Question 2

Considering a (2,2) correlating predictor of 1K entries; and assuming that the MIPS-like processor executes the following code fragment, **calculate the misprediction rate** in the presented case.
The BPU initial state is indicated in the table.

General assumptions:
- R10 is the main loop control register and is initialized to 0
- R3 and R7 are the reference values set to 5
- R2 and R6 are input registers
    - R2 input values are 3 in the even iterations (R10 = 0, 2, 4, 6,…), and 7 in the odd ones (R10 = 1,3,5,7,…).
    - R6 input values are always 0 < R6 < 5
- R2 `SLT R1,R2,R3 ;IF (R2 < R3) R1 ← 1`
  `;ELSE R1 ← 0`

Please use this table to help yourself to find the Misprediction rate that you have to report at the end. Please report in the table intermediate values.

If(r2 < r3) r12 ← 10
If(r6 < r7) r16 ← 10
If(r7 <= r2) …
r10 ← r10 + 1
r11 ← r10 – 99
if(r11 != 0) goto L0;
…

1° iterazione: r2 = 3 → L0 non salta
r6 < 5 → L1 salta
r2 < 5 → L2 salta
r10 = 1, r11 = -98 → L3 salta

2° iterazione r2 = 7 → L0 salta
r6 < 5 → L1 salta
r2 >= 5 → L2 non salta
r10 = 2, r11 = -97 -> L3 salta

3° iterazione r2 = 3 → L0 non salta
r6 < 5 → L1 salta
r2 < 5 → L2 salta
r10 = 3, r11 = -97 → L3 salta

4° iterazione r2 = 7 → L0 salta
r6 < r5 → L1 salta
r2 >= 5 → L2 non salta
r10 = 4, r11 = -96 → L3 salta

5° iterazione r2 = 3 → L0 non salta
r6 < 5 → L1 salta
r2 < 5 → L2 salta
r10 = 5, r11 = -95 → L3 salta

6° iterazione r2 = 7 → L0 salta
r6 < 5 → L1 salta
r2 >= 5 → L2 non salta
r10 = 6, r11 = -94 → L3 salta

7° iterazione r2 = 3 → L0 non salta
r6 < 5 → L1 salta
r2 < 5 → L2 salta
r10 = 7, r11 = -93 → L3 salta

MISPREDICTION RATE
Number of mispredictions / total number of decisions

_____14_____ / _____99*4 = 396_____ = 3.53%

Address	Instruction	2-bit predictors				2-bit shift register	misP. counter
		00	01	10	11		
0x0000	L0: …	0	0	0	0	00-11-01-11-01-11-01	
…	; Reading input values	0	0	0	0		
0x0010	SLT R1, R2, R3	0	0	0	0		
0x0014	BNEZ R1, L1	0	0	0	0-1-2-3	00-00 11-11 01-10 11-11 01-10 11-11 01-10	0-1-0-1-0-0-0…
0x0018	DADDI R12, R0, 10	0	0	0	0		
0x001C	L1: SLT R4, R6, R7	0	0	0	0		
0x0020	BNEZ R4, L2	0-1	0	0-1-2-3	0-1-2-3	00-01 11-11 10-01 11-11 10-01 11-11 10-01	1-1-1-1-1-0-0…
0x0024	DADDI R16, R0, 10	0	0	0	0		
0x0028	L2: SLT R3, R2, R7	0	0	0	0		
0x002C	BEQZ R3, L3	0	0-1-2-3	0	0	01-11 11-10 01-11 11-10 01-11 11-10 01-11	1-0-1-0-0-0-0…
0x0030	…	0	0	0	0		
0x0038	L3: …	0	0	0	0		
0x003c	DADDI R10, R10, #1	0	0	0	0		
0x0040	DADDI R11, R10, #-99	0	0	0	0		
0x0044	BNEZ R11, L0	0	0	0-1-2-3	0-1-2-3…-2	11-11 10-01 11-11 10-01 11-11 10-01 11-11… 11-10	1-1-1-1-0-0-0…-1
0x0048	…	0	0	0	0		