

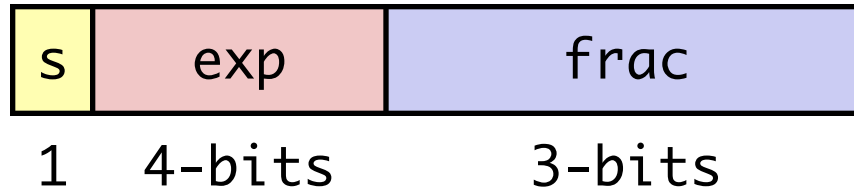
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IF2130/II2130 – Organisasi dan Arsitektur Komputer

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Representasi Informasi – Tiny Floating Point Example

Tiny Floating Point Example



- ▶ **8-bit Floating Point Representation**
 - ▶ the sign bit is in the most significant bit
 - ▶ the next four bits are the exponent, with a bias of 7
 - ▶ the last three bits are the **frac**
- ▶ **Same general form as IEEE Format**
 - ▶ normalized, denormalized
 - ▶ representation of 0, NaN, infinity



Dynamic Range (Positive Only)

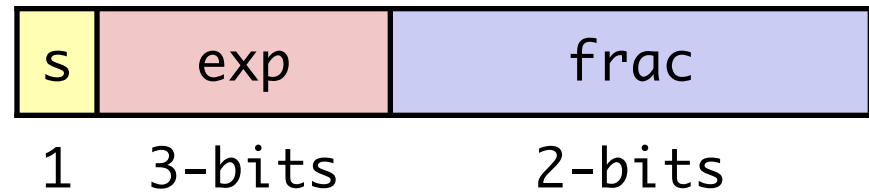
	s	exp	frac	E	Value	
Denormalized numbers	0	0000	000	-6	0	
	0	0000	001	-6	$1/8 * 1/64 = 1/512$	closest to zero
	0	0000	010	-6	$2/8 * 1/64 = 2/512$	
	...					
	0	0000	110	-6	$6/8 * 1/64 = 6/512$	
	0	0000	111	-6	$7/8 * 1/64 = 7/512$	largest denorm
Normalized numbers	0	0001	000	-6	$8/8 * 1/64 = 8/512$	smallest norm
	0	0001	001	-6	$9/8 * 1/64 = 9/512$	
	...					
	0	0110	110	-1	$14/8 * 1/2 = 14/16$	
	0	0110	111	-1	$15/8 * 1/2 = 15/16$	closest to 1 below
	0	0111	000	0	$8/8 * 1 = 1$	
	0	0111	001	0	$9/8 * 1 = 9/8$	closest to 1 above
	0	0111	010	0	$10/8 * 1 = 10/8$	
	...					
	0	1110	110	7	$14/8 * 128 = 224$	
	0	1110	111	7	$15/8 * 128 = 240$	largest norm
	0	1111	000	n/a	inf	



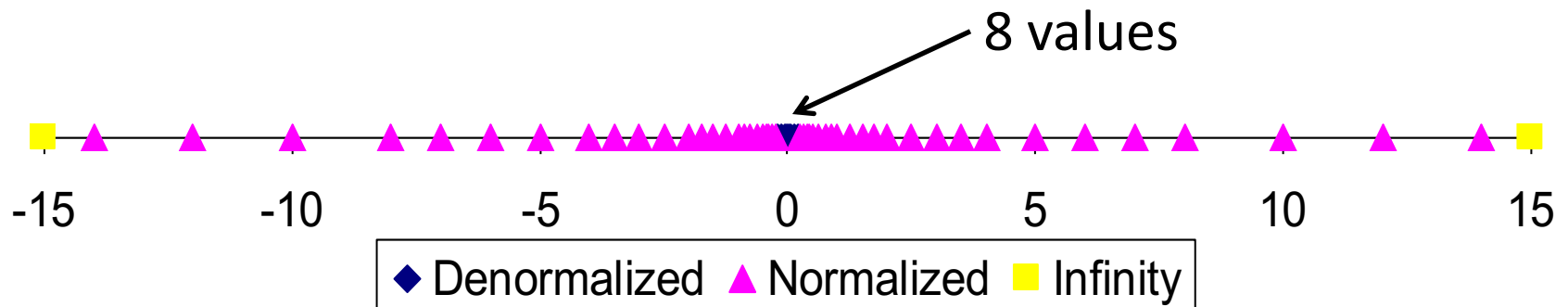
Distribution of Values

▶ 6-bit IEEE-like format

- ▶ $e = 3$ exponent bits
- ▶ $f = 2$ fraction bits
- ▶ Bias is $2^{3-1} - 1 = 3$



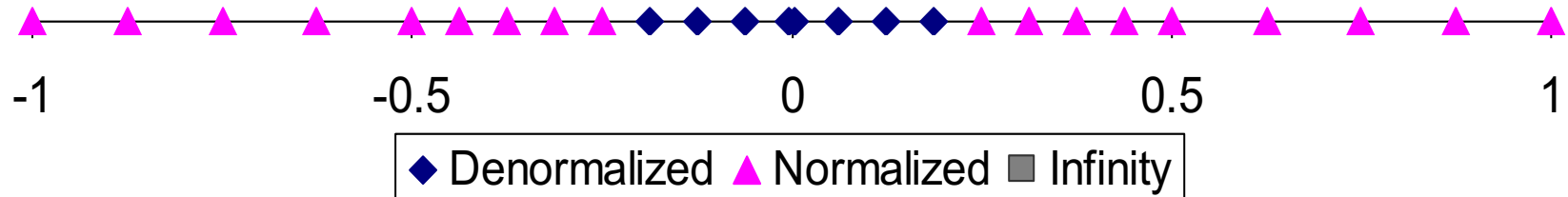
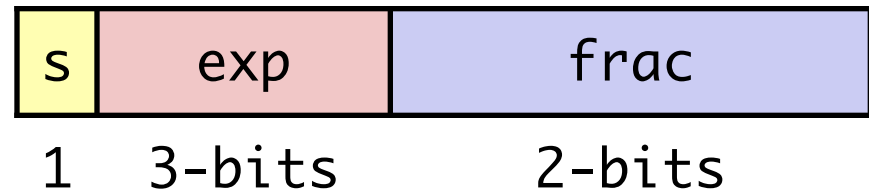
▶ Notice how the distribution gets denser toward zero.



Distribution of Values (close-up view)

▶ 6-bit IEEE-like format

- ▶ $e = 3$ exponent bits
- ▶ $f = 2$ fraction bits
- ▶ Bias is 3



Special Properties of the IEEE Encoding

- ▶ **FP Zero Same as Integer Zero**
 - ▶ All bits = 0
- ▶ **Can (Almost) Use Unsigned Integer Comparison**
 - ▶ Must first compare sign bits
 - ▶ Must consider $-0 = 0$
 - ▶ NaNs problematic
 - ▶ Will be greater than any other values
 - ▶ What should comparison yield?
 - ▶ Otherwise OK
 - ▶ Denorm vs. normalized
 - ▶ Normalized vs. infinity



End of Segment

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