|  |  |  |  |
| --- | --- | --- | --- |
| **Instructions** | **Meaning** | **Clock cycle for S4 (IE)** | **Remarks** |
| I11: ADD R5, R6, R5 | R5 ← R5 + R6 | 1 |  |
| I10: MUL R2, R6, R5 | R5 ← R2 × R6 | 3 |  |
| I9: SUB R5, R6, R5 | R5 ← R5 − R6 | 1 |  |
| I8: SUB R2, R6, R5 | R5 ← R2 − R6 | 1 | This will not get executed as the condition is mentioned in the assignment i.e. “if the only branch is taken” |
| I7: SUB R5, R6, R5 | R5 ← R5 − R6 | 1 |
| I6: ADD R2, R6, R5 | R5 ← R2 + R6 | 1 |
| I5: ADD R5, R6, R5 | R5 ← R5 + R6 | 1 |
| I4: ADD R2, R6, R5 | R5 ← R2 + R6 | 1 |
| I3: BQEZ R3, I9 | if R3 ≥ 0, jump to I9 | 3 | In Jump instruction the MO instruction will not get executed |
| I2: DIV R5, R3, R3 | R3 ← R5/R3 | 4 | As R3 & R5 are used in I1 so this will get stall in ID i.e. S2 |
| I1: MUL R3, R4, R5 | R5 ← R3 × R4 | 2 |  |
| I0: SUB R0, R1, R2 | R2 ← R0 + R1 | 1 |  |
| **Instructions** | **Meaning** |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| I11 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | IF | -- | -- | -- | -- | -- | ID | OF | IE | MO |
| I10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | IF | ID | -- | OF | IE | | | MO |  |  |  |
| I9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | IF | ID | OF | IE | MO |  |  |  |  |  |  |  |
| I8 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| I7 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| I6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| I5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| I4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| I3 |  |  |  | IF | -- | -- | -- | -- | -- | -- | -- | -- | IF | ID | OF | IE | | |  |  |  |  |  |  |  |  |  |  |  |  |
| I2 |  |  | IF | ID | -- | -- | -- | OF | IE | | | | MO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| I1 |  | IF | ID | OF | IE | | | MO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| I0 | IF | ID | OF | IE | MO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Clock Cycle | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |

**According to the required format**:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S5(MO) |  |  |  |  | I0 |  |  | I1 |  |  |  |  | I2 |  |  |  |  |  |  |  |  |  | I9 |  |  |  | I10 |  |  | I11 |
| S4 (IE) |  |  |  | I0 | I1 | I1 | I1 |  | I2 | I2 | I2 | I2 |  |  |  | I3 | I3 | I3 |  |  |  | I9 |  | I10 | I10 | I10 |  |  | I11 |  |
| S3 (OF) |  |  | I0 | I1 |  |  |  | I2 |  |  |  |  |  |  | I3 |  |  |  |  |  | I9 |  | I10 |  |  |  |  | I11 |  |  |
| S2 (ID) |  | I0 | I1 | I2 |  |  |  |  |  |  |  |  |  | I3 |  |  |  |  |  | I9 | I10 |  |  |  |  |  | I11 |  |  |  |
| S1 (IF) | I0 | I1 | I2 | I3 |  |  |  |  |  |  |  |  | I3 |  |  |  |  |  | I9 | I10 | I11 |  |  |  |  |  |  |  |  |  |
| Clock Cycle | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |