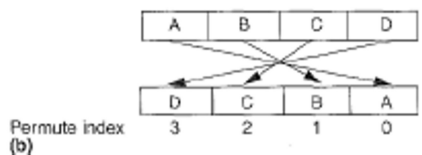
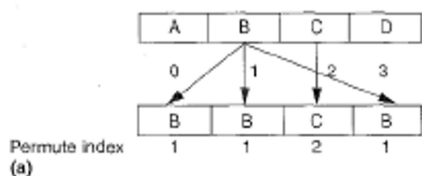
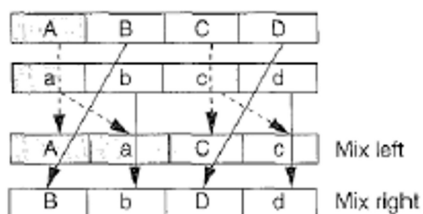


# Instruction

Thursday, March 23, 2017 3:53 PM



**Table 4.**  
**Register contents in matrix transpose.**

Instruction	Register contents
	<b>R1 = a1 b1 c1 d1</b>
	<b>R2 = a2 b2 c2 d2</b>
	<b>R3 = a3 b3 c3 d3</b>
	<b>R4 = a4 b4 c4 d4</b>
MixH,L R1,R2,t1	t1 = a1 a2 c1 c2
MixH,R R1,R2,t2	t2 = b1 b2 d1 d2
MixH,L R3,R4,t3	t3 = a3 a4 c3 c4
MixH,R R3,R4,t4	t4 = b3 b4 d3 d4
MixW,L t1,t3,R1	<b>R1 = a1 a2 a3 a4</b>
MixW,L t2,t4,R2	<b>R2 = b1 b2 b3 b4</b>
MixW,R t1,t3,R3	<b>R3 = c1 c2 c3 c4</b>
MixW,R t2,t4,R4	<b>R4 = d1 d2 d3 d4</b>

## ★ 4\*4 matrix transpose (16 instructions):

Load into R1-R4: (sstt set by us)

VLD r, s+t: 1001-////-sstt-10// -0010-rrrr-////-////

->1:

->2:

->3:

->4:

32-bit shuffle: 000-nnnnnnnn-11-10-ssss-rrrr-vvvv-wwww

Mix L: 000-00001010-11-10-0101-rrrr-vvvv-wwww

Mix R: 000-01011111-11-10-0101-rrrr-vvvv-wwww

Assuming storing in R1-R4:

1,2->5, L:000-00001010-11-10-0101-0101-0001-0010

1,2->6, R:000-01011111-11-10-0101-0110-0001-0010

3,4->7, L:000-00001010-11-10-0101-0111-0011-0100

3,4->8, R:000-01011111-11-10-0101-1000-0011-0100

5,7->1, L:000-00001010-11-10-0101-0001-0101-0111

6,8->2, L:000-00001010-11-10-0101-0010-0110-1000

5,7->3, R:000-01011111-11-10-0101-0011-0101-0100

6,8->4, R:000-01011111-11-10-0101-0100-0110-1000

Store back to memory:

VST s+t, r: 1011-00// -sstt-10// -0011-//// -vvvv-////

(Without SIMD: **32** instructions)

★ 4\*4 matrix multiplication (**72** instructions):  
**Load** into R1-R4, R5-R8:VLD (8 instructions)

**LOOP:** ( $4*15 = 60$ )

**Multiply:** R1\*R5,6,7,8 (4 instructions)

VMUL: 12\*-0110-rrrr-vvvv-wwww(32 bit)

1,5->9: 12\*-0110-1001-0001-0101

1,6->10: 12\*-0110-1010-0001-0110

1,7->11: 12\*-0110-1011-0001-0111

1,8->12: 12\*-0110-1100-0001-1000

**Transpose:**(using 9,10,11,12 back to 9,10,11,12) (8 instructions)

**Add:** R9+R10+R11+R12 (3 instructions)

VADD: 12\*-0000-rrrr-vvvv-wwww(32 bit)

9,10->9:

9,11->9:

9,12->1:

**Repeat**

**Store** back (4 instructions)

(Without SIMD:  $16+32+16*7 = \mathbf{160}$  instructions)