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U19CS076

Tutorial Problems

Pipelining

1. Draw the pipelining execution for following code and detect and resolve the hazard if any.

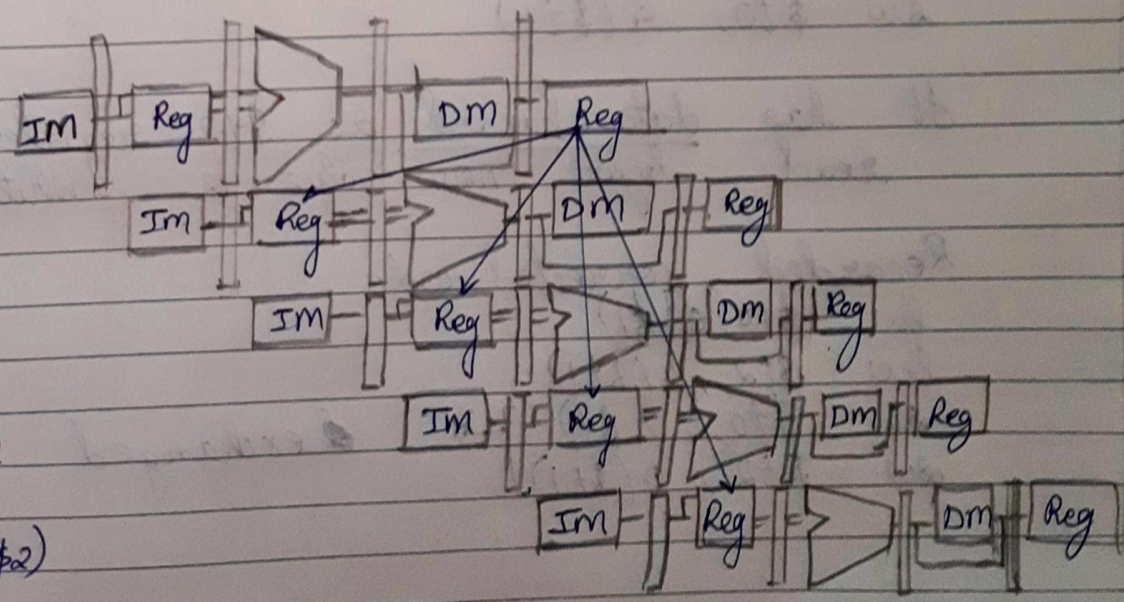
```
sub  $2 , $1 , $3
and  $12 , $2 , $5
or   $13 , $6 , $2
and  $14 , $2 , $2
sw   $15 , 100($2)
```

$2 = 10 before sub
$2 = -20 after sub

→ time (in clock cycle) CC → Clock Cycle

Value of $2	CC1	CC2	CC3	CC4	CC5	CC6	CC7	CC8	CC9
	10	10	10	10	10/-20	-20	-20	-20	-20

Program execution order (instructions)



Data Hazard

It is read after Write (RAW) hazard
In 1st instruction value of $2 is to be changed to -20

For 2, 3, 4] But the old value of $2 i.e, 10 is used in the subsequent instructions as the new value isn't updated. The further instruction read source before its new value is updated.

For CC5] $2 is updated to new value as it reaches end of cycle.

Q2. Detect and resolve hazard if any.

```
lw $t0, 0$(t1)
lw $t2, 4($t1)
sw $t2, 0($t1)
sw $t0, 4($t1)
```

It has data hazard as $t2 register is read before new value is written

Recorded, corrected code

```
lw $t0, 0($t1)
lw $t2, 4($t1)
sw $t0, 4($t1) ]→ exchanged
sw $t2, 0($t1) ]
```