

for (i=0; i<12; i++) :
 a=a+1

initialization happens once

i = X₂₀
 a = X₂₁

Addi X₂₀, X₀, 0

Addi X₅, X₀, 12

loop1:

BGE X₂₀, X₅, Exit

Addi X₂₁, X₂₁, 1

Addi X₂₀, X₂₀, 1

Beq X₀, X₀, loop1

Exit:

try yourself.

i = 0
 while (i < 12) :
 a = a + 1
 i = i + 1

Afterwards, look at both of these assembly codes.

If given any of these two codes can you determine if it's a while/for loop?

A[B[C[]]]

while (A[B[C[]]] == k) :

A[i] = A[C[i]]

already calculated!

i = j

j = j + 1

Double word
 A[0] = X₂₅

Word
 B[0] = X₂₆

Halfword
 C[0] = X₂₇

i = X₂₈

j = X₂₉

k = X₃₀

Double word = 64b
 8 cells

word = 32b
 4 cells

Half word = 16b
 2 cells

Loop 1 :

$X_6 = C[i]$
 ↓
 this is the offset now for B
 Slli $X_5, X_{28}, 1$; $X_5 = i \times 2^1 = i \times 2$ (half word)
 Add X_5, X_{27}, X_5 ; $X_5 = X_{27} + X_5$ (offset)
 LH $X_6, 0[X_5]$
 Base of C offset
 ⇒

$X_7 = B[C[i]]$
 ↓
 this is the offset now for A
 Slli $X_5, X_6, 2$; $X_5 = [C[i]] \times 2^2 = C[i] \times 4$ (word)
 Add X_5, X_5, X_{26} ; $X_5 = X_{26} + X_5$ (offset)
 LW $X_7, 0[X_5]$
 Base of B offset

$X_7 = A[B[C[i]]]$
 Finally 😊
 Slli $X_5, X_7, 3$; $X_5 = [B[C[i]]] \times 2^3 = B[C[i]] \times 8$ (Double word)
 Add X_5, X_5, X_{25} ; $X_5 = X_{25} + X_5$
 LD $X_7, 0[X_5]$
 Base of A offset

BNE $X_7, X_{30}, \text{break Loop 1}$

$X_6 = A[C[i]]$
 Slli $X_5, X_6, 3$; $X_5 = [C[i]] \times 2^3 = C[i] \times 8$ (Double word)
 Add X_5, X_{25}, X_5 ; $X_5 = X_5 + X_{25}$
 Ld $X_6, 0[X_5]$; offset Base

Slli $X_5, X_{28}, 3$; $X_5 = i \times 8 = 8i$ (offset)
 Add X_5, X_5, X_{25} ; $X_5 = X_5 + X_{25}$
 Sd $X_6, 0[X_5]$; offset Base

Add x_{28}, x_{29}, x_0 ; $i = j + 0 \Rightarrow i = j$

Addi $x_{29}, x_{29}, 1$; $j = j + 1$

Beq $x_0, x_0, \text{Loop 1}$

break Loop 1 ;

while ($A[B[C[]]] == K$) : } try this
 $i = j$
 $A[i] = A[C[]]$
 $j = j + 1$

for ($i = 0; i < 15; i += 2$):

if ($a == 5$):

for ($j = i; j < 12; j++$):

$a += 2$

else:

$a \neq 10$

$\rightarrow 3 + 1 + 1$

$i = X_{20}$

$a = X_{21}$

$j = X_{22}$

Solution:

Addi $X_{20}, X_0, 0$

Addi $X_{23}, X_0, 15$

Loop1:

BGE $X_{20}, X_{23}, \text{Loop1Exit}$

Addi $X_{24}, X_0, 5$

BNE $X_{21}, X_{24}, \text{Else}$

Add X_{22}, X_0, X_{20}

Addi $X_{25}, X_0, 12$

Loop2:

BGE $X_{22}, X_{25}, \text{incrementI}$

Addi $X_{21}, X_{21}, 2$

Addi $X_{22}, X_{22}, 1$

Bge $X_0, X_0, \text{loop2}$

Else:

Slli $x_8, x_{21}, 3$; $x_8 = a \times 8$

Add x_8, x_8, x_{21} ; $x_8 = 8a + a = 9a$

Add x_{21}, x_{21}, x_8 ; $x_{21} = a + 9a = 10a$

IncrementI:

Addi $x_{20}, x_{20}, 2$

Beq $x_0, x_0, \text{Loop1}$

Loop1Exit: