

36APS – 4.cvičení

Simulace WinDLX, základní optimalizační techniky

Program	Počet taktů	Počet Instrukcí	CPI	RAW Stalls	Control Stalls
Loop1.s	1310	604	2,17	603	99
Loop2.s	1010	604	1,67	303	99
Loop3.s	387	355	1,09	4	24
Loop4.s	389	357	1,09	3	25

a) Loop1.s – originální verze

```

Init:  lhi      r1,Xarray>>16
      addui    r1,r1,Xarray&0xffff ; base address of X
      array

      addui    r4,r0,100 ; loop control variable
Loop:  lw      r2,0(r1) ; start of the loop for
      optimization
      addui    r2,r2,10
      sw      0(r1),r2
      addui    r1,r1,4 ; address pointer
      subui    r4,r4,1 ; loop control variable
      bnez    r4,Loop
      trap #0
    
```

b) Loop2.s – optimalizovaná verze:

```

Init:  lhi      r1,Xarray>>16
      addui    r1,r1,Xarray&0xffff ; base address of X array
      addui    r4,r0,100 ; loop control variable

Loop:  lw      r2,0(r1) ; start of the loop for
      optimization
      subui    r4,r4,1 ; loop control variable
      addui    r2,r2,10

      sw      0(r1),r2
      addui    r1,r1,4 ; address pointer

      bnez    r4,Loop
      trap #0
    
```

c) Loop3.s – optimalizovaná a rozbalená verze pro 100 iterací:

```

Init:  lhi      r1,Xarray>>16
      addui    r1,r1,Xarray&0xffff ; base address of X array
      addui    r4,r0,100 ; loop control variable

Loop:  subui    r4,r4,4 ; loop control variable
    
```

```

r1+0   lw      r2,0(r1) ; start of the loop for optimization
r1+4   lw      r3,4(r1) ; start of the loop for optimization
r1+8   lw      r5,8(r1) ; start of the loop for optimization
r1+12  lw      r6,12(r1) ; start of the loop for optimization

      addui    r2,r2,10
      addui    r3,r3,10
      addui    r5,r5,10
      addui    r6,r6,10
      sw      0(r1),r2
      sw      4(r1),r3
      sw      8(r1),r5
      sw      12(r1),r6

      bnez    r4,Loop
      addui    r1,r1,16 ; address pointer 4*4B

      trap #0
    
```

d) Loop4.s – optimalizovaná a rozbalená verze pro N iterací:

```

Init:  lhi      r1,Xarray>>16
      addui    r4,r0,50 ; Pocet prvku pole !!!!
      addui    r1,r1,Xarray&0xffff ; base address of X array

      andi    r7,r4,0x03 ; N mod M
      beqz    r7,Loop2 ; r7 je nula, preskoc to

Loop:  lw      r2,0(r1) ; start of the loop for
      optimization

      subui    r7,r7,1 ; loop control variable

      addui    r1,r1,4 ; address pointer

      addui    r2,r2,10
      sw      0(r1),r2

      bnez    r7,Loop

      andi    r4,r4,0xffffc ; (N div M)*N

Loop2: subui    r4,r4,4 ; loop control variable

      lw      r2,0(r1) ; r1+0
      lw      r3,4(r1) ; r1+4
      lw      r5,8(r1) ; r1+8
      lw      r6,12(r1) ; r1+12
      addui    r2,r2,10
    
```

```

addui    r3,r3,10
addui    r5,r5,10
addui    r6,r6,10
sw       0(r1),r2
sw       4(r1),r3
sw       8(r1),r5
sw       12(r1),r6

bnez     r4,Loop2
addui    r1,r1,16      ; address pointer 4*4B

trap #0

```

N	Počet taktů	Počet instrukcí	CPI
10	63	48	1,31
30	138	118	1,17
50	213	188	1,13
100	389	357	1,09