

Task II.1

The program:

```
SEARCH:    LW R5, 0(R3)      /I1 Load item
           SUB R6, R5, R2    /I2 compare with key
           BNEZ R6, NOMATCH  /I3 check for match
           ADDI R1, R1, #1    /I4 count matches
NOMATCH:   ADDI R3, R3, #4    /I5 next item
           BNE R4, R3, SEARCH /I6 continue until all items
```

a)

Pipeline:

Clock		C1	C2	C3	C1	C2	C3	C4	C5	C6	C7
I1	LW R5, 0(R3)	IF	ID	EX	ME	WB					
I2	SUB R6, R5, R2		IF	ID	EX	ME	WB				
I3	BNEZ R6, NOMATCH			IF	ID	EX	ME	WB			
I4	ADDI R1, R1, #1				IF	ID	EX	ME	WB		
I5	ADDI R3, R3, #4					IF	ID	EX	ME	WB	
I6	BNE R4, R3, SEARCH						IF	ID	EX	ME	WB

Clock		C1	C2	C3	C1	C2	C3	C4	C5	C6	C7	C8
I1	LW R5, 0(R3)	IF	ID	EX	ME	WB						
I2	SUB R6, R5, R2		NOOPS	NOOPS	NOOPS	IF	ID	EX	ME	WB		
I3	BNEZ R6, NOMATCH						NOOPS	NOOPS	NOOPS	IF	ID	EX
I4	ADDI R1, R1, #1										IF	ID
I5	ADDI R3, R3, #4											IF
I6	BNE R4, R3, SEARCH											

For I2 is delayed since it is dependent on R5 from I1. Therefore the ID step of I2 must be after the WB step of

11.