DATE

SRN: PES2UG20CS216 Name: Aaren

Q3) Given

```
i1  LDR  R1, [R2, #40]   - (1)
i2  ADD  R2, R3, R3      - (2)
i3  ADD  R1, R1, R2      - (3)
i4  STR  R1, [R2, #40]   - (4)
```

a) (1) and (2) : Anti dependence on R2
(1) and (3) : Output dependence on R1
(1) and (4) : True dependence on R1 if no parti
(2) and (3) : True dependence on R2
(2) and (4) : True dependence on R2
(3) and (4) : True dependence on R1

b) Without data Forwarding:

```
i1   F  D  E  M  W
i2      F  D  E  M  W
i3         F  D  E  M  W
i4            F  D  E  M  W
```

Structural Hazards : i1 and i4

Data Hazards : RAW : i3 and i4
i1 and i3
i2 and i3
i1 and i4
WAW : i1 and i3
i2 and i4

PES UNIVERSITY

DATE | SRN: PES2UG20CS216 | Name: Naren.

With data forwarding

Structural Hazard: i1 and i4

Data Hazard: WAW: i1 and i3, i2 and i4

c) Since all RAW are eliminated after data forwarding, we don't require NOPS

Q4)

a)

	LDR	F	D	E	M	W		
	BEQ		F	D	E	M	W	★ i3 instruction
i3	ADD			F	D	E	M	W is not executed.
	BEQ				F	D	E	M W
	STR					F	D	E M W
	AND						F	D E M W

b) After Addition of safe instruction

	BEQ	F	D	E	M	W			
	LDR		F	D	E	M	W		(safe instruction)
	ADD			F	D	E	M	W	
	BEQ				F	D	E	M	W
	STR					F	D	E	M W (safe instruction)
	AND						F	D	E M W

PES UNIVERSITY