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ALEXIS LEFEBVRE
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Labo 2 : L'agence tout
RiSC16

Question3

We still observe 2 data forwarding, and a stomp. The remaining data forwardings are:

1. *nop* followed by *nop* at lines 13 & 14. Since the *nop* pseudo instruction consists in an *add 0,0,0*, we try to read from register 0 the output of the previous *nop*, which causes a data forwarding. However, this is not a problem since R0 is read-only and we do not care about the result.
2. The 2nd one is due to the line 16, the *beq* instruction. We use the R0 value, but the result from the previous *nop* is not "normally" stored in it. Since R0 is read-only, we do not care.

```
1          addi    2,0,1    // Change the order of instructions to avoid
                        data hazards
2          addi    1,1,3
3          addi    3,0,2
4          addi    7,0,7
5          sw      2,0,0
6          sw      2,0,1
7          sw      3,0,2
8 boucle: beq     7,0,end
9          lw      2,1,-2
10         addi    1,1,1
11         addi    7,7,-1
12         add     3,3,2
13         nop                                // To avoid data hazard
14         nop                                // "
15         sw      3,1,-1
16         beq     0,0,boucle
17 end: halt
```

Question 4

The *CPI* of the exemple from first lab is 1.450. The *CPI* for the corrected code is 1.278. The new one is lower since the number of data hazards are reduced. Less bubbles are introduced in the pipeline, which results in less delay.

Question 5

We can compute the *CPI* using:

$$CPI = \frac{depth + instruction + stall + 2 * stomp}{instruction}$$

Here is the link to the source of the report: <https://www.writelatex.com/read/kptqvhgncsf>.