SIMD Parte 2

Conversiones, Shuffles y Blends

David Alejandro González Márquez

Departamento de Computación
Facultad de Ciencias Exactas y Naturales
Universidad de Buenos Aires

Agenda

- Problemas de Precisión
- Instrucciones de Shuffle
- Instrucciones de Blend
- Instrucciones de Conversión

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- No todos los números pueden ser representados de **forma exacta** en punto flotante

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  Por ejemplo: Si hacemos la operación $(0xFE + 0x11)/0x02$ en enteros, el resultado es $0x87$, siendo el correcto $0x87,8$

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- Los registros tienen un tipo de datos oculto al programador, usar instrucciones en enteros en punto flotante o a la inversa, implica una **penalidad**

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- Los registros tienen un tipo de datos oculto al programador, usar instrucciones en enteros en punto flotante o a la inversa, implica una **penalidad**
- El **costo** de las operaciones depende de cada una, ya sea en punto flotante o enteros

Shuffles

Las instrucciones de *Shuffle* permiten **reordenar** datos en registros.
Sus parámetros serán el **registro a reordenar** y una **máscara** que indicará cómo hacerlo.

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- PSHUFB - Shuffle Packed Bytes
- PSHUFHW - Shuffles high 16bit values
- PSHUFLW - Shuffles low 16bit values
- PSHUFD - Shuffle Packed Doublewords

- SHUFPS - Shuffle Packed Single FP Values
- SHUFPD - Shuffle Packed Double FP Values

Shuffles

PSHUFB — Packed Shuffle Bytes

Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
0F 38 00 /r[1] PSHUFB *mm1, mm2/m64*	RM	V/V	SSSE3	Shuffle bytes in *mm1* according to contents of *mm2/m64*.
66 0F 38 00 /r PSHUFB *xmm1, xmm2/m128*	RM	V/V	SSSE3	Shuffle bytes in *xmm1* according to contents of *xmm2/m128*.
VEX.NDS.128.66.0F38.WIG 00 /r VPSHUFB *xmm1, xmm2, xmm3/m128*	RVM	V/V	AVX	Shuffle bytes in *xmm2* according to contents of *xmm3/m128*.
VEX.NDS.256.66.0F38.WIG 00 /r VPSHUFB *ymm1, ymm2, ymm3/m256*	RVM	V/V	AVX2	Shuffle bytes in *ymm2* according to contents of *ymm3/m256*.

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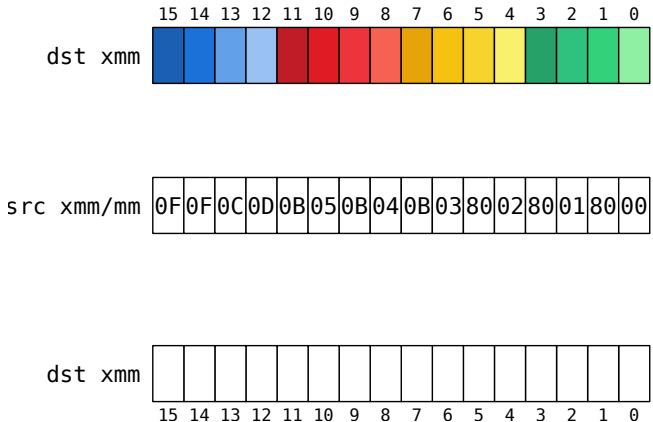
VEX.NDS.256.66.0F38.WIG 00 /r VPSHUFB *ymm1, ymm2, ymm3/m256*	RVM	V/V	AVX2	Shuffle bytes in *ymm2* according to contents of *ymm3/m256*.

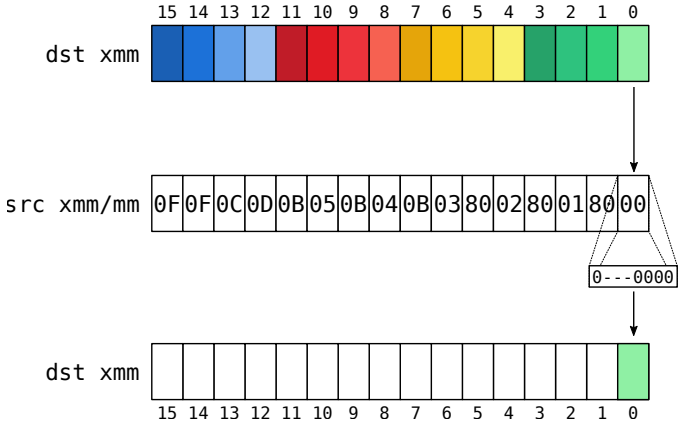
PSHUFB (with 128 bit operands)

```
    for i = 0 to 15 {
        if (SRC[(i * 8)+7] = 1 ) then
            DEST[(i*8)+7..(i*8)+0] ← 0;
         else
            index[3..0] ← SRC[(i*8)+3 .. (i*8)+0];
            DEST[(i*8)+7..(i*8)+0] ← DEST[(index*8+7)..(index*8+0)];
        endif
    }
DEST[VLMAX-1:128] ← 0
```

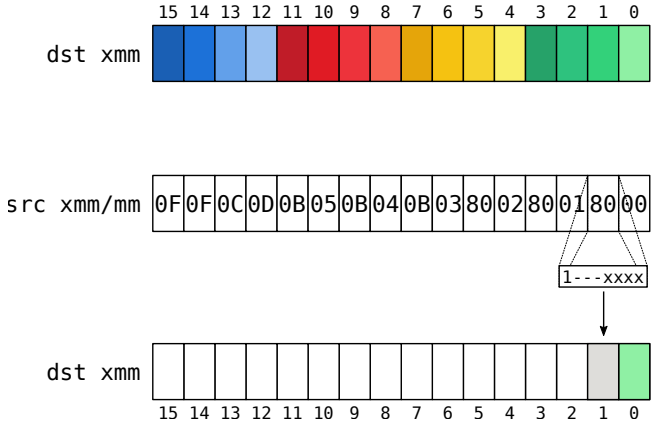
Ejemplo-PSHUFB dst, src



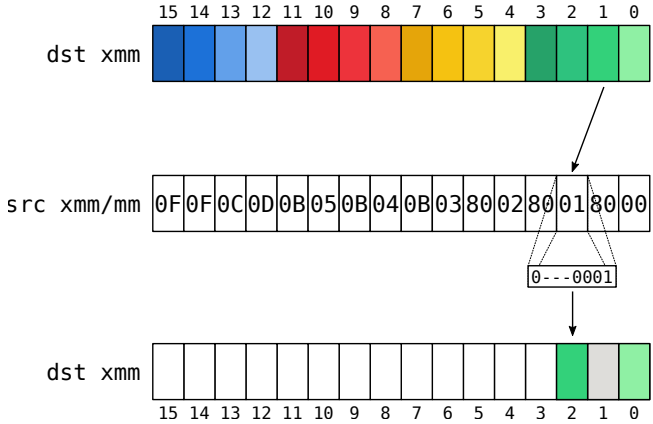
Ejemplo-PSHUFB dst, src



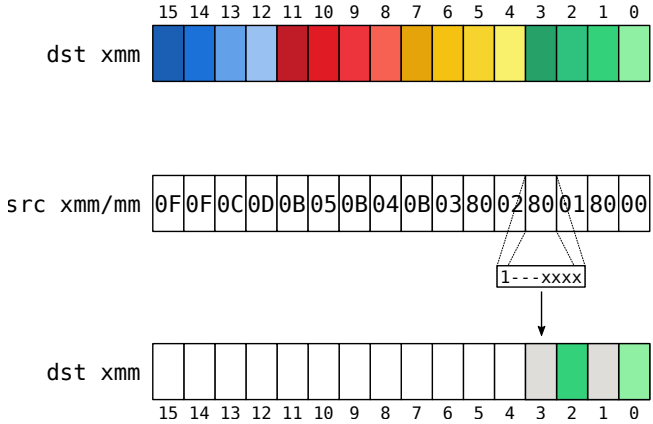
Ejemplo-PSHUFB dst, src



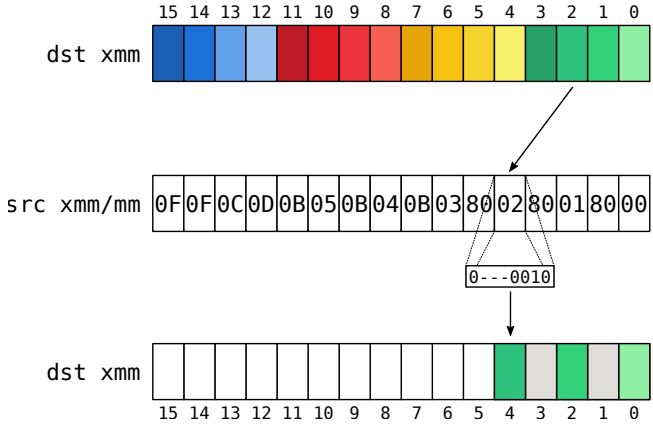
Ejemplo-PSHUFB dst, src



Ejemplo-PSHUFB dst, src



Ejemplo-PSHUFB dst, src



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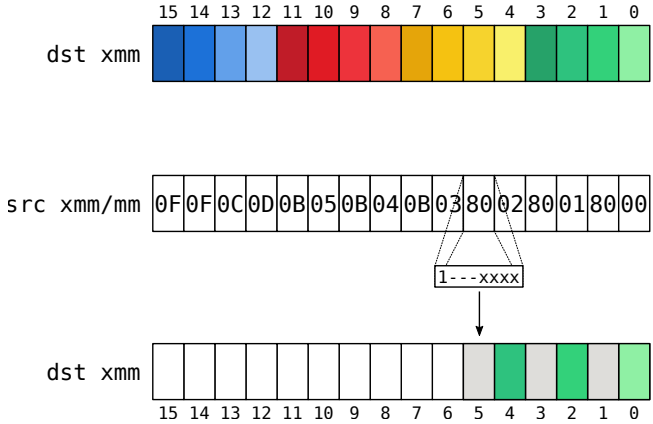
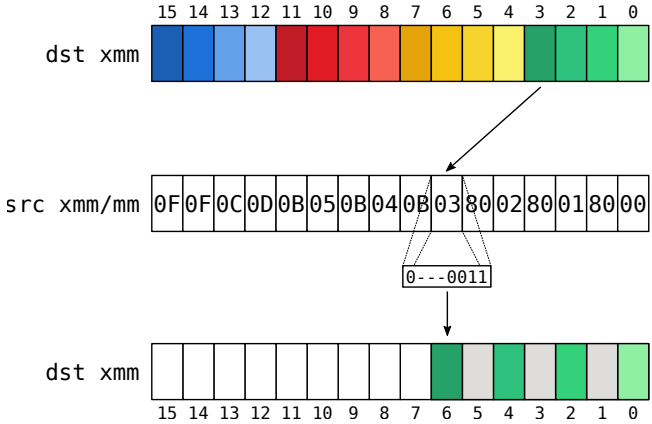


Ejemplo-PSHUFB dst, src



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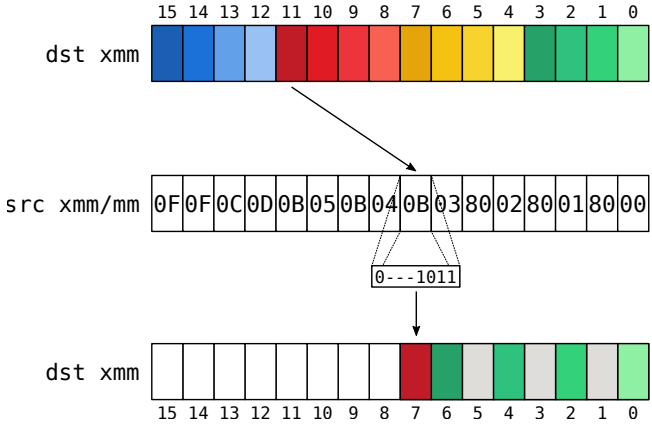

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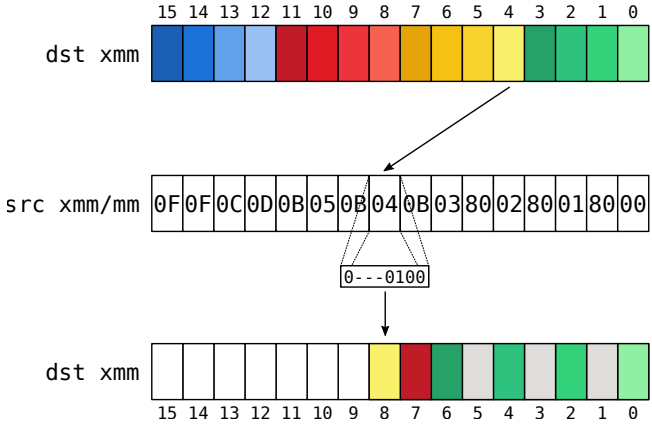

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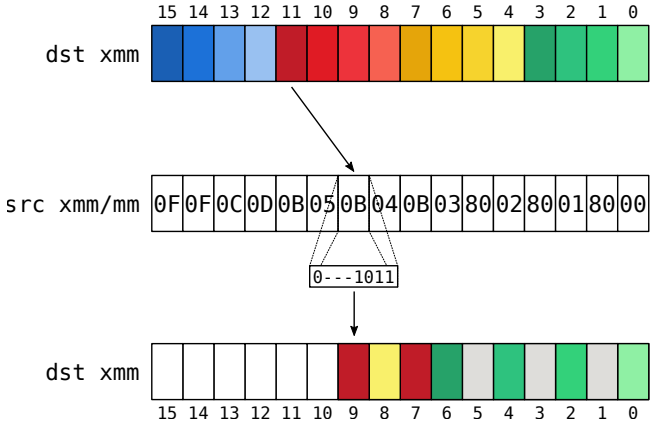

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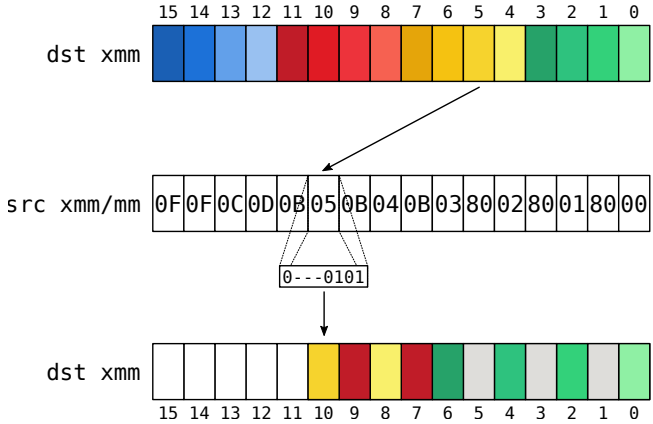

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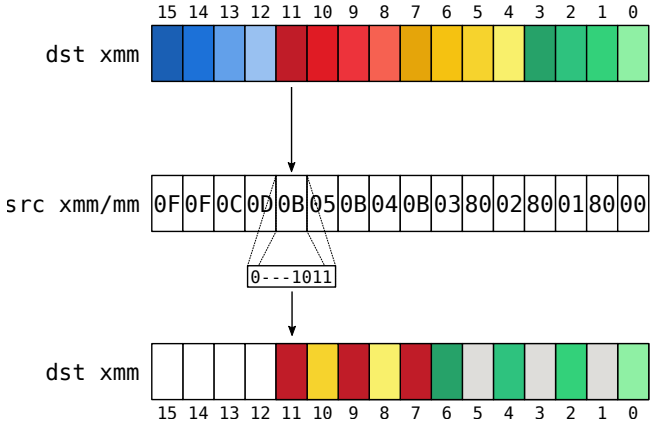

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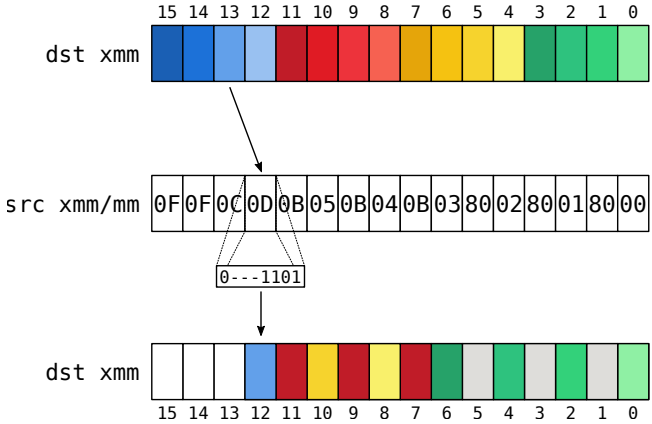

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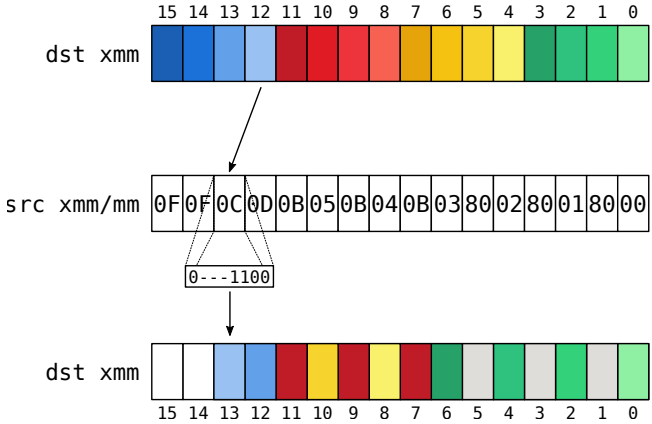

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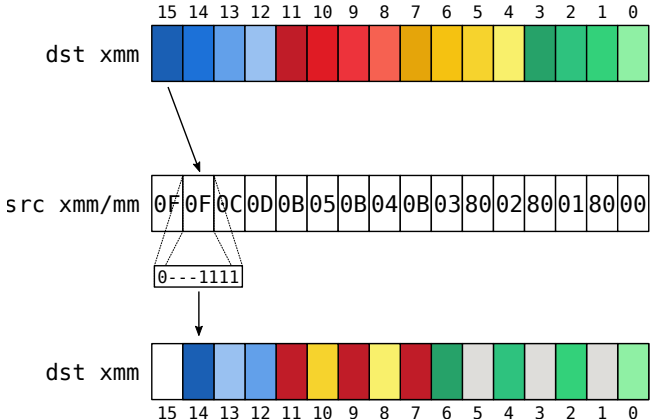

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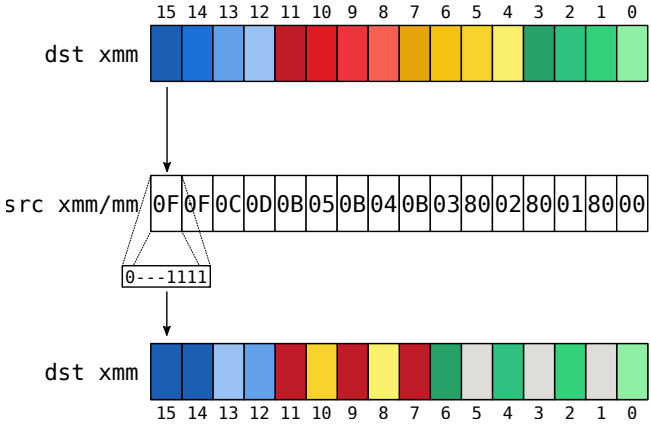

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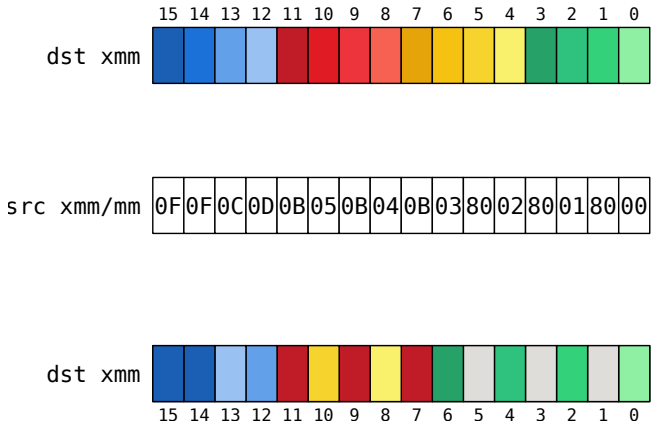

PSHUFLW—Shuffle Packed Low Words

Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
F2 0F 70 /r ib PSHUFLW *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE2	Shuffle the low words in *xmm2/m128* based on the encoding in *imm8* and store the result in *xmm1*.
VEX.128.F2.0F.WIG 70 /r ib VPSHUFLW *xmm1, xmm2/m128, imm8*	RMI	V/V	AVX	Shuffle the low words in *xmm2/m128* based on the encoding in *imm8* and store the result in *xmm1*.
VEX.256.F2.0F.WIG 70 /r ib VPSHUFLW *ymm1, ymm2/m256, imm8*	RMI	V/V	AVX2	Shuffle the low words in *ymm2/m256* based on the encoding in *imm8* and store the result in *ymm1*.

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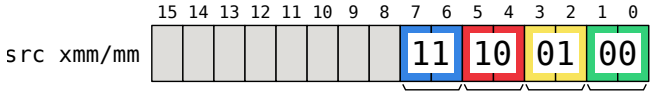
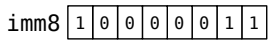
VEX.256.F2.0F.WIG 70 /r ib VPSHUFLW *ymm1, ymm2/m256, imm8*	RMI	V/V	AVX2	Shuffle the low words in *ymm2/m256* based on the encoding in *imm8* and store the result in *ymm1*.

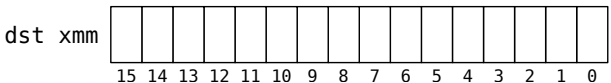
PSHUFLW (128-bit Legacy SSE version)

DEST[15:0] ← (SRC >> (imm[1:0] *16))[15:0]
DEST[31:16] ← (SRC >> (imm[3:2] * 16))[15:0]
DEST[47:32] ← (SRC >> (imm[5:4] * 16))[15:0]
DEST[63:48] ← (SRC >> (imm[7:6] * 16))[15:0]
DEST[127:64] ← SRC[127:64]
DEST[VLMAX-1:128] (Unmodified)

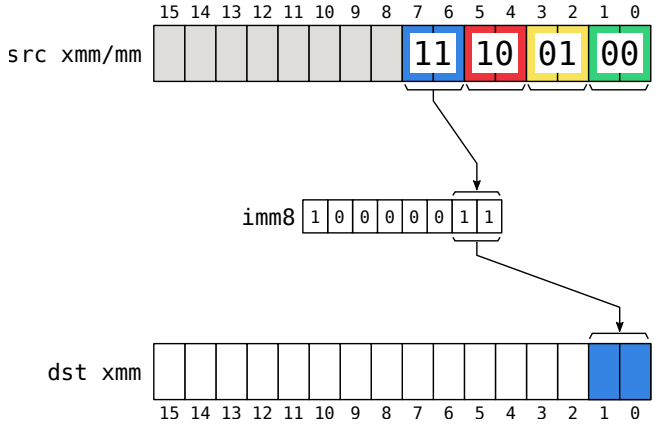
Ejemplo-PSHUFLW dst, src , imm8







Ejemplo-PSHUFLW dst, src , imm8



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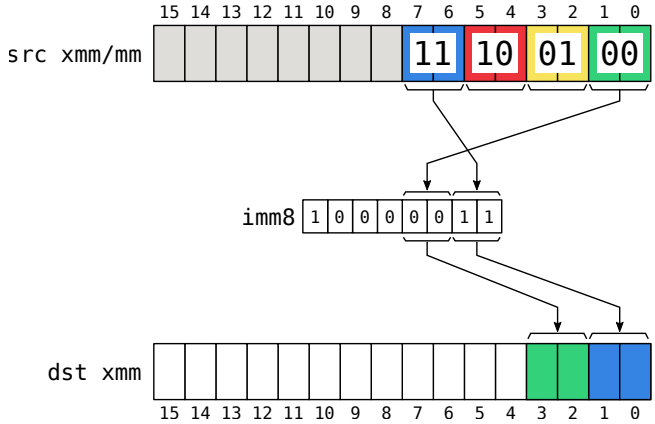

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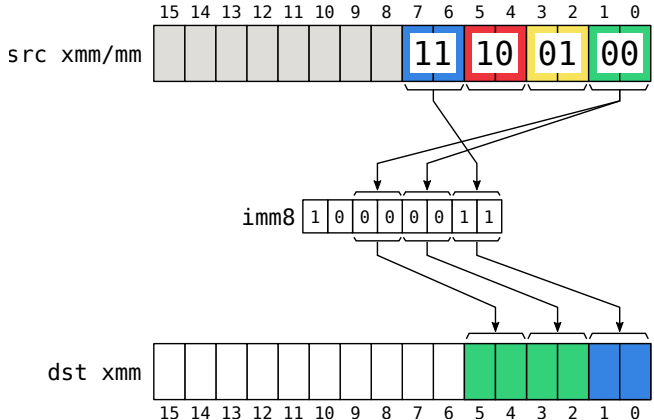
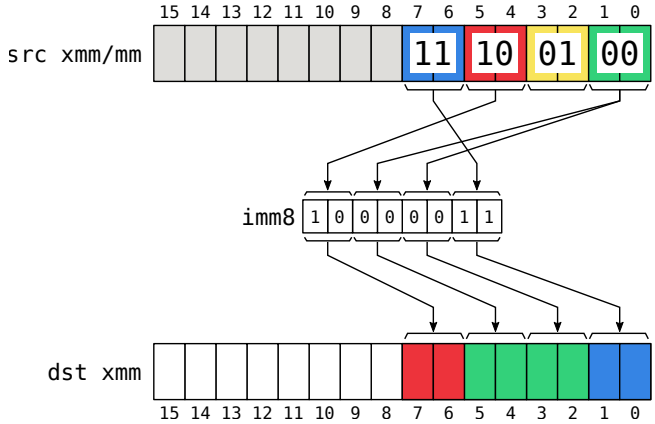


Ejemplo-PSHUFLW dst, src , imm8



Shuffles

PSHUFHW—Shuffle Packed High Words

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F3 0F 70 /r ib PSHUFHW *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE2	Shuffle the high words in *xmm2/m128* based on the encoding in *imm8* and store the result in *xmm1*.
VEX.128.F3.0F.WIG 70 /r ib VPSHUFHW *xmm1, xmm2/m128, imm8*	RMI	V/V	AVX	Shuffle the high words in *xmm2/m128* based on the encoding in *imm8* and store the result in *xmm1*.
VEX.256.F3.0F.WIG 70 /r ib VPSHUFHW *ymm1, ymm2/m256, imm8*	RMI	V/V	AVX2	Shuffle the high words in *ymm2/m256* based on the encoding in *imm8* and store the result in *ymm1*.

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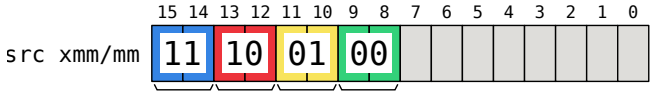
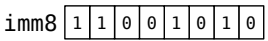
VEX.256.F3.0F.WIG 70 /r ib VPSHUFHW *ymm1, ymm2/m256, imm8*	RMI	V/V	AVX2	Shuffle the high words in *ymm2/m256* based on the encoding in *imm8* and store the result in *ymm1*.

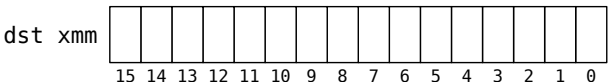
PSHUFHW (128-bit Legacy SSE version)

DEST[63:0] ← SRC[63:0]
DEST[79:64] ← (SRC >> (imm[1:0] *16))[79:64]
DEST[95:80] ← (SRC >> (imm[3:2] * 16))[79:64]
DEST[111:96] ← (SRC >> (imm[5:4] * 16))[79:64]
DEST[127:112] ← (SRC >> (imm[7:6] * 16))[79:64]
DEST[VLMAX-1:128] (Unmodified)

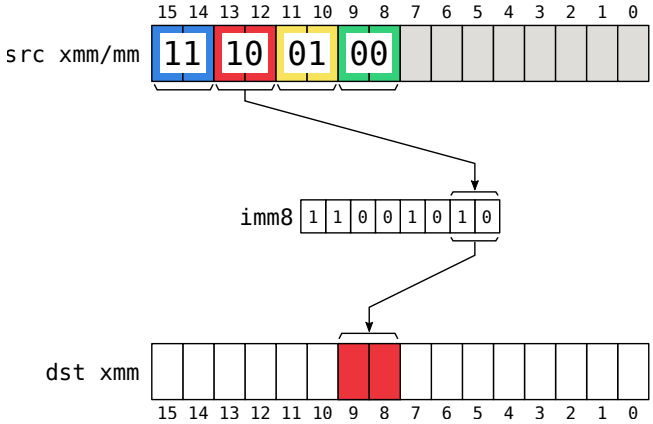
Ejemplo-PSHUFHW dst, src , imm8



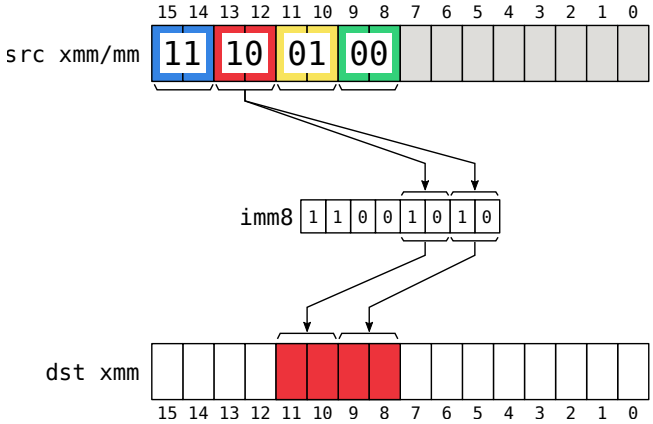




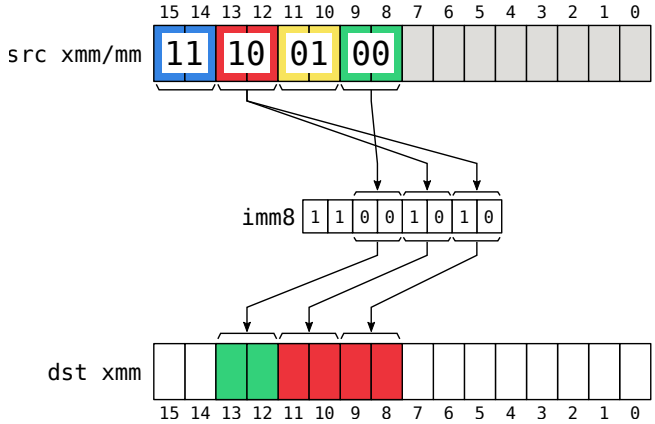
Ejemplo-PSHUFHW dst, src , imm8



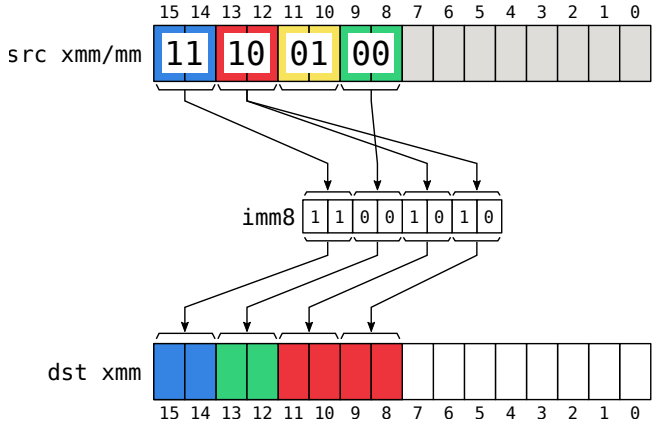
Ejemplo-PSHUFHW dst, src , imm8



Ejemplo-PSHUFHW dst, src , imm8



Ejemplo-PSHUFHW dst, src , imm8



Shuffles

PSHUFD—Shuffle Packed Doublewords

Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
66 0F 70 /r ib PSHUFD *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE2	Shuffle the doublewords in *xmm2/m128* based on the encoding in *imm8* and store the result in *xmm1*.
VEX.128.66.0F.WIG 70 /r ib VPSHUFD *xmm1, xmm2/m128, imm8*	RMI	V/V	AVX	Shuffle the doublewords in *xmm2/m128* based on the encoding in *imm8* and store the result in *xmm1*.
VEX.256.66.0F.WIG 70 /r ib VPSHUFD *ymm1, ymm2/m256, imm8*	RMI	V/V	AVX2	Shuffle the doublewords in *ymm2/m256* based on the encoding in *imm8* and store the result in *ymm1*.

Shuffles

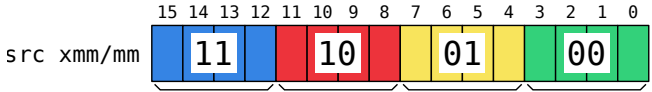
PSHUFD—Shuffle Packed Doublewords

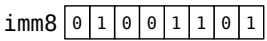
Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
66 0F 70 /r ib PSHUFD *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE2	Shuffle the doublewords in *xmm2/m128* based on the encoding in *imm8* and store the result in *xmm1*.
VEX.128.66.0F.WIG 70 /r ib VPSHUFD *xmm1, xmm2/m128, imm8*	RMI	V/V	AVX	Shuffle the doublewords in *xmm2/m128* based on the encoding in *imm8* and store the result in *xmm1*.
VEX.256.66.0F.WIG 70 /r ib VPSHUFD *ymm1, ymm2/m256, imm8*	RMI	V/V	AVX2	Shuffle the doublewords in *ymm2/m256* based on the encoding in *imm8* and store the result in *ymm1*.

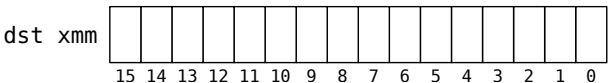
PSHUFD (128-bit Legacy SSE version)

DEST[31:0] ← (SRC >> (ORDER[1:0] * 32))[31:0];
DEST[63:32] ← (SRC >> (ORDER[3:2] * 32))[31:0];
DEST[95:64] ← (SRC >> (ORDER[5:4] * 32))[31:0];
DEST[127:96] ← (SRC >> (ORDER[7:6] * 32))[31:0];
DEST[VLMAX-1:128] (Unmodified)

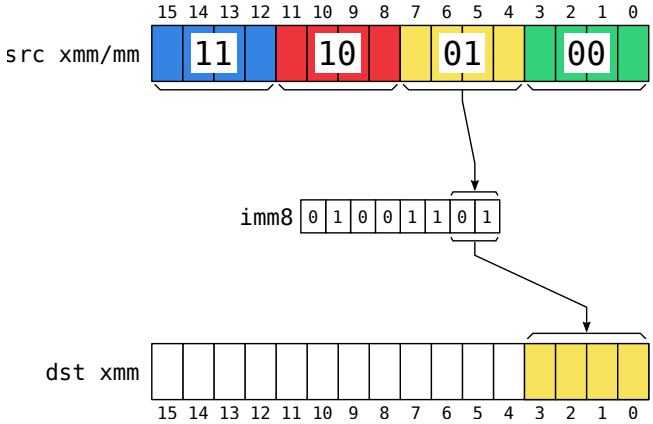
Ejemplo-PSHUFD dst, src , imm8



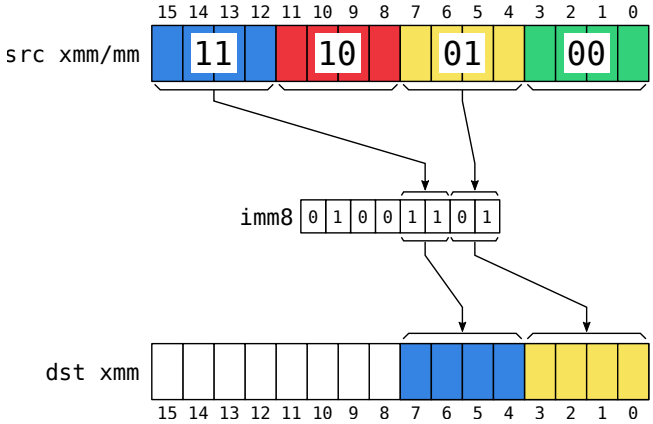




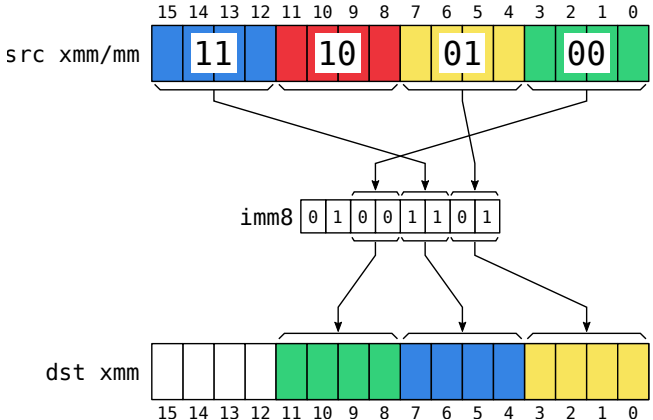
Ejemplo-PSHUFD dst, src , imm8



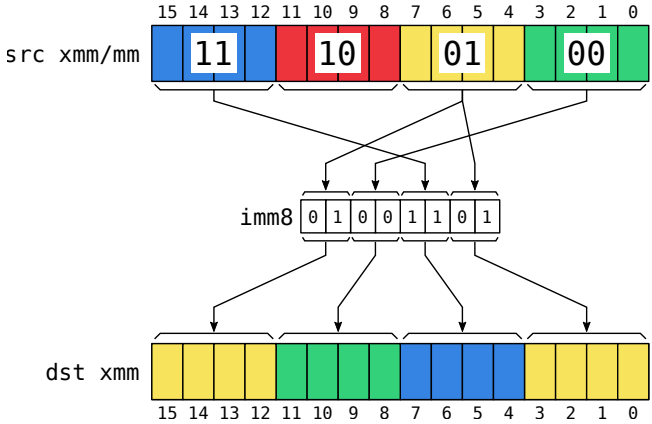
Ejemplo-PSHUFD dst, src , imm8



Ejemplo-PSHUFD dst, src , imm8



Ejemplo-PSHUFD dst, src , imm8



Shuffles

SHUFPS—Shuffle Packed Single-Precision Floating-Point Values

Opcode*/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
0F C6 /r ib SHUFPS *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE	Shuffle packed single-precision floating-point values selected by *imm8* from *xmm1* and *xmm1/m128* to *xmm1*.
VEX.NDS.128.0F.WIG C6 /r ib VSHUFPS *xmm1, xmm2, xmm3/m128, imm8*	RVMI	V/V	AVX	Shuffle Packed single-precision floating-point values selected by *imm8* from *xmm2* and *xmm3/mem*.
VEX.NDS.256.0F.WIG C6 /r ib VSHUFPS *ymm1, ymm2, ymm3/m256, imm8*	RVMI	V/V	AVX	Shuffle Packed single-precision floating-point values selected by *imm8* from *ymm2* and *ymm3/mem*.

Shuffles

SHUFPS—Shuffle Packed Single-Precision Floating-Point Values

Opcode*/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
0F C6 /r ib SHUFPS *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE	Shuffle packed single-precision floating-point values selected by *imm8* from *xmm1* and *xmm1/m128* to *xmm1*.
VEX.NDS.128.0F.WIG C6 /r ib VSHUFPS *xmm1, xmm2, xmm3/m128, imm8*	RVMI	V/V	AVX	Shuffle Packed single-precision floating-point values selected by *imm8* from *xmm2* and *xmm3/mem*.
VEX.NDS.256.0F.WIG C6 /r ib VSHUFPS *ymm1, ymm2, ymm3/m256, imm8*	RVMI	V/V	AVX	Shuffle Packed single-precision floating-point values selected by *imm8* from *ymm2* and *ymm3/mem*.

SHUFPS (128-bit Legacy SSE version)

DEST[31:0] ← Select4(SRC1[127:0], imm8[1:0]);
DEST[63:32] ← Select4(SRC1[127:0], imm8[3:2]);
DEST[95:64] ← Select4(SRC2[127:0], imm8[5:4]);
DEST[127:96] ← Select4(SRC2[127:0], imm8[7:6]);
DEST[VLMAX-1:128] (Unmodified)

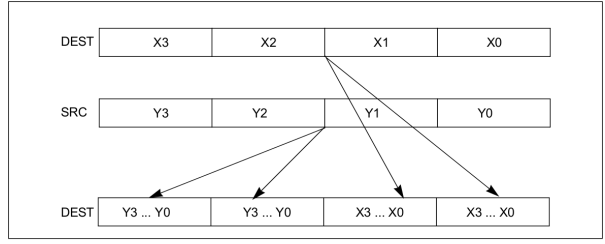
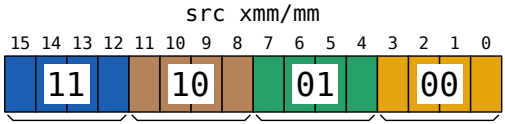
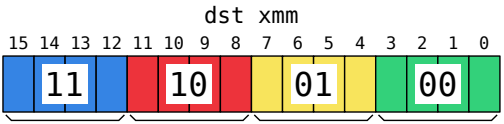
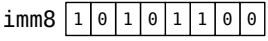


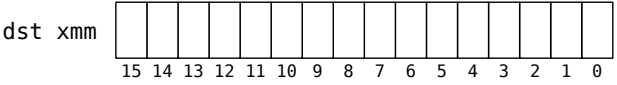
Figure 4-22. SHUFPS Shuffle Operation

Ejemplo - SHUFPS dst, src , imm8

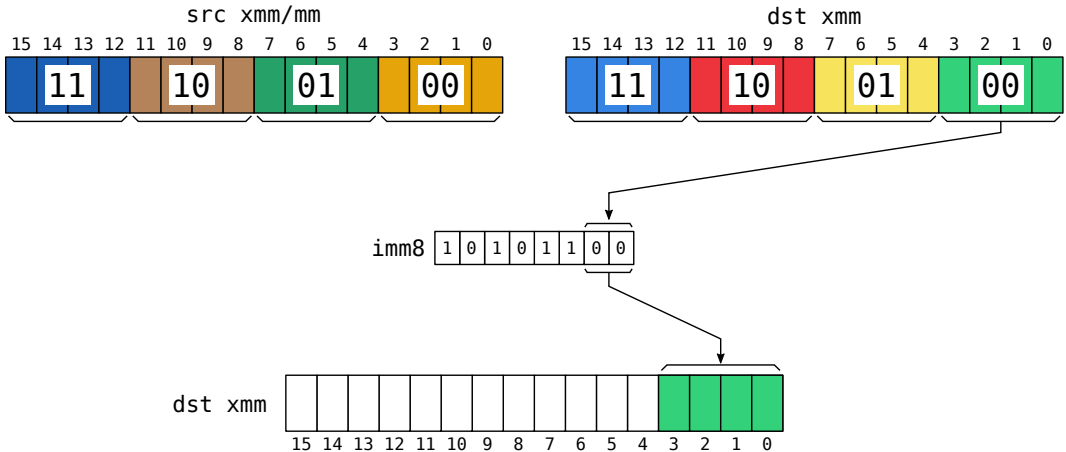




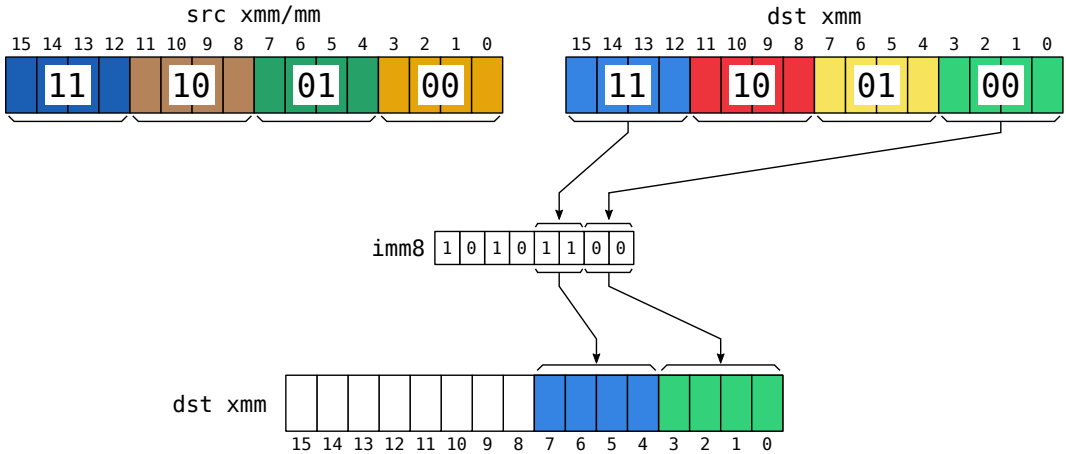




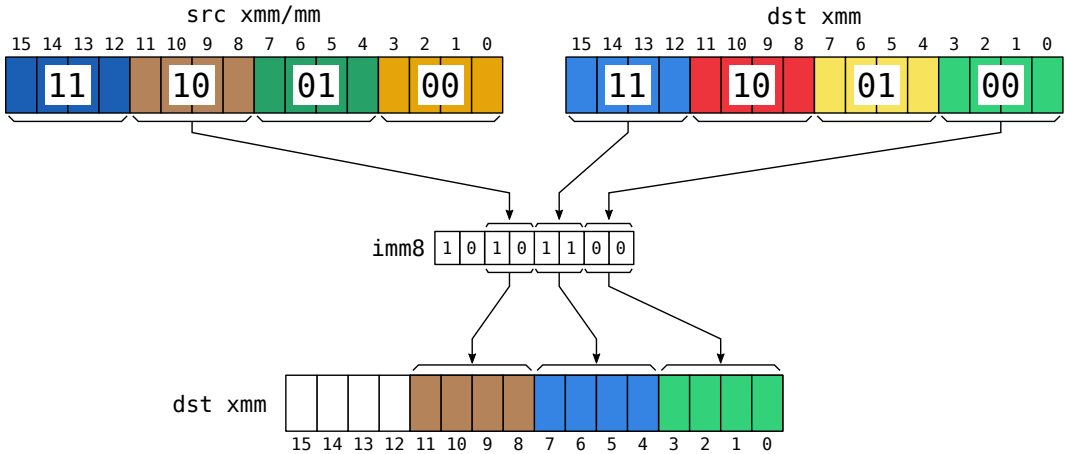
Ejemplo - SHUFPS dst, src , imm8



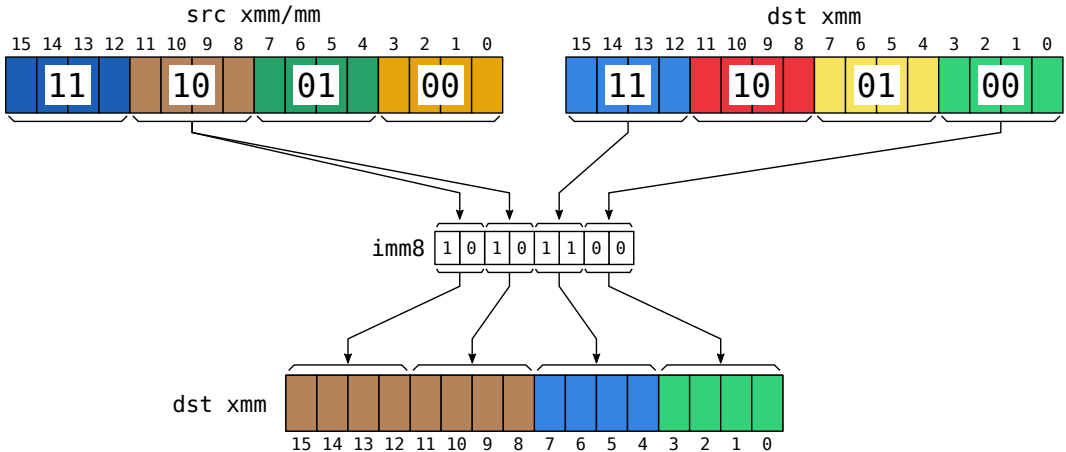
Ejemplo - SHUFPS dst, src , imm8



Ejemplo - SHUFPS dst, src , imm8



Ejemplo - SHUFPS dst, src , imm8



Shuffles

SHUFPD—Shuffle Packed Double-Precision Floating-Point Values

Opcode*/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
66 0F C6 /r ib SHUFPD *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE2	Shuffle packed double-precision floating-point values selected by *imm8* from *xmm1* and *xmm2/m128* to *xmm1*.
VEX.NDS.128.66.0F.WIG C6 /r ib VSHUFPD *xmm1, xmm2, xmm3/m128, imm8*	RVMI	V/V	AVX	Shuffle Packed double-precision floating-point values selected by *imm8* from *xmm2* and *xmm3/mem*.
VEX.NDS.256.66.0F.WIG C6 /r ib VSHUFPD *ymm1, ymm2, ymm3/m256, imm8*	RVMI	V/V	AVX	Shuffle Packed double-precision floating-point values selected by *imm8* from *ymm2* and *ymm3/mem*.

SHUFPD (128-bit Legacy SSE version)

```
IF IMM0[0] = 0
    THEN DEST[63:0] ← SRC1[63:0]
    ELSE DEST[63:0] ← SRC1[127:64] FI;
IF IMM0[1] = 0
    THEN DEST[127:64] ← SRC2[63:0]
    ELSE DEST[127:64] ← SRC2[127:64] FI;
DEST[VLMAX-1:128] (Unmodified)
```

DEST

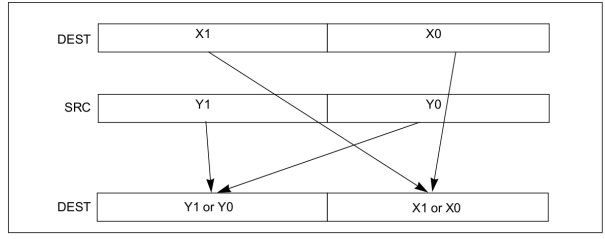
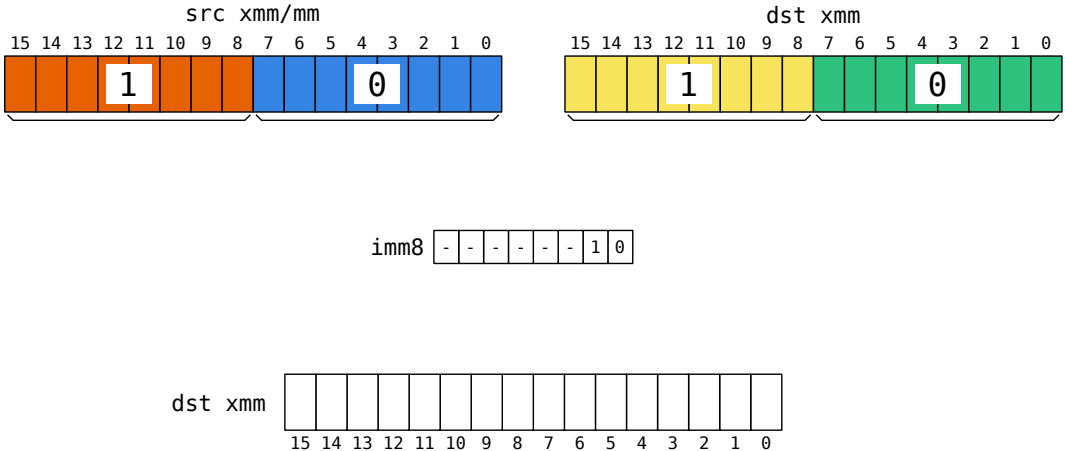
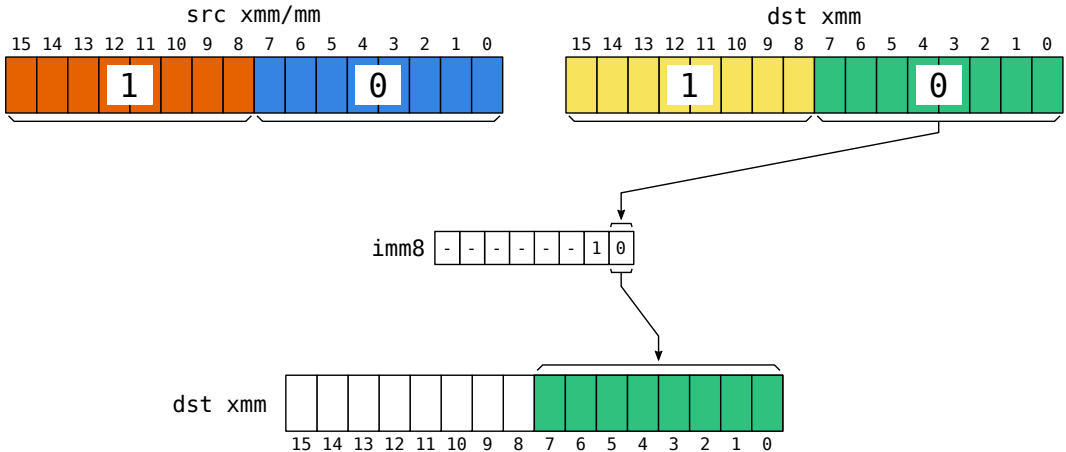


Figure 4-21. SHUFPD Shuffle Operation

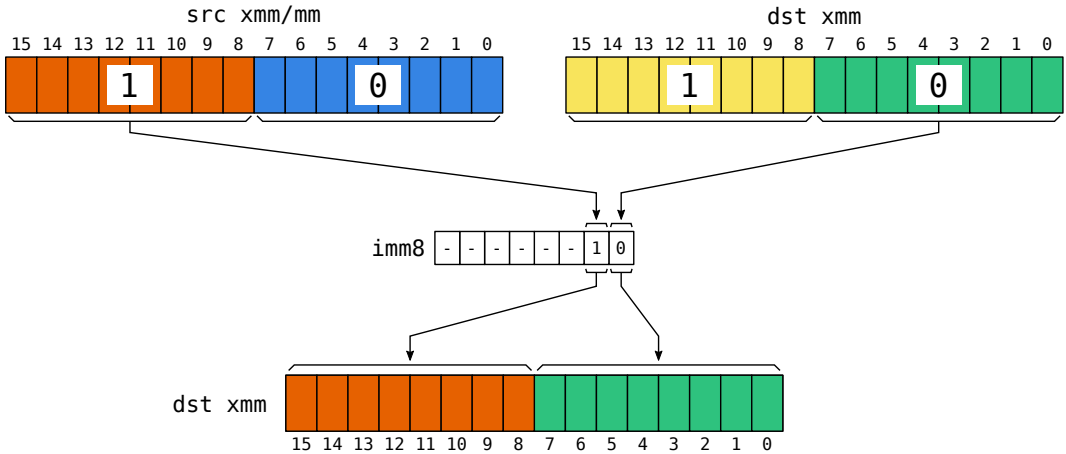
Ejemplo - SHUFPD dst, src , imm8



Ejemplo - SHUFPD dst, src , imm8



Ejemplo - SHUFPD dst, src , imm8



Insert/Extract

Las instrucciones de *Insert* y *Extract*, permiten como su nombre lo indica, **insertar** y **extraer** valores dentro de un registro.

Insert/Extract

Las instrucciones de *Insert* y *Extract*, permiten como su nombre lo indica, **insertar** y **extraer** valores dentro de un registro.

- INSERTPS - Insert Packed Single FP Value
- EXTRACTPS - Extract Packed Single FP Value

- PINSRB - Insert Byte
- PINSRW - Insert Word
- PINSRD - Insert Dword
- PINSRQ - Insert Qword

- PEXTRB - Extract Byte
- PEXTRW - Extract Word
- PEXTRD - Extract Dword
- PEXTRQ - Extract Qword

Insert

Extract

INSERTPS — Insert Packed Single Precision Floating-Point Value

Opcode/ Instruction	Op/ En	64/32-bit Mode	CPUID Feature Flag	Description
66 0F 3A 21 /r ib INSERTPS *xmm1, xmm2/m32, imm8*	RMI	V/V	SSE4_1	Insert a single precision floating-point value selected by *imm8* from *xmm2/m32* into xmm1 at the specified destination element specified by *imm8* and zero out destination elements in *xmm1* as indicated in *imm8*.
VEX.NDS.128.66.0F3A.WIG 21 /r ib VINSERTPS xmm1, xmm2, xmm3/m32, imm8	RVMI	V/V	AVX	Insert a single precision floating point value selected by imm8 from xmm3/m32 and merge into xmm2 at the specified destination element specified by imm8 and zero out destination elements in xmm1 as indicated in imm8.

Insert Extract

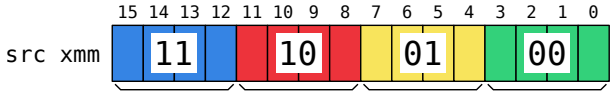
INSERTPS — Insert Packed Single Precision Floating-Point Value

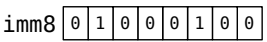
Opcode/ Instruction	Op/ En	64/32-bit Mode	CPUID Feature Flag	Description
66 0F 3A 21 /r ib INSERTPS *xmm1, xmm2/m32, imm8*	RMI	V/V	SSE4_1	Insert a single precision floating-point value selected by *imm8* from *xmm2/m32* into xmm1 at the specified destination element specified by *imm8* and zero out destination elements in *xmm1* as indicated in *imm8*.
VEX.NDS.128.66.0F3A.WIG 21 /r ib VINSERTPS xmm1, xmm2, xmm3/m32, imm8	RVMI	V/V	AVX	Insert a single precision floating point value selected by imm8 from xmm3/m32 and merge into xmm2 at the specified destination element specified by imm8 and zero out destination elements in xmm1 as indicated in imm8.

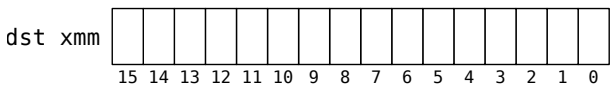
INSERTPS (128-bit Legacy SSE version)

```
IF (SRC = REG) THEN COUNT_S ← imm8[7:6]
    ELSE COUNT_S ← 0
COUNT_D ← imm8[5:4]
ZMASK ← imm8[3:0]
CASE (COUNT_S) OF
    0: TMP ← SRC[31:0]
    1: TMP ← SRC[63:32]
    2: TMP ← SRC[95:64]
    3: TMP ← SRC[127:96]
ESAC;
CASE (COUNT_D) OF
    0: TMP2[31:0] ← TMP
       TMP2[127:32] ← DEST[127:32]
    1: TMP2[63:32] ← TMP
       TMP2[31:0] ← DEST[31:0]
       TMP2[127:64] ← DEST[127:64]
    2: TMP2[95:64] ← TMP
       TMP2[63:0] ← DEST[63:0]
       TMP2[127:96] ← DEST[127:96]
    3: TMP2[127:96] ← TMP
       TMP2[95:0] ← DEST[95:0]
ESAC;
IF (ZMASK[0] = 1) THEN DEST[31:0] ← 00000000H
    ELSE DEST[31:0] ← TMP2[31:0]
IF (ZMASK[1] = 1) THEN DEST[63:32] ← 00000000H
    ELSE DEST[63:32] ← TMP2[63:32]
IF (ZMASK[2] = 1) THEN DEST[95:64] ← 00000000H
    ELSE DEST[95:64] ← TMP2[95:64]
IF (ZMASK[3] = 1) THEN DEST[127:96] ← 00000000H
    ELSE DEST[127:96] ← TMP2[127:96]
DEST[VLMAX-1:128] (Unmodified)
```

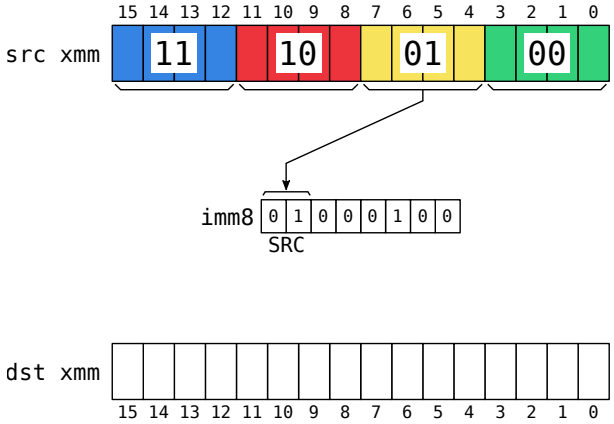
Ejemplo - INSERTPS dst, src , imm8



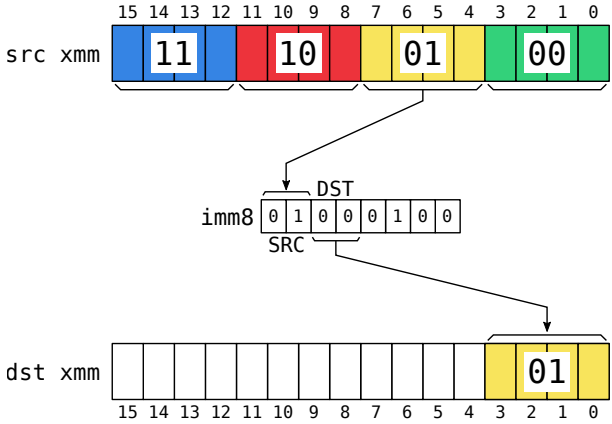




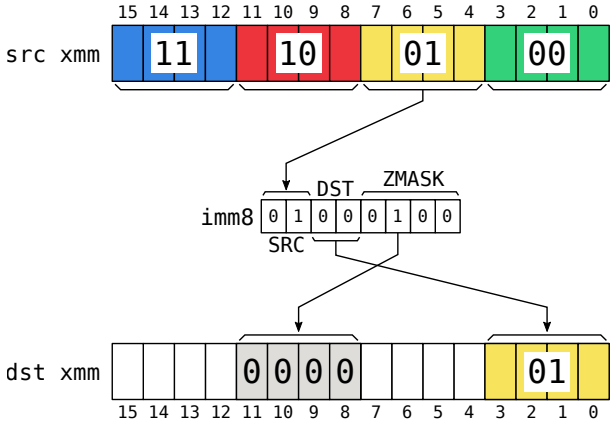
Ejemplo - INSERTPS dst, src , imm8



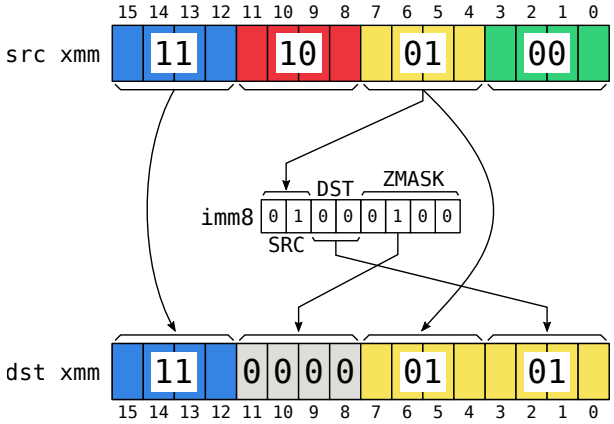
Ejemplo - INSERTPS dst, src , imm8



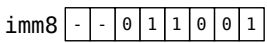
Ejemplo - INSERTPS dst, src , imm8

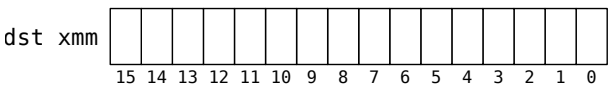


Ejemplo - INSERTPS dst, src , imm8

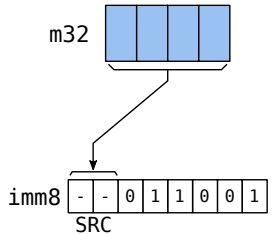


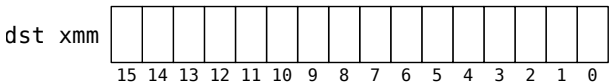
Ejemplo - INSERTPS dst, src , imm8



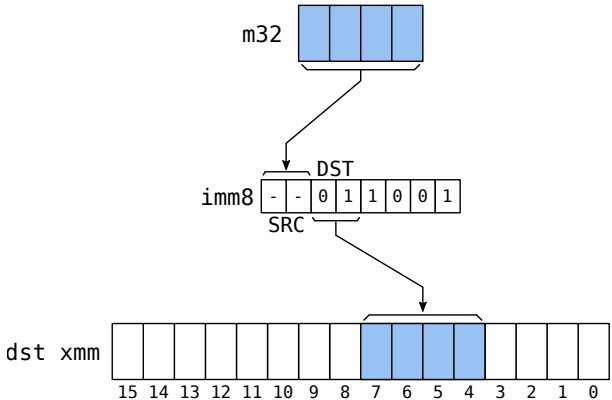


Ejemplo - INSERTPS dst, src , imm8

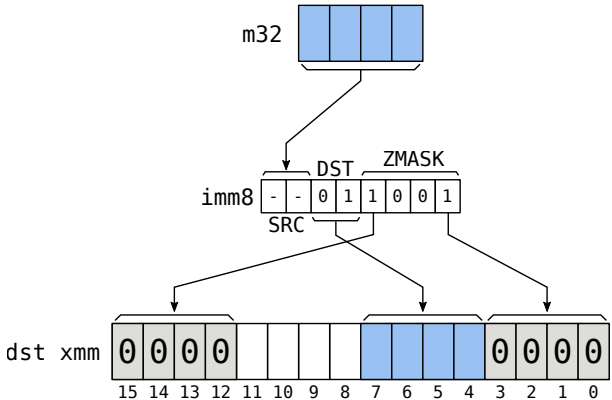




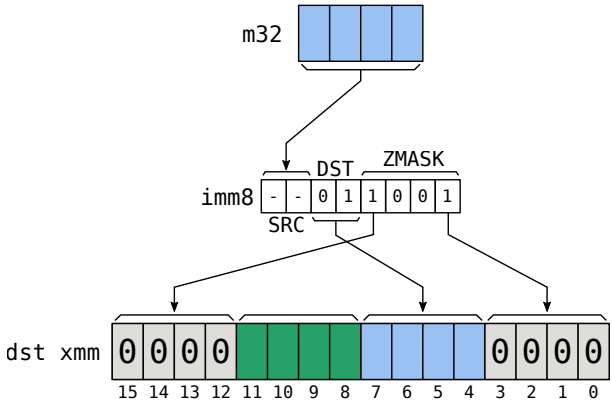
Ejemplo - INSERTPS dst, src , imm8



Ejemplo - INSERTPS dst, src , imm8



Ejemplo - INSERTPS dst, src , imm8



Insert

Extract

EXTRACTPS — Extract Packed Single Precision Floating-Point Value

Opcode/ Instruction	Op/ En	64/32-bit Mode	CPUID Feature Flag	Description
66 0F 3A 17 /r ib EXTRACTPS *reg/m32, xmm2, imm8*	MRI	V/V	SSE4_1	Extract a single-precision floating-point value from *xmm2* at the source offset specified by *imm8* and store the result to *reg or m32*. The upper 32 bits of r64 is zeroed if reg is r64.
VEX.128.66.0F3A.WIG 17 /r ib VEXTRACTPS r/m32, xmm1, imm8	MRI	V/V	AVX	Extract one single-precision floating-point value from xmm1 at the offset specified by imm8 and store the result in reg or m32. Zero extend the results in 64-bit register if applicable.

Insert

Extract

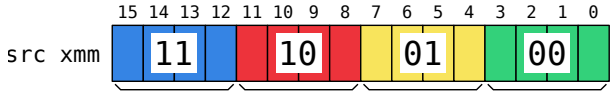
EXTRACTPS — Extract Packed Single Precision Floating-Point Value

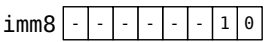
Opcode/ Instruction	Op/ En	64/32-bit Mode	CPUID Feature Flag	Description
66 0F 3A 17 /r ib EXTRACTPS *reg/m32, xmm2, imm8*	MRI	V/V	SSE4_1	Extract a single-precision floating-point value from *xmm2* at the source offset specified by *imm8* and store the result to *reg or m32*. The upper 32 bits of r64 is zeroed if reg is r64.
VEX.128.66.0F3A.WIG 17 /r ib VEXTRACTPS r/m32, xmm1, imm8	MRI	V/V	AVX	Extract one single-precision floating-point value from xmm1 at the offset specified by imm8 and store the result in reg or m32. Zero extend the results in 64-bit register if applicable.

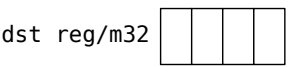
EXTRACTPS (128-bit Legacy SSE version)

```
SRC_OFFSET ← IMM8[1:0]
IF ( 64-Bit Mode and DEST is register)
    DEST[31:0] ← (SRC[127:0] » (SRC_OFFET*32)) AND 0FFFFFFFFh
    DEST[63:32] ← 0
ELSE
    DEST[31:0] ← (SRC[127:0] » (SRC_OFFET*32)) AND 0FFFFFFFFh
FI
```

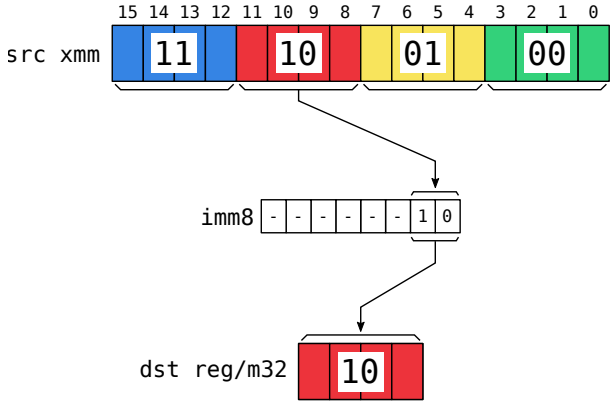
Ejemplo-EXTRACTPS dst, src , imm8







Ejemplo-EXTRACTPS dst, src , imm8



Insert
Extract

PINSRB/PINSRD/PINSRQ — Insert Byte/Dword/Qword

Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
66 0F 3A 20 /r ib PINSRB *xmm1, r32/m8, imm8*	RMI	V/V	SSE4_1	Insert a byte integer value from *r32/m8* into *xmm1* at the destination element in *xmm1* specified by *imm8*.
66 0F 3A 22 /r ib PINSRD *xmm1, r/m32, imm8*	RMI	V/V	SSE4_1	Insert a dword integer value from *r/m32* into the *xmm1* at the destination element specified by *imm8*.
66 REX.W 0F 3A 22 /r ib PINSRQ *xmm1, r/m64, imm8*	RMI	V/N. E.	SSE4_1	Insert a qword integer value from *r/m64* into the *xmm1* at the destination element specified by *imm8*.
VEX.NDS.128.66.0F3A.W0 20 /r ib VPINSRB *xmm1, xmm2, r32/m8, imm8*	RVMI	V[1]/V	AVX	Merge a byte integer value from *r32/m8* and rest from *xmm2* into *xmm1* at the byte offset in *imm8*.
VEX.NDS.128.66.0F3A.W0 22 /r ib VPINSRD *xmm1, xmm2, r/m32, imm8*	RVMI	V/V	AVX	Insert a dword integer value from *r32/m32* and rest from *xmm2* into *xmm1* at the dword offset in *imm8*.
VEX.NDS.128.66.0F3A.W1 22 /r ib VPINSRQ *xmm1, xmm2, r/m64, imm8*	RVMI	V/I	AVX	Insert a qword integer value from *r64/m64* and rest from *xmm2* into *xmm1* at the qword offset in *imm8*.

Insert Extract

PINSRB/PINSRD/PINSRQ — Insert Byte/Dword/Qword

Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
66 0F 3A 20 /r ib PINSRB *xmm1, r32/m8, imm8*	RMI	V/V	SSE4_1	Insert a byte integer value from *r32/m8* into *xmm1* at the destination element in *xmm1* specified by *imm8*.
66 0F 3A 22 /r ib PINSRD *xmm1, r/m32, imm8*	RMI	V/V	SSE4_1	Insert a dword integer value from *r/m32* into the *xmm1* at the destination element specified by *imm8*.
66 REX.W 0F 3A 22 /r ib PINSRQ *xmm1, r/m64, imm8*	RMI	V/N. E.	SSE4_1	Insert a qword integer value from *r/m64* into the *xmm1* at the destination element specified by *imm8*.
VEX.NDS.128.66.0F3A.W0 20 /r ib VPINSRB *xmm1, xmm2, r32/m8, imm8*	RVMI			
VEX.NDS.128.66.0F3A.W0 22 /r ib VPINSRD *xmm1, xmm2, r/m32, imm8*	RVMI			
VEX.NDS.128.66.0F3A.W1 22 /r ib VPINSRQ *xmm1, xmm2, r/m64, imm8*	RVMI			

```
CASE OF
    PINSRB:  SEL ← COUNT[3:0];
             MASK ← (0FFH << (SEL * 8));
             TEMP ← (((SRC[7:0] << (SEL *8)) AND MASK);
    PINSRD:  SEL ← COUNT[1:0];
             MASK ← (0FFFFFFFFH << (SEL * 32));
             TEMP ← (((SRC << (SEL *32)) AND MASK)  ;
    PINSRQ:  SEL ← COUNT[0]
             MASK ← (0FFFFFFFFFFFFFFFFH << (SEL * 64));
             TEMP ← (((SRC << (SEL *32)) AND MASK)  ;
ESAC;
        DEST ← ((DEST AND NOT MASK) OR TEMP);
```

Insert
Extract

PINSRW—Insert Word

Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
0F C4 /*r* ib[1] PINSRW *mm, r32/m16, imm8*	RMI	V/V	SSE	Insert the low word from *r32* or from *m16* into *mm* at the word position specified by *imm8*.
66 0F C4 /*r* ib PINSRW *xmm, r32/m16, imm8*	RMI	V/V	SSE2	Move the low word of *r32* or from *m16* into *xmm* at the word position specified by *imm8*.
VEX.NDS.128.66.0F.W0 C4 /r ib VPINSRW *xmm1, xmm2, r32/m16, imm8*	RVMI	V[2]/V	AVX	Insert a word integer value from *r32/m16* and rest from *xmm2* into *xmm1* at the word offset in *imm8*.

Insert Extract

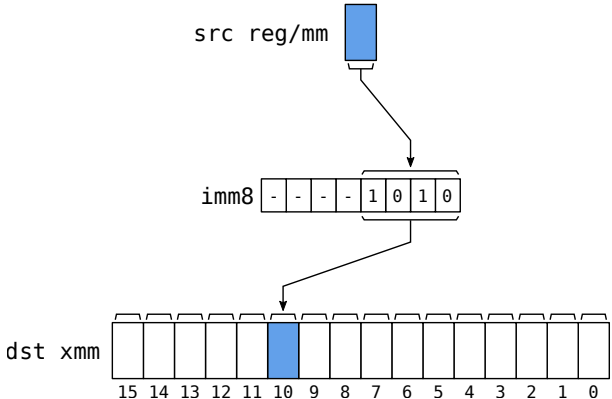
PINSRW—Insert Word

Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
0F C4 /*r* ib[1] PINSRW *mm, r32/m16, imm8*	RMI	V/V	SSE	Insert the low word from *r32* or from *m16* into *mm* at the word position specified by *imm8*.
66 0F C4 /*r* ib PINSRW *xmm, r32/m16, imm8*	RMI	V/V	SSE2	Move the low word of *r32* or from *m16* into *xmm* at the word position specified by *imm8*.
VEX.NDS.128.66.0F.W0 C4 /r ib VPINSRW *xmm1, xmm2, r32/m16, imm8*	RVMI	V[2]/V	AVX	Insert a word integer value from *r32/m16* and rest from *xmm2* into *xmm1* at the word offset in *imm8*.

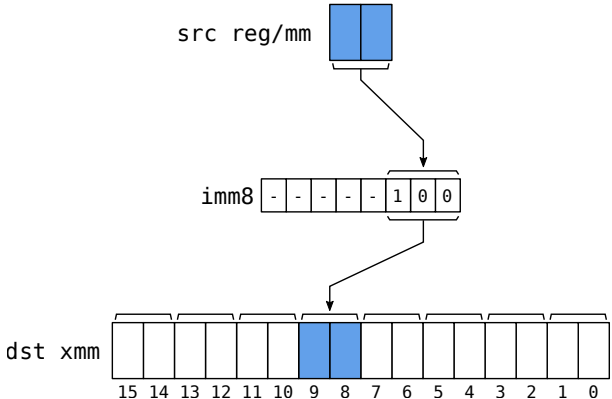
PINSRW (with 128-bit source operand)

```
SEL ← COUNT AND 7H;
    CASE (Determine word position) OF
        SEL ← 0:    MASK ← 00000000000000000000000000FFFFH;
        SEL ← 1:    MASK ← 00000000000000000000000FFFF0000H;
        SEL ← 2:    MASK ← 000000000000000000FFFF00000000H;
        SEL ← 3:    MASK ← 0000000000000000FFFF000000000000H;
        SEL ← 4:    MASK ← 00000000000FFFF00000000000000000H;
        SEL ← 5:    MASK ← 000000000FFFF000000000000000000H;
        SEL ← 6:    MASK ← 0000FFFF0000000000000000000000H;
        SEL ← 7:    MASK ← FFFF00000000000000000000000000H;
DEST ← (DEST AND NOT MASK) OR (((SRC << (SEL * 16)) AND MASK);
```

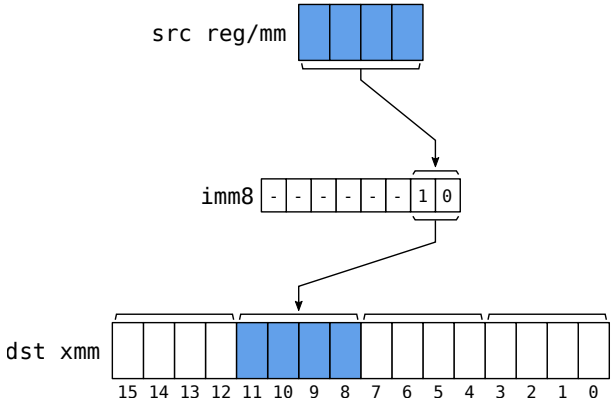
Ejemplo-PINSRB dst, src , imm8



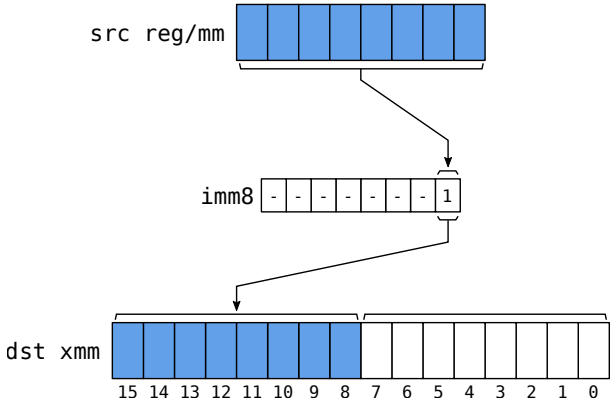
Ejemplo-PINSRW dst, src , imm8



Ejemplo-PINSRD dst, src , imm8



Ejemplo-PINSRQ dst, src , imm8



Insert

Extract

PEXTRB/PEXTRD/PEXTRQ — Extract Byte/Dword/Qword

Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
66 0F 3A 14 /r ib PEXTRB *reg/m8, xmm2, imm8*	MRI	V/V	SSE4_1	Extract a byte integer value from *xmm2* at the source byte offset specified by *imm8* into *reg or m8*. The upper bits of r32 or r64 are zeroed.
66 0F 3A 16 /r ib PEXTRD *r/m32, xmm2, imm8*	MRI	V/V	SSE4_1	Extract a dword integer value from *xmm2* at the source dword offset specified by *imm8* into *r/m32*.
66 REX.W 0F 3A 16 /r ib PEXTRQ *r/m64, xmm2, imm8*	MRI	V/N.E.	SSE4_1	Extract a qword integer value from *xmm2* at the source qword offset specified by *imm8* into *r/m64*.
VEX.128.66.0F3A.W0 14 /r ib VPEXTRB *reg/m8, xmm2, imm8*	MRI	V[1]/V	AVX	Extract a byte integer value from *xmm2* at the source byte offset specified by *imm8* into *reg* or *m8*. The upper bits of r64/r32 is filled with zeros.
VEX.128.66.0F3A.W0 16 /r ib VPEXTRD *r32/m32, xmm2, imm8*	MRI	V/V	AVX	Extract a dword integer value from *xmm2* at the source dword offset specified by *imm8* into *r32/m32*.
VEX.128.66.0F3A.W1 16 /r ib VPEXTRQ *r64/m64, xmm2, imm8*	MRI	V/i	AVX	Extract a qword integer value from *xmm2* at the source dword offset specified by *imm8* into *r64/m64*.

Insert

Extract

PEXTRB/PEXTRD/PEXTRQ — Extract Byte/Dword/Qword

Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
66 0F 3A 14 /r ib PEXTRB *reg/m8, xmm2, imm8*	MRI	V/V	SSE4_1	Extract a byte integer value from *xmm2* at the source byte offset specified by *imm8* into *reg*
66 0F 3A 16 /r ib PEXTRD *r/m32, xmm2, imm8*	MRI			
66 REX.W 0F 3A 16 /r ib PEXTRQ *r/m64, xmm2, imm8*	MRI			
VEX.128.66.0F3A.W0 14 /r ib VPEXTRB *reg/m8, xmm2, imm8*	MRI			
VEX.128.66.0F3A.W0 16 /r ib VPEXTRD *r32/m32, xmm2, imm8*	MRI			
VEX.128.66.0F3A.W1 16 /r ib VPEXTRQ *r64/m64, xmm2, imm8*	MRI			

```
CASE of
    PEXTRB: SEL ← COUNT[3:0];
            TEMP ← (Src >> SEL*8) AND FFH;
            IF (DEST = Mem8)
                THEN
                Mem8 ← TEMP[7:0];
            ELSE IF (64-Bit Mode and 64-bit register selected)
                THEN
                    R64[7:0] ← TEMP[7:0];
                    r64[63:8] ← ZERO_FILL; };
            ELSE
                    R32[7:0] ← TEMP[7:0];
                    r32[31:8] ← ZERO_FILL; };
            FI;
    PEXTRD:SEL ← COUNT[1:0];
            TEMP ← (Src >> SEL*32) AND FFFF_FFFFH;
            DEST ← TEMP;
    PEXTRQ: SEL ← COUNT[0];
            TEMP ← (Src >> SEL*64);
            DEST ← TEMP;
EASC:
```

Insert
Extract

PEXTRW—Extract Word

Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
0F C5 /*r* ib[1] PEXTRW *reg, mm, imm8*	RMI	V/V	SSE	Extract the word specified by *imm8* from *mm* and move it to *reg*, bits 15-0. The upper bits of r32 or r64 is zeroed.
66 0F C5 /*r* ib PEXTRW *reg, xmm, imm8*	RMI	V/V	SSE2	Extract the word specified by *imm8* from *xmm* and move it to *reg*, bits 15-0. The upper bits of r32 or r64 is zeroed.
66 0F 3A 15 /r ib PEXTRW *reg/m16, xmm, imm8*	MRI	V/V	SSE4_1	Extract the word specified by *imm8* from *xmm* and copy it to lowest 16 bits of *reg or m16*. Zero-extend the result in the destination, r32 or r64.
VEX.128.66.0F.W0 C5 /r ib VPEXTRW *reg, xmm1, imm8*	RMI	V[2]/V	AVX	Extract the word specified by *imm8* from *xmm1* and move it to reg, bits 15:0. Zero-extend the result. The upper bits of r64/r32 is filled with zeros.
VEX.128.66.0F3A.W0 15 /r ib VPEXTRW *reg/m16, xmm2, imm8*	MRI	V/V	AVX	Extract a word integer value from *xmm2* at the source word offset specified by *imm8* into *reg* or *m16*. The upper bits of r64/r32 is filled with zeros.

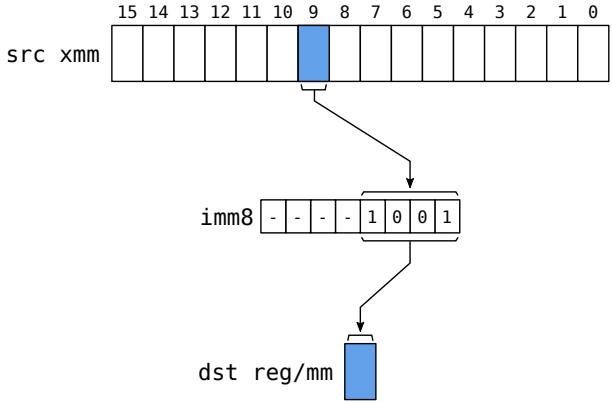
Insert Extract

PEXTRW—Extract Word

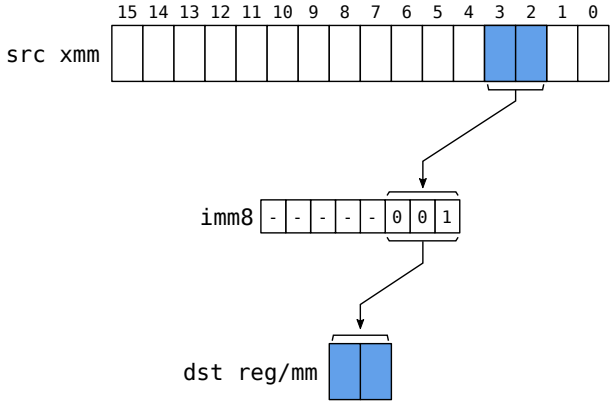
Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
0F C5 /*r* ib[1] PEXTRW *reg, mm, imm8*	RMI	V/V	SSE	Extract the word specified by *imm8* from *mm* and move it to *reg*, bits 15-0. The upper bits of r32 or r64 is zeroed.
66 0F C5 /*r* ib PEXTRW *reg, xmm, imm8*	RMI	V/V	SSE2	Extract the word specified by *imm8* from *xmm* and move it to *reg*, bits 15-0. The upper bits of r32 or r64 is zeroed.

```
IF (DEST = Mem16)
THEN
    SEL ← COUNT[2:0];
    TEMP ← (Src >> SEL*16) AND FFFFH;
    Mem16 ← TEMP[15:0];
ELSE IF (64-Bit Mode and destination is a general-purpose register)
    THEN
        FOR (PEXTRW instruction with 64-bit source operand)
          {  SEL ← COUNT[1:0];
             TEMP ← (SRC >> (SEL * 16)) AND FFFFH;
             r64[15:0] ← TEMP[15:0];
             r64[63:16] ← ZERO_FILL; };
        FOR (PEXTRW instruction with 128-bit source operand)
          {  SEL ← COUNT[2:0];
             TEMP ← (SRC >> (SEL * 16)) AND FFFFH;
             r64[15:0] ← TEMP[15:0];
             r64[63:16] ← ZERO_FILL; }
ELSE
        FOR (PEXTRW instruction with 64-bit source operand)
          {  SEL ← COUNT[1:0];
             TEMP ← (SRC >> (SEL * 16)) AND FFFFH;
             r32[15:0] ← TEMP[15:0];
             r32[31:16] ← ZERO_FILL; };
        FOR (PEXTRW instruction with 128-bit source operand)
          {  SEL ← COUNT[2:0];
             TEMP ← (SRC >> (SEL * 16)) AND FFFFH;
             r32[15:0] ← TEMP[15:0];
             r32[31:16] ← ZERO_FILL; };
    FI;
FI;
```

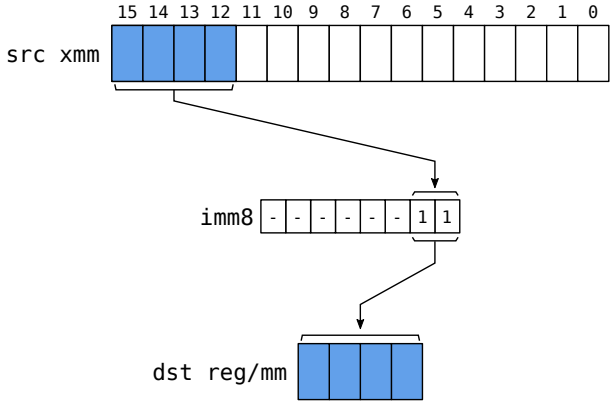
Ejemplo-PEXTRB dst, src , imm8



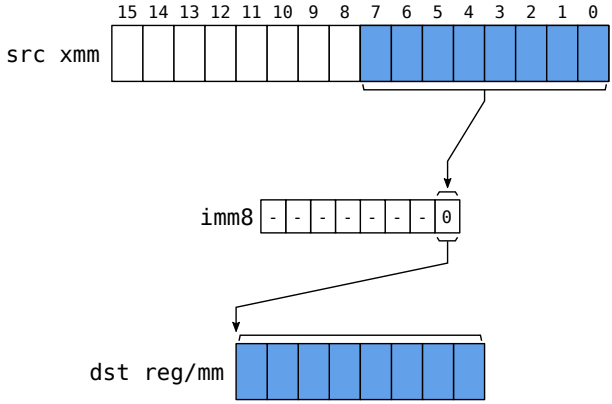
Ejemplo-PEXTRW dst, src , imm8



Ejemplo-PEXTRD dst, src , imm8



Ejemplo-PEXTRQ dst, src , imm8



Blend

Las instrucciones de *Blend* permiten **mezclar** registros dependiendo del valor de sus datos.
Usando tanto inmediatos como otros registros.

Blend

Las instrucciones de *Blend* permiten **mezclar** registros dependiendo del valor de sus datos. Usando tanto inmediatos como otros registros.

- BLENDPS - Blend Packed Single FP Values
- BLENDPD - Blend Packed Double FP Values

- BLENDVPS - Variable Blend Packed Single FP Values
- BLENDVPD - Variable Blend Packed Double FP Values

- PBLENDW - Blend Packed Words

- PBLENDVB - Variable Blend Packed Bytes

Blend

BLENDPS — Blend Packed Single Precision Floating-Point Values

Opcode/ Instruction	Op/ En	64/32-bit Mode	CPUID Feature Flag	Description
66 0F 3A 0C /r ib BLENDPS *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE4_1	Select packed single precision floating-point values from *xmm1* and *xmm2/m128* from mask specified in *imm8* and store the values into *xmm1*.

BLENDPD — Blend Packed Double Precision Floating-Point Values

Opcode/ Instruction	Op/ En	64/32-bit Mode	CPUID Feature Flag	Description
66 0F 3A 0D /r ib BLENDPD *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE4_1	Select packed DP-FP values from *xmm1* and *xmm2/m128* from mask specified in imm8 and store the values into *xmm1*.

Blend

BLENDPS — Blend Packed Single Precision Floating-Point Values

Opcode/ Instruction	Op/ En	64/32-bit Mode	CPUID Feature Flag	Description
66 0F 3A 0C /r ib BLENDPS *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE4_1	Select packed single precision floating-point values from *xmm1* and *xmm2/m128* from mask specified in *imm8* and store the values into *xmm1*.

BLENDPD — Blend Packed Double Precision Floating-Point Values

Opcode/ Instruction	Op/ En	64/32-bit Mode	CPUID Feature Flag	Description
66 0F 3A 0D /r ib BLENDPD *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE4_1	Select packed DP-FP values from *xmm1* and *xmm2/m128* from mask specified in imm8 and store the values into *xmm1*.

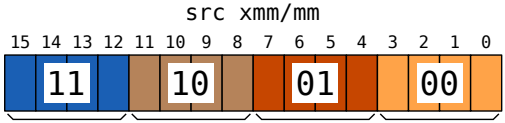
BLENDPS

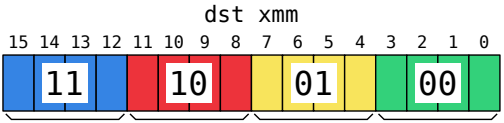
```
IF (IMM8[0] = 0) THEN DEST[31:0] ←DEST[31:0]
        ELSE DEST [31:0] ← SRC[31:0] FI
IF (IMM8[1] = 0) THEN DEST[63:32] ← DEST[63:32]
        ELSE DEST [63:32] ← SRC[63:32] FI
IF (IMM8[2] = 0) THEN DEST[95:64] ← DEST[95:64]
        ELSE DEST [95:64] ← SRC[95:64] FI
IF (IMM8[3] = 0) THEN DEST[127:96] ← DEST[127:96]
        ELSE DEST [127:96] ← SRC[127:96] FI
DEST[VLMAX-1:128] (Unmodified)
```

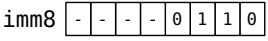
BLENDPD

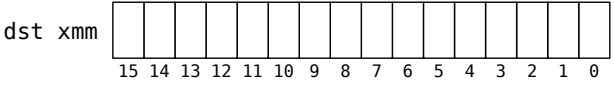
```
IF (IMM8[0] = 0)THEN DEST[63:0] ← DEST[63:0]
        ELSE DEST [63:0] ← SRC[63:0] FI
IF (IMM8[1] = 0) THEN DEST[127:64] ← DEST[127:64]
        ELSE DEST [127:64] ← SRC[127:64] FI
DEST[VLMAX-1:128] (Unmodified)
```

Ejemplo-BLENDPS dst, src , imm8

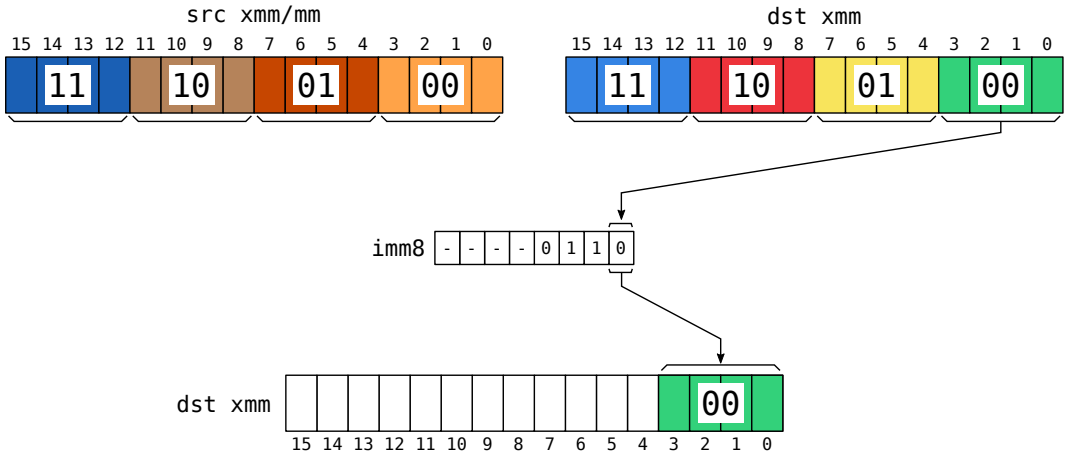




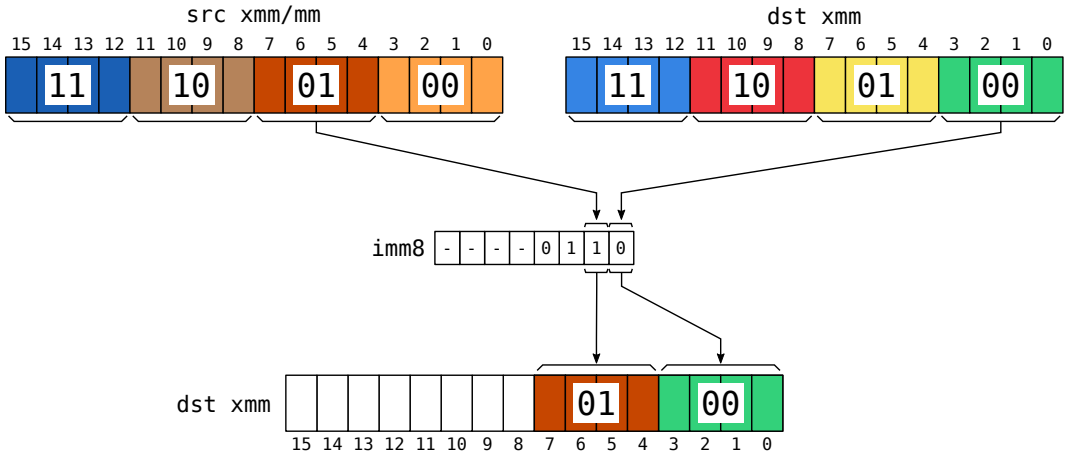




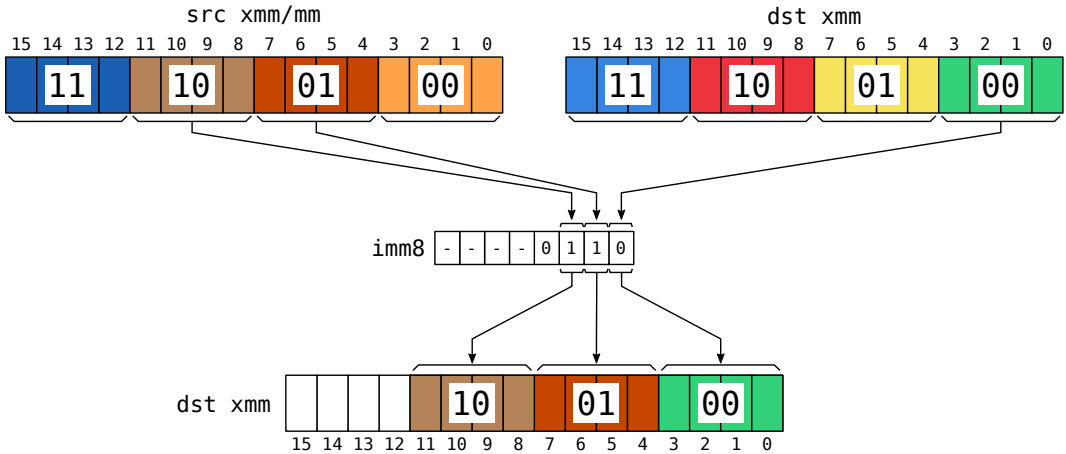
Ejemplo-BLENDPS dst, src , imm8



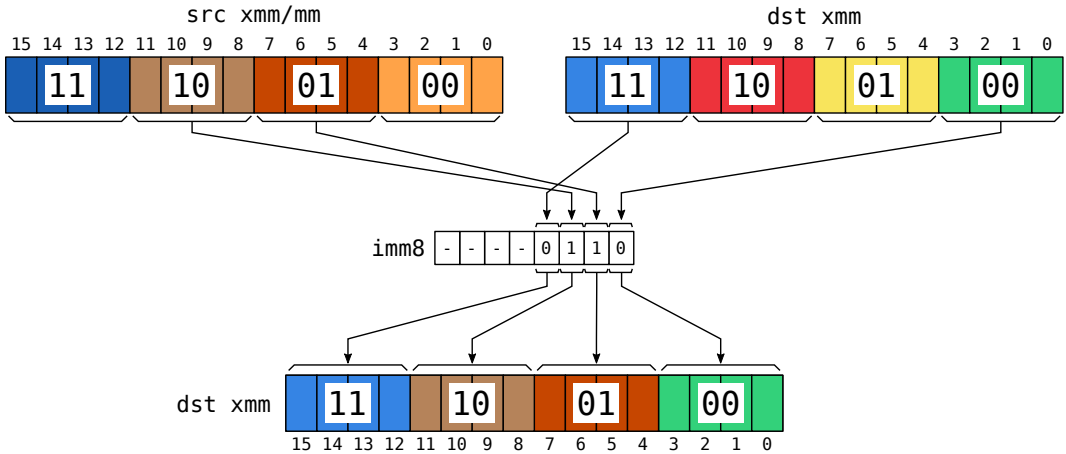
Ejemplo-BLENDPS dst, src , imm8



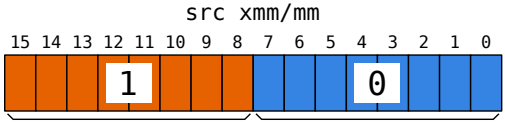
Ejemplo-BLENDPS dst, src , imm8

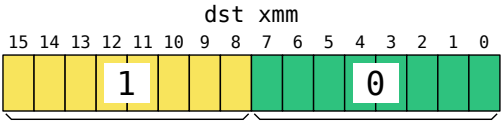


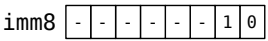
Ejemplo-BLENDPS dst, src , imm8

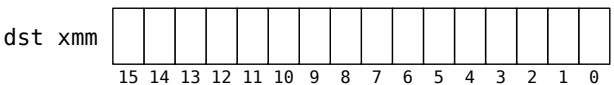


Ejemplo-BLENDPD dst, src , imm8

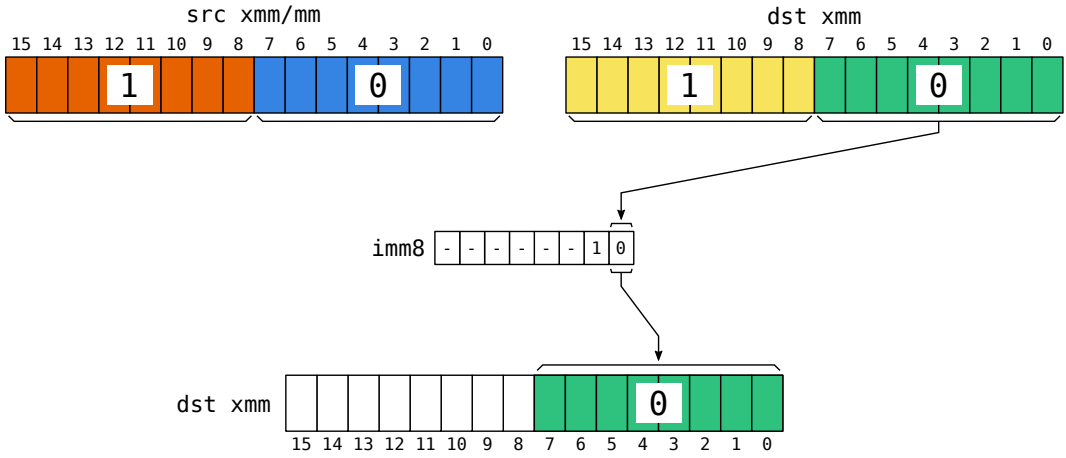




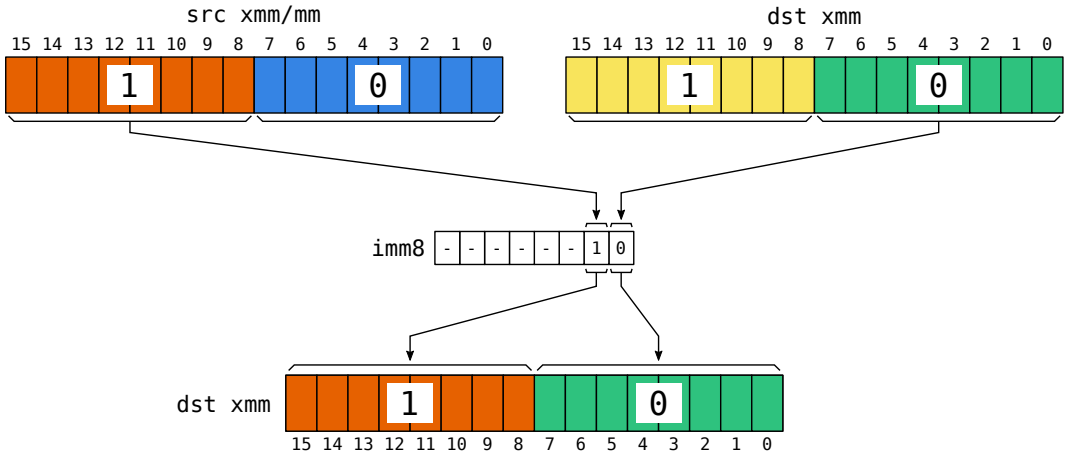




Ejemplo-BLENDPD dst, src , imm8



Ejemplo-BLENDPD dst, src , imm8



Blend

BLENDVPS — Variable Blend Packed Single Precision Floating-Point Values

Opcode/ Instruction	Op/ En	64/32-bit Mode	CPUID Feature Flag	Description
66 0F 38 14 /r BLENDVPS *xmm1, xmm2/m128, <XMM0>*	RM0	V/V	SSE4_1	Select packed single precision floating-point values from *xmm1* and *xmm2/m128* from mask specified in *XMM0* and store the values into *xmm1*.

BLENDVPD — Variable Blend Packed Double Precision Floating-Point Values

Opcode/ Instruction	Op/ En	64/32-bit Mode	CPUID Feature Flag	Description
66 0F 38 15 /r BLENDVPD *xmm1, xmm2/m128 , <XMM0>*	RM0	V/V	SSE4_1	Select packed DP FP values from *xmm1* and *xmm2* from mask specified in *XMM0* and store the values in *xmm1*.

Blend

BLENDVPS — Variable Blend Packed Single Precision Floating-Point Values

Opcode/ Instruction	Op/ En	64/32-bit Mode	CPUID Feature Flag	Description
66 0F 38 14 /r BLENDVPS *xmm1, xmm2/m128, <XMM0>*	RM0	V/V	SSE4_1	Select packed single precision floating-point values from *xmm1* and *xmm2/m128* from mask specified in *XMM0* and store the values into *xmm1*.

BLENDVPD — Variable Blend Packed Double Precision Floating-Point Values

Opcode/ Instruction	Op/ En	64/32-bit Mode	CPUID Feature Flag	Description
66 0F 38 15 /r BLENDVPD *xmm1, xmm2/m128 , <XMM0>*	RM0	V/V	SSE4_1	Select packed DP FP values from *xmm1* and *xmm2* from mask specified in *XMM0* and store the values in *xmm1*.

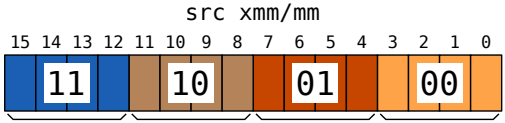
BLENDVPS

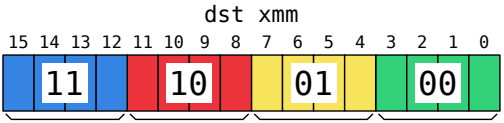
BLENDVPS (128-bit Legacy SSE version)
MASK ← XMM0
IF (MASK[31] = 0) THEN DEST[31:0] ← DEST[31:0]
ELSE DEST [31:0] ← SRC[31:0] FI
IF (MASK[63] = 0) THEN DEST[63:32] ← DEST[63:32]
ELSE DEST [63:32] ← SRC[63:32] FI
IF (MASK[95] = 0) THEN DEST[95:64] ← DEST[95:64]
ELSE DEST [95:64] ← SRC[95:64] FI
IF (MASK[127] = 0) THEN DEST[127:96] ← DEST[127:96]
ELSE DEST [127:96] ← SRC[127:96] FI
DEST[VLMAX-1:128] (Unmodified)

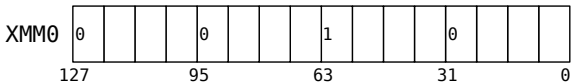
BLENDVPD

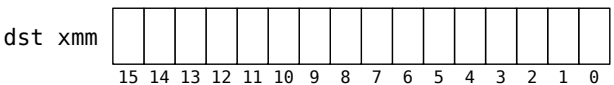
BLENDVPD (128-bit Legacy SSE version)
MASK ← XMM0
IF (MASK[63] = 0) THEN DEST[63:0] ← DEST[63:0]
ELSE DEST [63:0] ← SRC[63:0] FI
IF (MASK[127] = 0) THEN DEST[127:64] ← DEST[127:64]
ELSE DEST [127:64] ← SRC[127:64] FI
DEST[VLMAX-1:128] (Unmodified)

Ejemplo-BLENDVPS dst, src , imm8

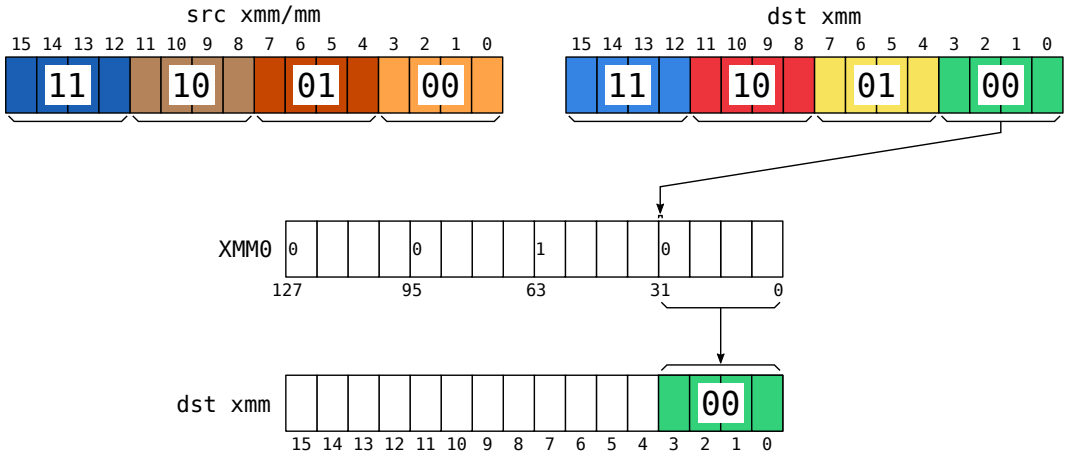




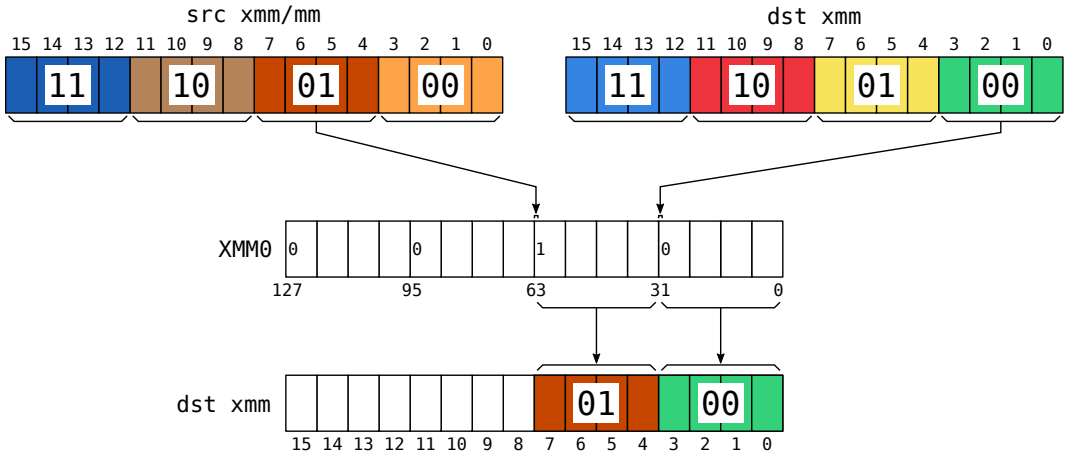




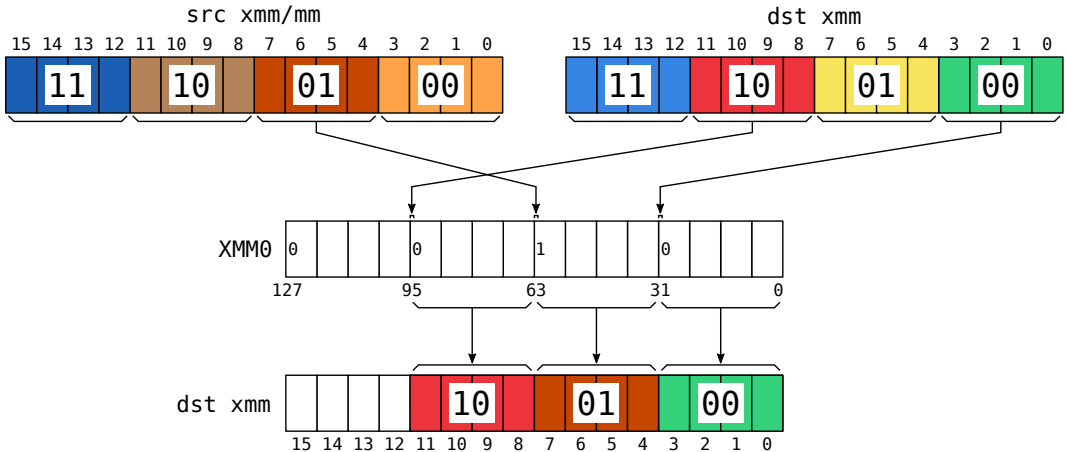
Ejemplo-BLENDVPS dst, src , imm8



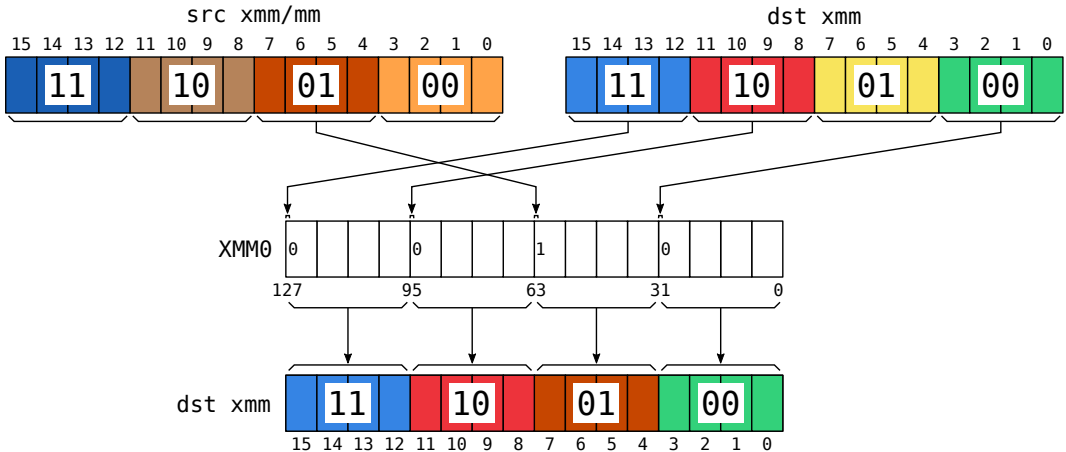
Ejemplo-BLENDVPS dst, src , imm8



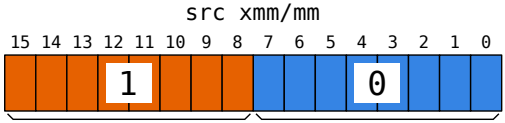
Ejemplo-BLENDVPS dst, src , imm8

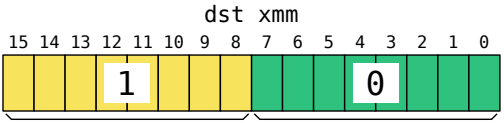


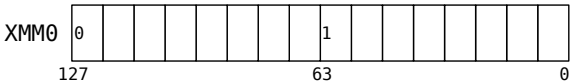
Ejemplo-BLENDVPS dst, src , imm8

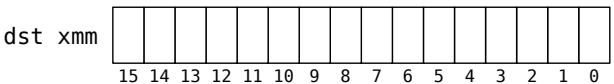


Ejemplo-BLENDVPD dst, src , imm8

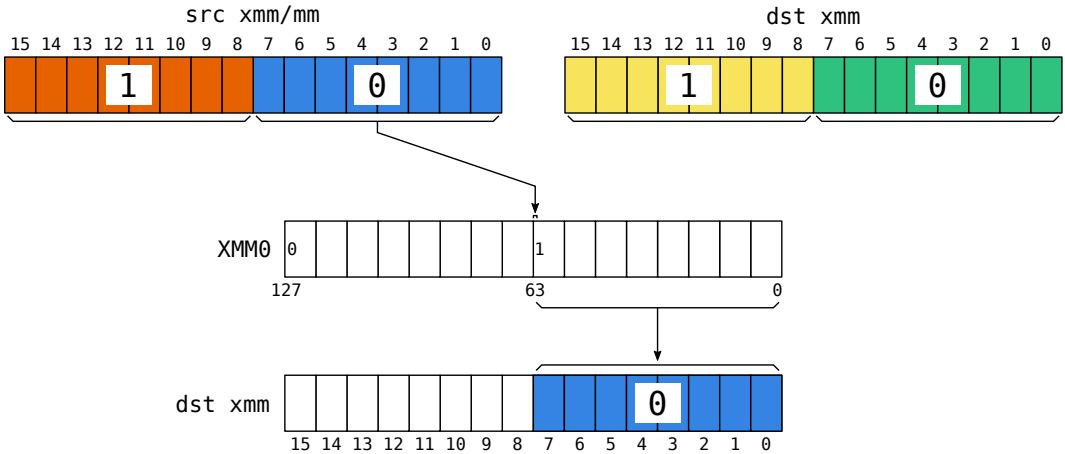




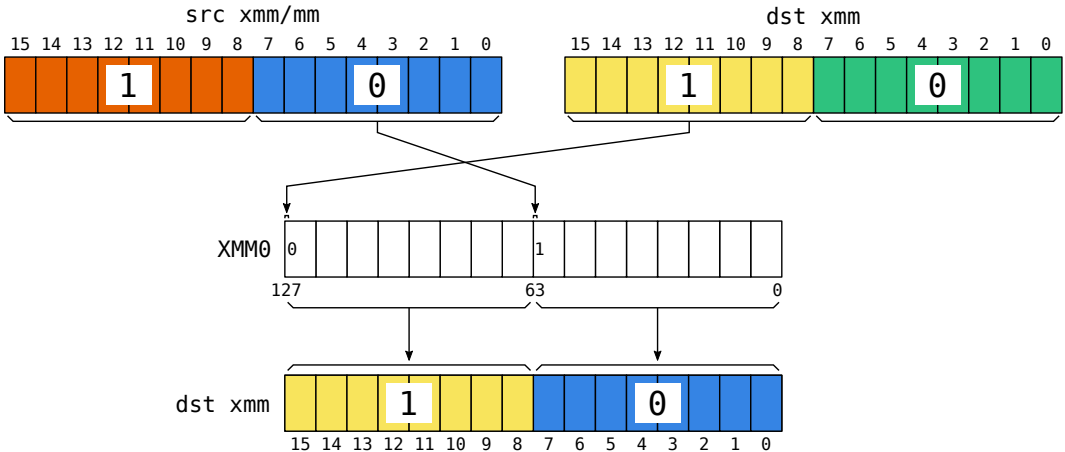




Ejemplo-BLENDVPD dst, src , imm8



Ejemplo-BLENDVPD dst, src , imm8



Blend

PBLENDW — Blend Packed Words

Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
66 0F 3A 0E /r ib PBLENDW *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE4_1	Select words from *xmm1* and *xmm2/m128* from mask specified in *imm8* and store the values into *xmm1*.

Blend

PBLENDW — Blend Packed Words

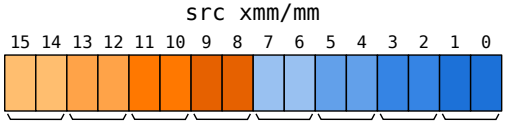
Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
66 0F 3A 0E /r ib PBLENDW *xmm1, xmm2/m128, imm8*	RMI	V/V	SSE4_1	Select words from *xmm1* and *xmm2/m128* from mask specified in *imm8* and store the values into *xmm1*.

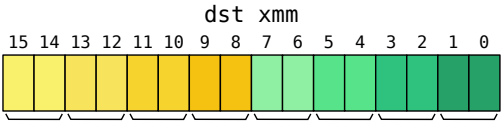
Operation

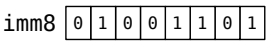
PBLENDW (128-bit Legacy SSE version)

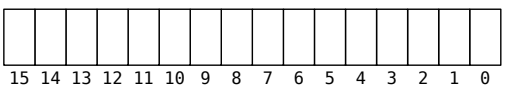
IF (imm8[0] = 1) THEN DEST[15:0] ← SRC[15:0]
ELSE DEST[15:0] ← DEST[15:0]
IF (imm8[1] = 1) THEN DEST[31:16] ← SRC[31:16]
ELSE DEST[31:16] ← DEST[31:16]
IF (imm8[2] = 1) THEN DEST[47:32] ← SRC[47:32]
ELSE DEST[47:32] ← DEST[47:32]
IF (imm8[3] = 1) THEN DEST[63:48] ← SRC[63:48]
ELSE DEST[63:48] ← DEST[63:48]
IF (imm8[4] = 1) THEN DEST[79:64] ← SRC[79:64]
ELSE DEST[79:64] ← DEST[79:64]
IF (imm8[5] = 1) THEN DEST[95:80] ← SRC[95:80]
ELSE DEST[95:80] ← DEST[95:80]
IF (imm8[6] = 1) THEN DEST[111:96] ← SRC[111:96]
ELSE DEST[111:96] ← DEST[111:96]
IF (imm8[7] = 1) THEN DEST[127:112] ← SRC[127:112]

Ejemplo-PBLENDW dst, src , imm8

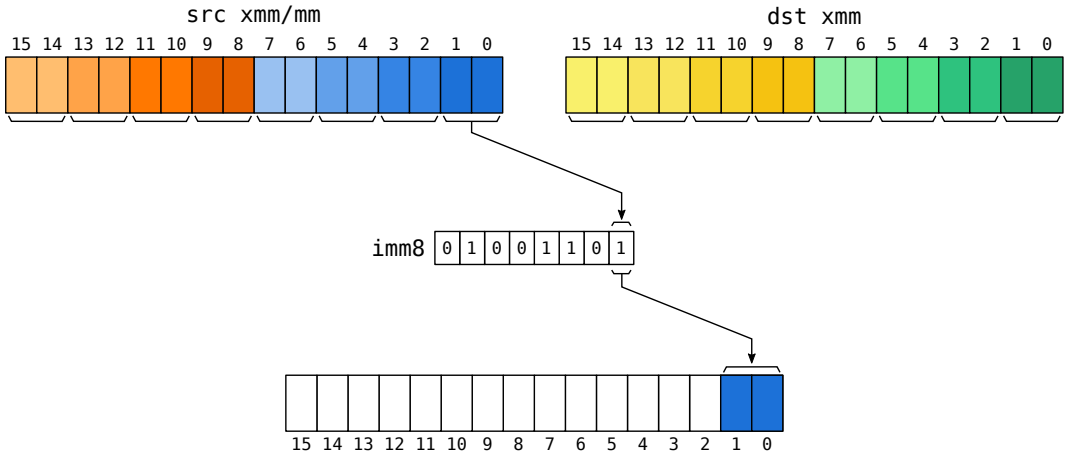




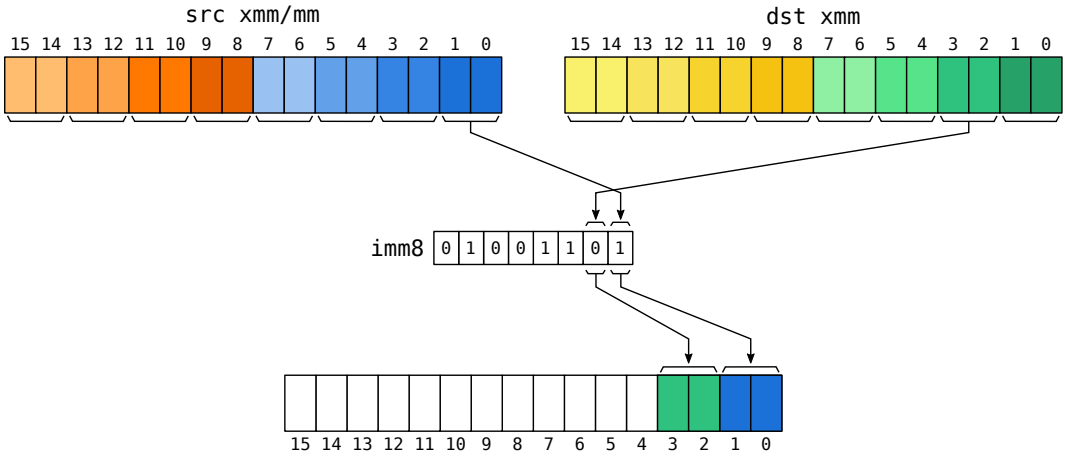




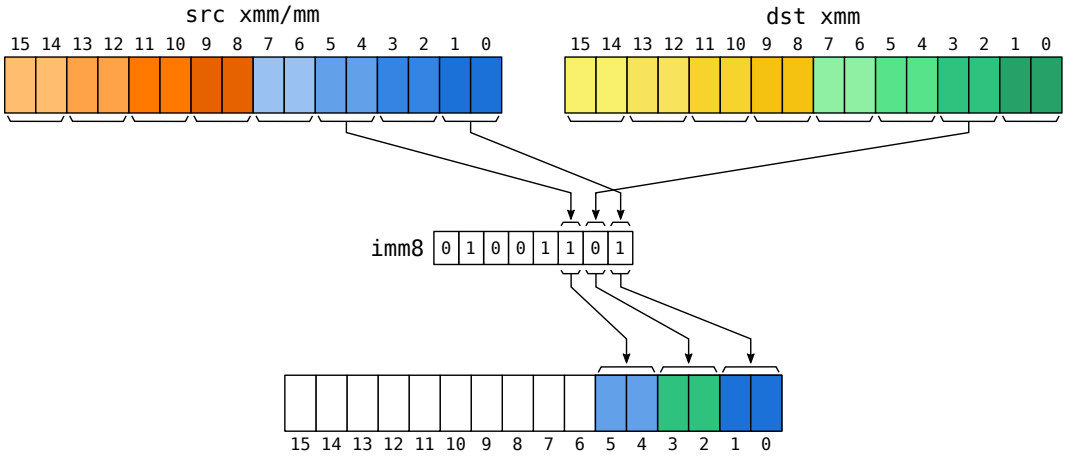
Ejemplo-PBLENDW dst, src , imm8



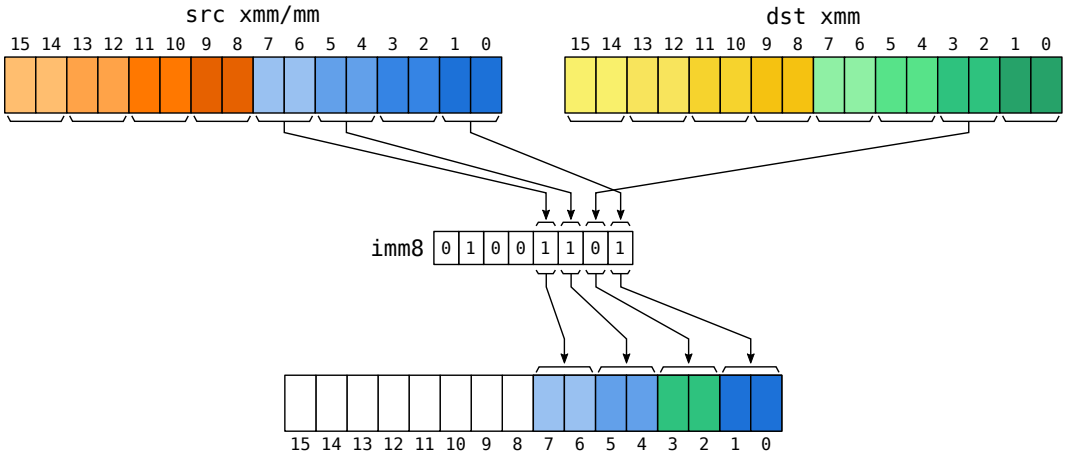
Ejemplo-PBLENDW dst, src , imm8



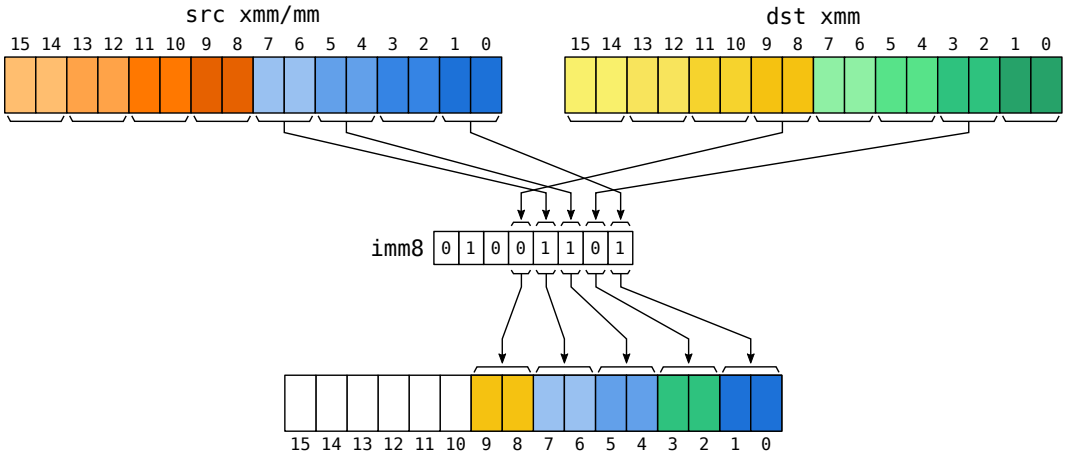
Ejemplo-PBLENDW dst, src , imm8



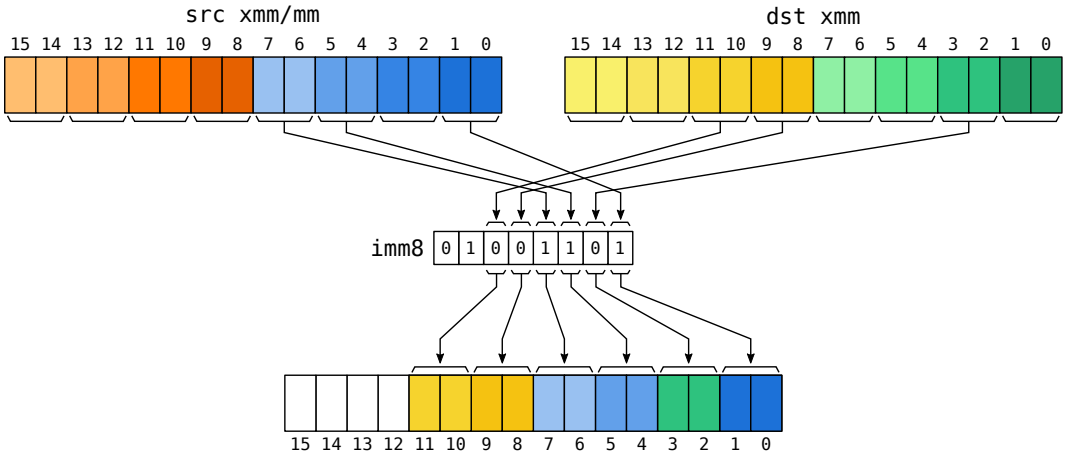
Ejemplo-PBLENDW dst, src , imm8



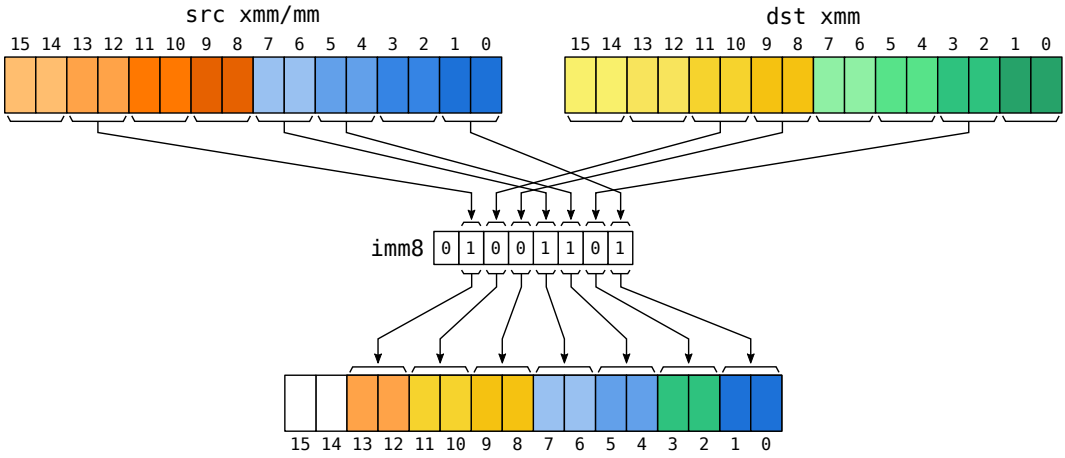
Ejemplo-PBLENDW dst, src , imm8



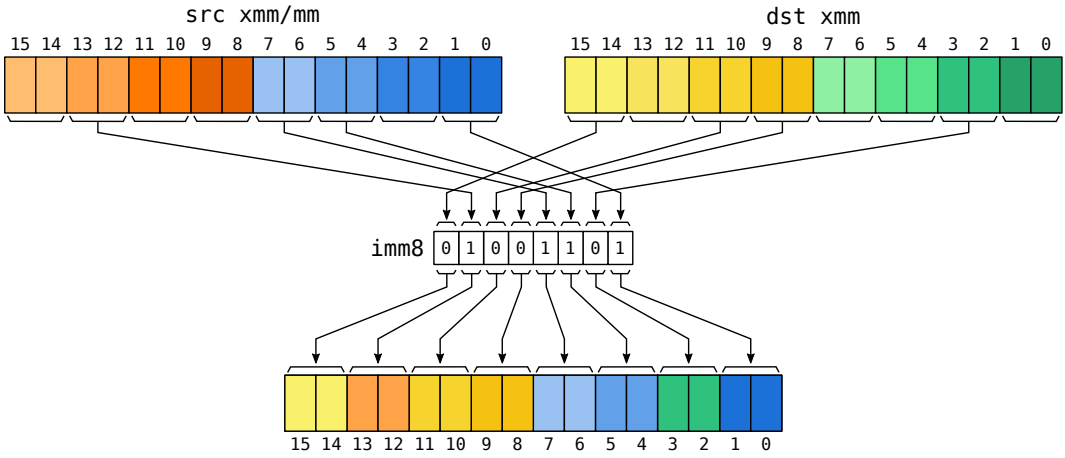
Ejemplo-PBLENDW dst, src , imm8



Ejemplo-PBLENDW dst, src , imm8



Ejemplo-PBLENDW dst, src , imm8



Blend

PBLENDVB — Variable Blend Packed Bytes

Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
66 0F 38 10 /r PBLENDVB *xmm1, xmm2/m128, <XMM0>*	RM	V/V	SSE4_1	Select byte values from *xmm1* and *xmm2/m128* from mask specified in the high bit of each byte in *XMM0* and store the values into *xmm1*.

Blend

PBLENDVB — Variable Blend Packed Bytes

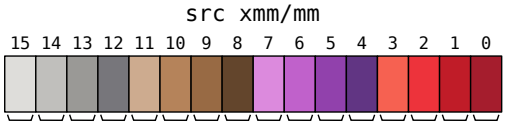
Opcode/ Instruction	Op/ En	64/32 bit Mode Support	CPUID Feature Flag	Description
66 0F 38 10 /r PBLENDVB *xmm1, xmm2/m128, <XMM0>*	RM	V/V	SSE4_1	Select byte values from *xmm1* and *xmm2/m128* from mask specified in the high bit of each byte in *XMM0* and store the values into *xmm1*.

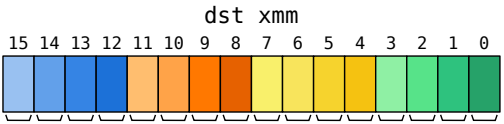
Operation

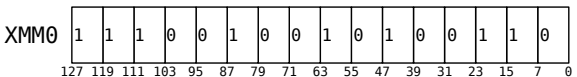
PBLENDVB (128-bit Legacy SSE version)

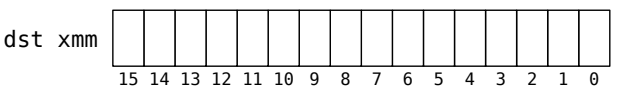
MASK ← XMM0
IF (MASK[7] = 1) THEN DEST[7:0] ← SRC[7:0];
ELSE DEST[7:0] ← DEST[7:0];
IF (MASK[15] = 1) THEN DEST[15:8] ← SRC[15:8];
ELSE DEST[15:8] ← DEST[15:8];
IF (MASK[23] = 1) THEN DEST[23:16] ← SRC[23:16]
ELSE DEST[23:16] ← DEST[23:16];
IF (MASK[31] = 1) THEN DEST[31:24] ← SRC[31:24]
ELSE DEST[31:24] ← DEST[31:24];
IF (MASK[39] = 1) THEN DEST[39:32] ← SRC[39:32]
ELSE DEST[39:32] ← DEST[39:32];
IF (MASK[47] = 1) THEN DEST[47:40] ← SRC[47:40]
ELSE DEST[47:40] ← DEST[47:40];
IF (MASK[55] = 1) THEN DEST[55:48] ← SRC[55:48]
ELSE DEST[55:48] ← DEST[55:48];
IF (MASK[63] = 1) THEN DEST[63:56] ← SRC[63:56]
ELSE DEST[63:56] ← DEST[63:56];
IF (MASK[71] = 1) THEN DEST[71:64] ← SRC[71:64]
ELSE DEST[71:64] ← DEST[71:64];
IF (MASK[79] = 1) THEN DEST[79:72] ← SRC[79:72]
ELSE DEST[79:72] ← DEST[79:72];
IF (MASK[87] = 1) THEN DEST[87:80] ← SRC[87:80]
ELSE DEST[87:80] ← DEST[87:80];
IF (MASK[95] = 1) THEN DEST[95:88] ← SRC[95:88]
ELSE DEST[95:88] ← DEST[95:88];
IF (MASK[103] = 1) THEN DEST[103:96] ← SRC[103:96]
ELSE DEST[103:96] ← DEST[103:96];
IF (MASK[111] = 1) THEN DEST[111:104] ← SRC[111:104]
ELSE DEST[111:104] ← DEST[111:104];
IF (MASK[119] = 1) THEN DEST[119:112] ← SRC[119:112]
ELSE DEST[119:112] ← DEST[119:112];
IF (MASK[127] = 1) THEN DEST[127:120] ← SRC[127:120]
ELSE DEST[127:120] ← DEST[127:120])
DEST[VLMAX-1:128] (Unmodified)

Ejemplo-PBLENDVB dst, src

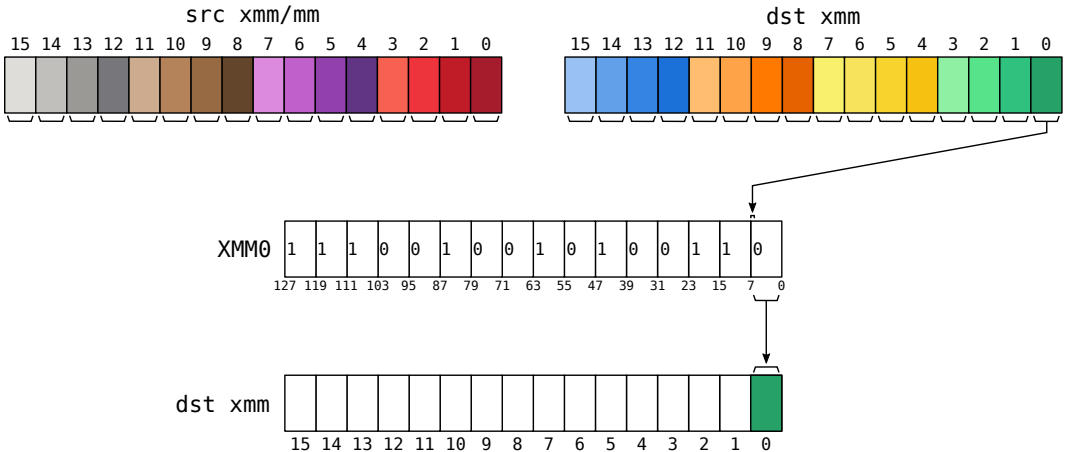




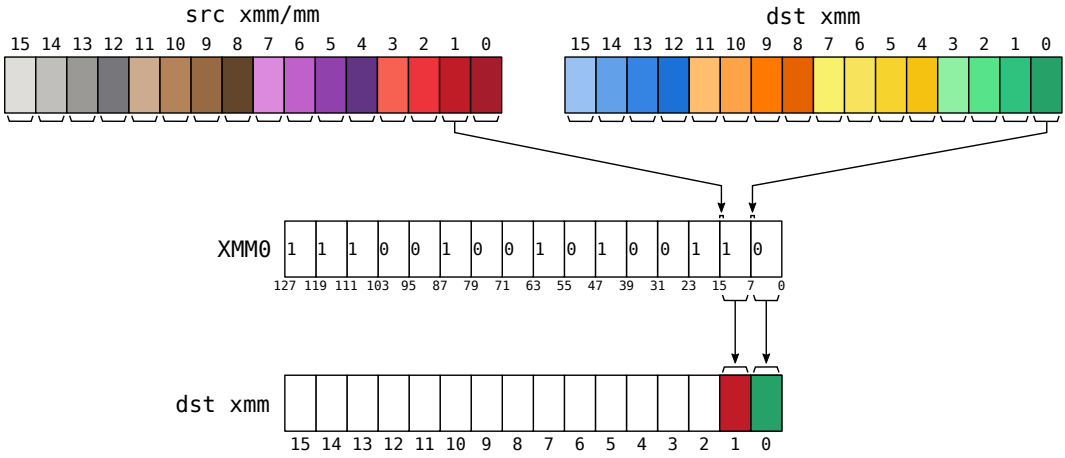




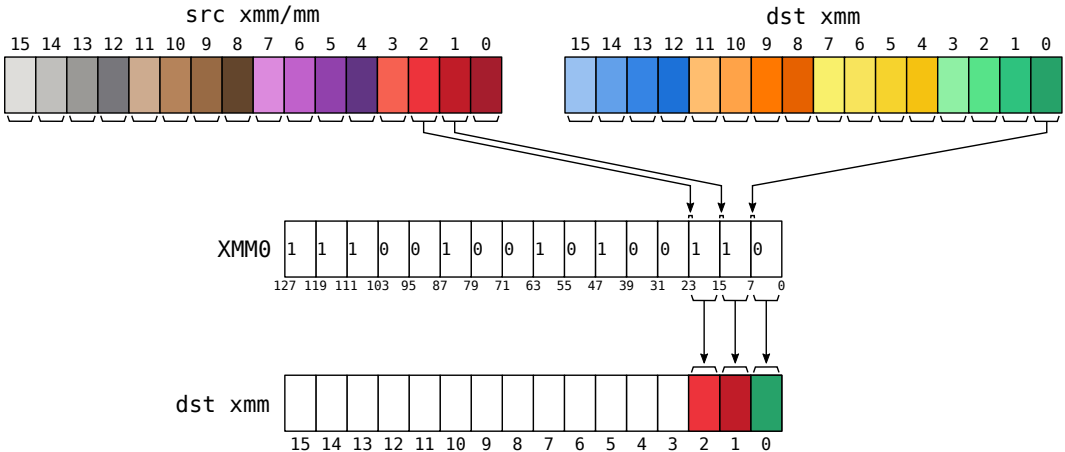
Ejemplo-PBLENDVB dst, src



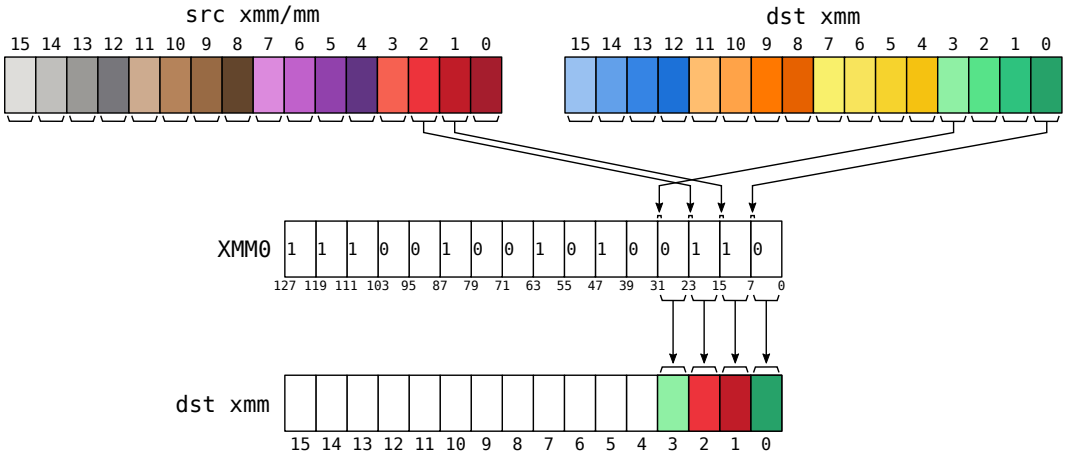
Ejemplo-PBLENDVB dst, src



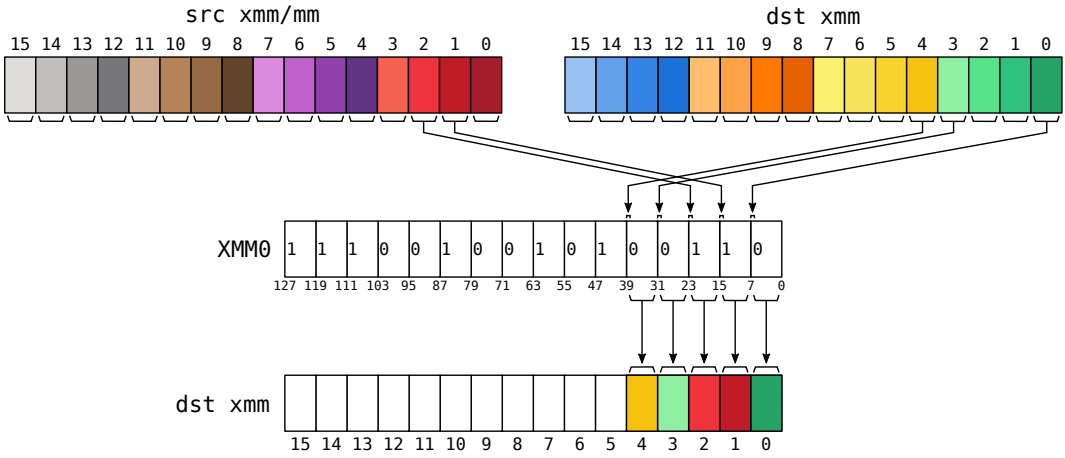
Ejemplo-PBLENDVB dst, src



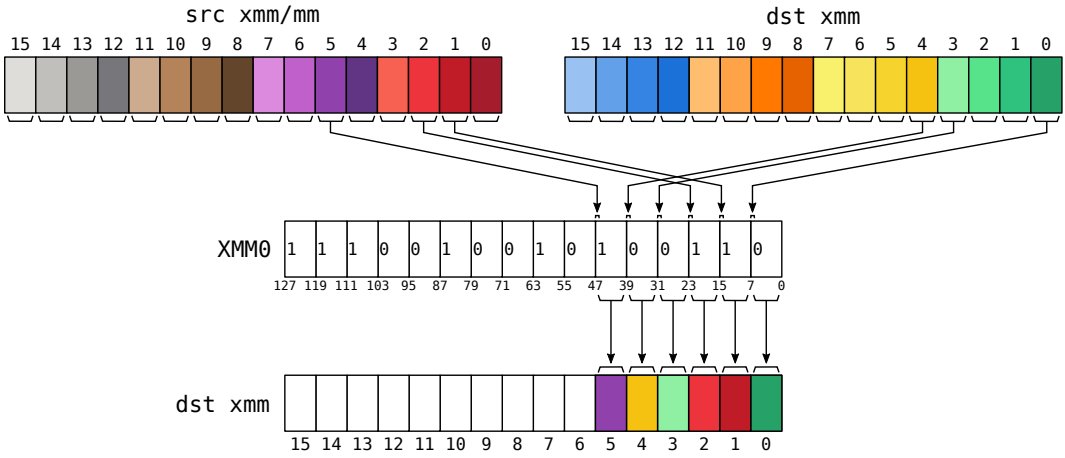
Ejemplo-PBLENDVB dst, src



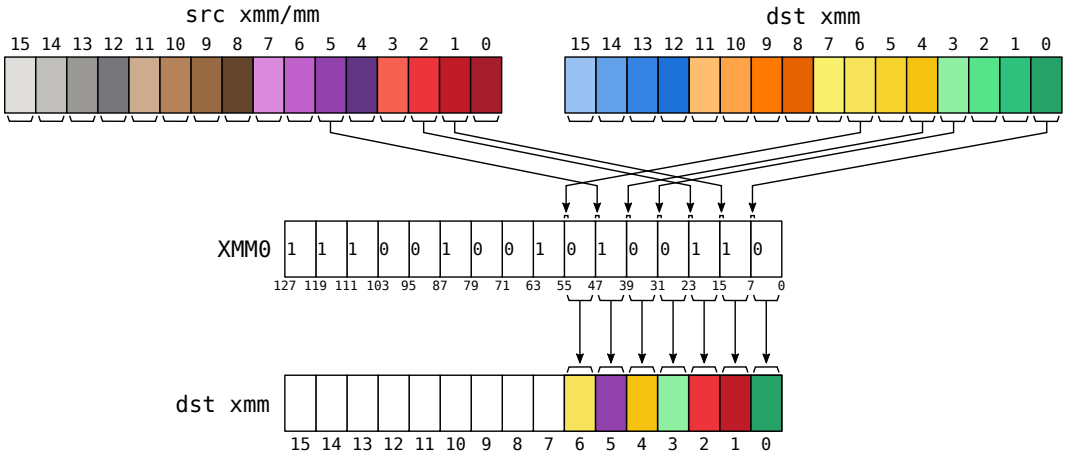
Ejemplo-PBLENDVB dst, src



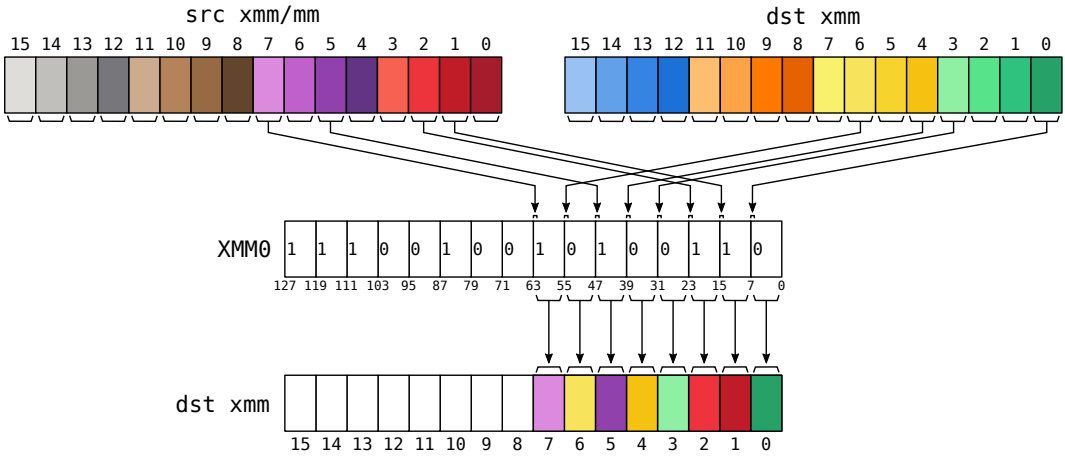
Ejemplo-PBLENDVB dst, src



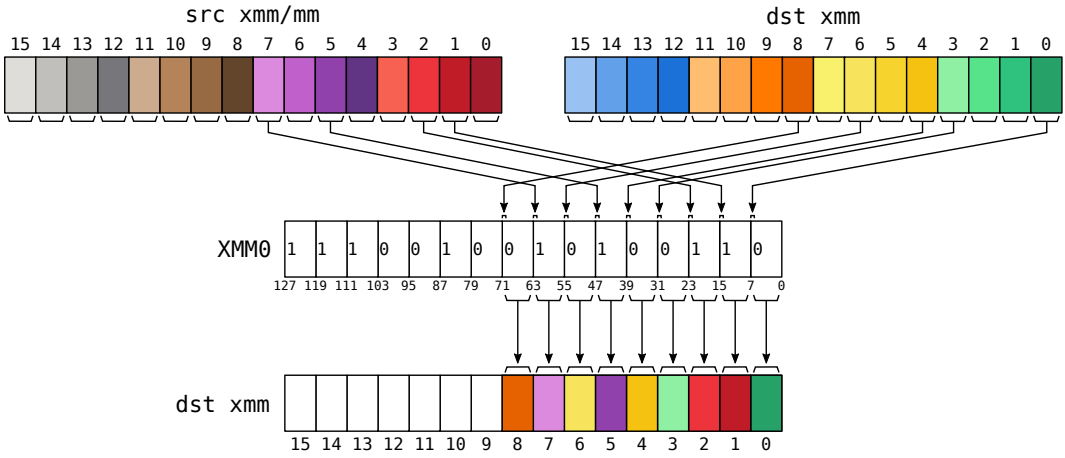
Ejemplo-PBLENDVB dst, src



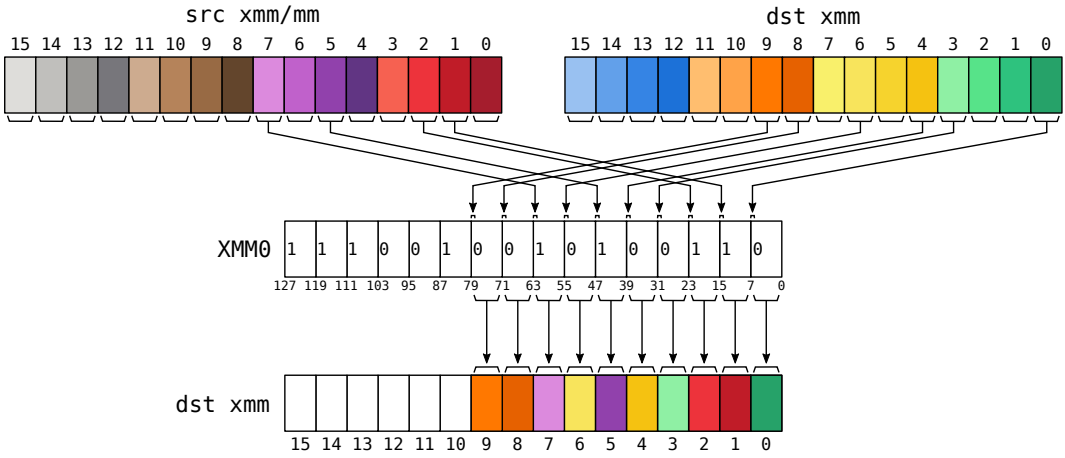
Ejemplo-PBLENDVB dst, src



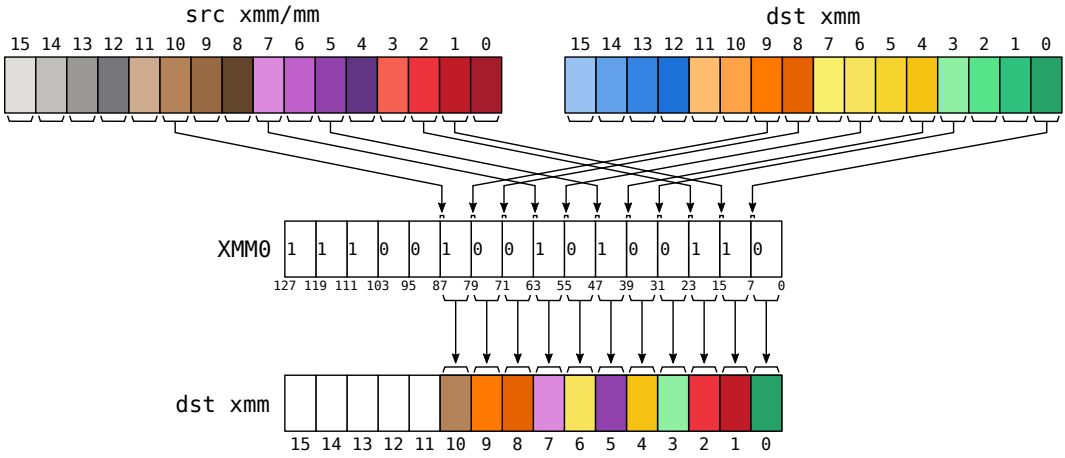
Ejemplo-PBLENDVB dst, src



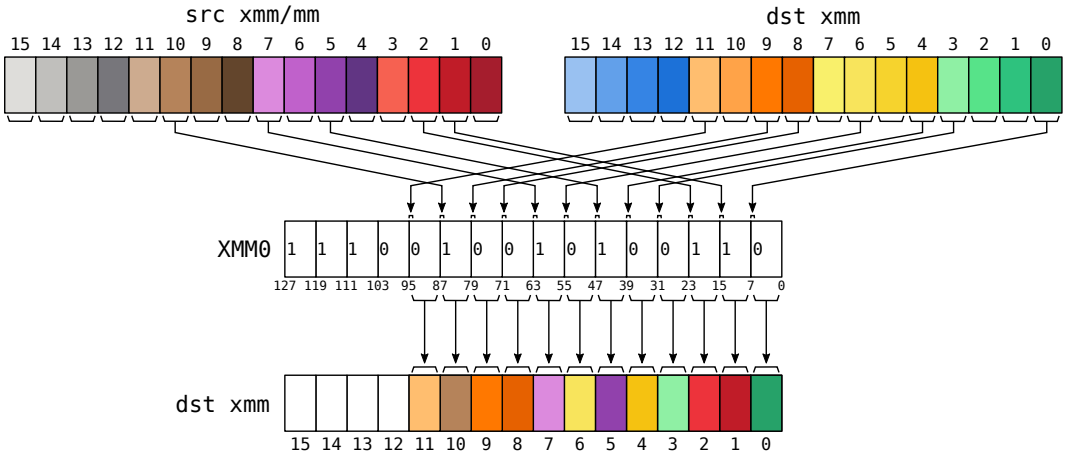
Ejemplo-PBLENDVB dst, src



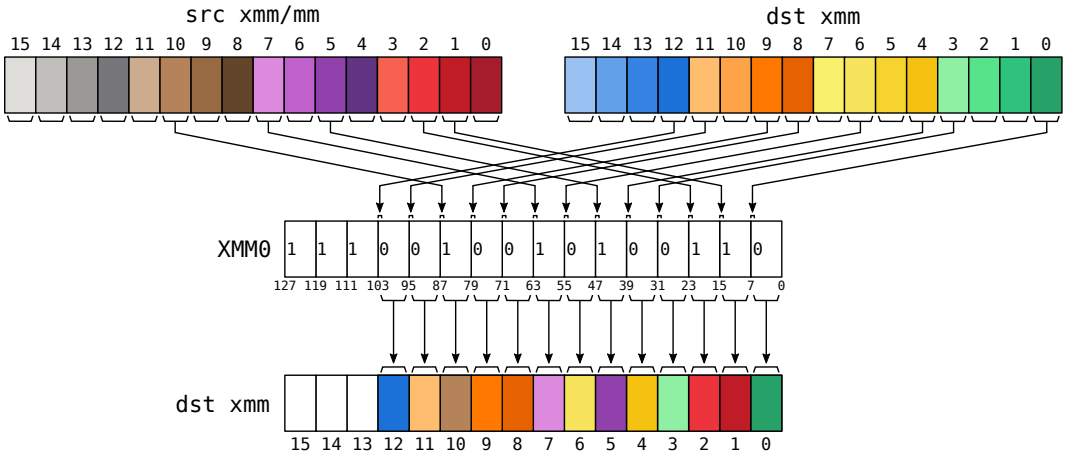
Ejemplo-PBLENDVB dst, src



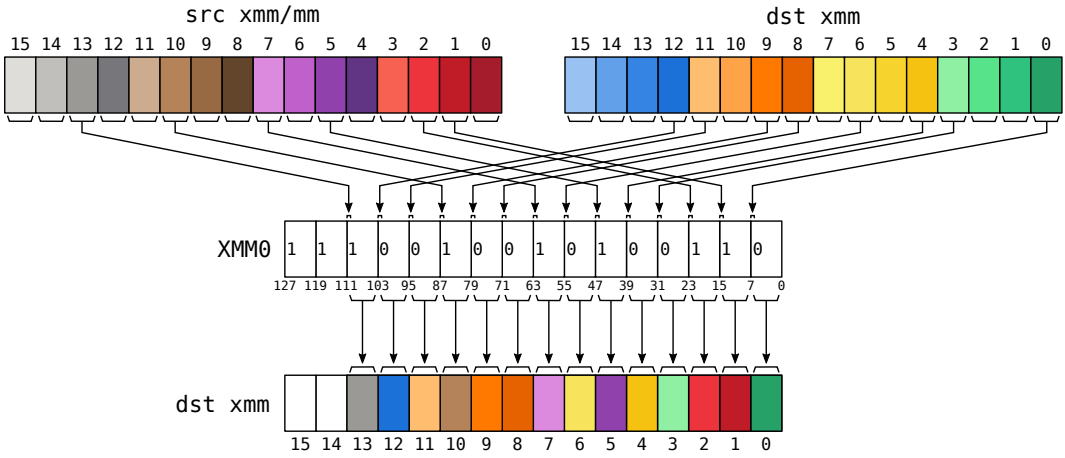
Ejemplo-PBLENDVB dst, src



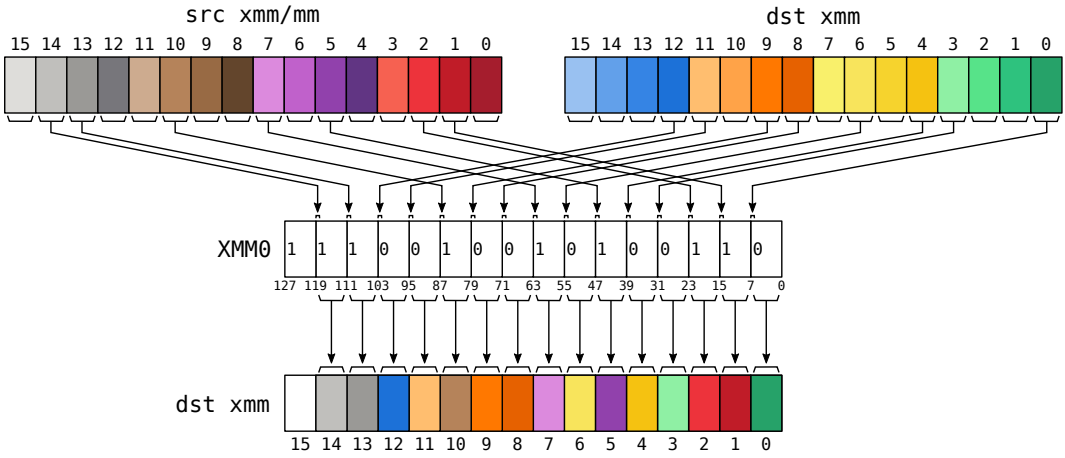
Ejemplo-PBLENDVB dst, src



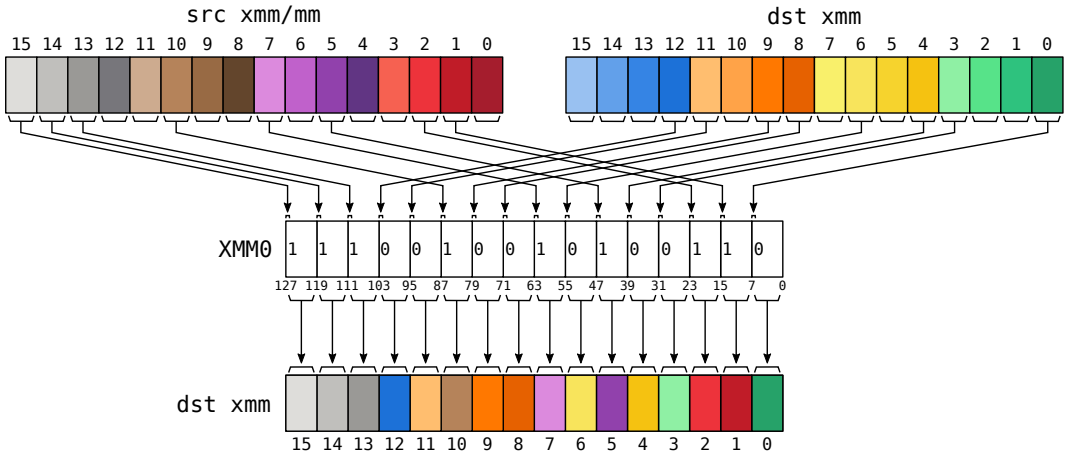
Ejemplo-PBLENDVB dst, src



Ejemplo-PBLENDVB dst, src



Ejemplo-PBLENDVB dst, src



Conversiones

Las instrucciones de conversión son de la forma: CVTxx2yy

Donde xx e yy pueden valer:

ps - Packed Single FP	pd - Packed Double FP	pi - Packed Integer
ss - Scalar Single FP	sd - Scalar Double FP	si - Scalar Integer
		dq - Packed Dword

Conversiones

Las instrucciones de conversión son de la forma: CVTxx2yy

Donde xx e yy pueden valer:

ps - Packed Single FP	pd - Packed Double FP	pi - Packed Integer
ss - Scalar Single FP	sd - Scalar Double FP	si - Scalar Integer
		dq - Packed Dword

Instrucciones solo de punto flotante

- CVTSD2SS - Scalar Double FP to Scalar Single FP (1X) → `CVTSD2SS xmm1, xmm2/m64`
- CVTSS2SD - Scalar Single FP to Scalar Double FP (1X) → `CVTSS2SD xmm1, xmm2/m32`

Conversiones

Las instrucciones de conversión son de la forma: CVTxx2yy

Donde xx e yy pueden valer:

ps - Packed Single FP	pd - Packed Double FP	pi - Packed Integer
ss - Scalar Single FP	sd - Scalar Double FP	si - Scalar Integer
		dq - Packed Dword

Instrucciones solo de punto flotante

- CVTSD2SS - Scalar Double FP to Scalar Single FP (1X) → `CVTSD2SS xmm1, xmm2/m64`
- CVTSS2SD - Scalar Single FP to Scalar Double FP (1X) → `CVTSS2SD xmm1, xmm2/m32`

- CVTPD2PS - Packed Double FP to Packed Single FP (2X) → `CVTPD2PS xmm1, xmm2/m128`
- CVTPS2PD - Packed Single FP to Packed Double FP (2X) → `CVTPS2PD xmm1, xmm2/m64`

Conversiones

Instrucciones entre enteros y punto flotante

- CVTSI2SS - Dword Integer to Scalar Single FP → `CVTSI2SS xmm, r/m32`
- CVTSS2SI - Scalar Single FP to Dword Integer → `CVTSS2SI r32, xmm/m32`

- CVTSI2SD - Dword Integer to Scalar Double FP → `CVTSI2SD xmm, r/m64`
- CVTSD2SI - Scalar Double FP to Dword Integer → `CVTSD2SI r64, xmm/m64`

Conversiones

Instrucciones entre enteros y punto flotante

- CVTSI2SS - Dword Integer to Scalar Single FP → `CVTSI2SS xmm, r/m32`
- CVTSS2SI - Scalar Single FP to Dword Integer → `CVTSS2SI r32, xmm/m32`

- CVTSI2SD - Dword Integer to Scalar Double FP → `CVTSI2SD xmm, r/m64`
- CVTSD2SI - Scalar Double FP to Dword Integer → `CVTSD2SI r64, xmm/m64`

- CVTDQ2PS - Packed Dword Integers to Packed Single FP (4X) → `CVTDQ2PS xmm1, xmm2/m128`
- CVTPS2DQ - Packed Single FP to Packed Dword Integers (4X) → `CVTPS2DQ xmm1, xmm2/m128`

- CVTDQ2PD - Packed Dword Integers to Packed Double FP (2X) → `CVTDQ2PD xmm1, xmm2/m64`
- CVTPD2DQ - Packed Double FP to Packed Dword Integers (2X) → `CVTPD2DQ xmm1, xmm2/m128`

Conversiones

Instrucciones de redondeo

- ROUNDSS - Round Scalar Single FP to Integer → `ROUNDSS xmm1, xmm2/m32, imm8`
- ROUNDSD - Round Scalar Double FP to Integer → `ROUNDSD xmm1, xmm2/m64, imm8`
- ROUNDPS - Round Packed Single FP to Integer (4X) → `ROUNDPS xmm1, xmm2/m128, imm8`
- ROUNDPD - Round Packed Double FP to Integer (2X) → `ROUNDPD xmm1, xmm2/m128, imm8`

El parámetro inmediato indica el tipo de redondeo.

Conversiones

Instrucciones de redondeo

- ROUNDSS - Round Scalar Single FP to Integer → `ROUNDSS xmm1, xmm2/m32, imm8`
- ROUNDSD - Round Scalar Double FP to Integer → `ROUNDSD xmm1, xmm2/m64, imm8`
- ROUNDPS - Round Packed Single FP to Integer (4X) → `ROUNDPS xmm1, xmm2/m128, imm8`
- ROUNDPD - Round Packed Double FP to Integer (2X) → `ROUNDPD xmm1, xmm2/m128, imm8`

El parámetro inmediato indica el tipo de redondeo.

Instrucciones de truncado

- CVTTSS2SI - Truncation Scalar Single FP to Dword Integer (1X) → `CVTTSS2SI r32, xmm/m32`
- CVTTSD2SI - Truncation Scalar Double FP to Signed Integer (1X) → `CVTTSD2SI r32, xmm/m64`
- CVTTPS2DQ - Truncation Packed Single FP to Packed Dword Int. (4X) → `CVTTPS2DQ xmm1, xmm2/m128`

Ejercicios

1. Sea un vector a de n valores punto flotante de 32 bits.
   Realizar la siguiente operación: $\sqrt{a[i*2] \cdot 0{,}7 + a[i*2+1] \cdot 0{,}3 \cdot 255}$
   Donde i itera entre 0 y $n/2$. Almacenar el resultado sobre el mismo vector en double y considerar que $n \equiv 0\ (4)$.

2. Sea un vector que contiene exactamente 10 valores enteros sin signo de 3 bytes cada uno. Realizar la sumatoria de los mismos y almacenar el resultado en un double.

3. Sea un vector de n valores enteros de 32 bits almacenados en big-endian. Convertir cada uno de los valores a double, considerar que $n \equiv 0\ (4)$. Almacenarlos en un nuevo vector de forma que primero se guarden los valores de índice par y luego los de índice impar. Es decir: XYXY...XYXY $\rightarrow$ XXXX...YYYY

Bibliografía: Fuentes y material adicional

- Convenciones de llamados a función en x86:
  `https://en.wikipedia.org/wiki/X86_calling_conventions`
- Notas sobre System V ABI:
  `https://wiki.osdev.org/System_V_ABI`
- Documentación de NASM:
  `https://nasm.us/doc/`
- Artículo sobre el flag `-pie`:
  `https://eklitzke.org/position-independent-executables`
- Documentación de System V ABI:
  `https://uclibc.org/docs/psABI-x86_64.pdf`
- Manuales de Intel:
  `https://software.intel.com/en-us/articles/intel-sdm`

¡Gracias!

Recuerden leer los comentarios al final de este video por aclaraciones o fe de erratas.