCH IS NOT TAKEN
            8. NOP
            9. NOP – END.