**HAZARDS HANDLING**

1. Read After Write (RAW) since DADD requires the value of R1 returned by LD.
2. Write After Write (WAW) since DADD modifies the value of R1 that is also computed by MULT.
3. Structural hazard because of MULT.
4. Read After Write (RAW) since SD in Memory stage requires the value of R1 computed by DADD.
5. Read After Write (RAW) since SD in Execution stage requires the value of R1 computed by DADD.
7. 2-bit saturating counter branch predictor

|  |  |  |  |
| --- | --- | --- | --- |
| Current counter value | Prediction () | Actual outcome () | New counter value |
| 00 | NT | NT | 00 |
| 00 | NT | T | 01 |
| 01 | NT | NT | 00 |
| 01 | NT | T | 10 |
| 10 | T | NT | 01 |
| 10 | T | T | 11 |
| 11 | T | NT | 10 |
| 11 | T | T | 11 |

* What happens here is we create some sort of truth table in Prediction and Actual outcome where in Actual outcome is and Prediction is .
* Then starting with counter 00 we try to find the new counter value based on the Prediction and Actual outcome where NT (Not Taken) in Actual outcome will mean to decrement to the previous counter value and T (Taken) in Actual outcome will mean to increment to the next/new counter value in binary form.
* In the new counter value: 00 means strongly not taken

01 means weakly not taken

10 means weakly taken

11 means strongly taken

* The new counter value gets recorded as the next current counter value but in the table above I have just placed the binaries 00, 01, 10 and 11 in doubles so as to show their different occurrences.

1. 2-bit counter prediction rate

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Iteration | Current counter value | Prediction () | Actual outcome () | New counter value |
| 1 | 00 | NT | NT | 00 |
| 2 | 00 | NT | T | 01 |
| 3 | 01 | NT | NT | 00 |
| 4 | 00 | NT | T | 01 |
| 5 | 01 | T | NT | 00 |
| 6 | 00 | T | T | 01 |
| 7 | 01 | T | NT | 00 |
| 8 | 00 | T | T | 01 |