Chapter-6
Numerical considerations

2's complement	Decimal value	Excess-3
101	–3	000
110	–2	001
111	–1	010
000	0	011
001	1	100
010	2	101
011	3	110
100	Reserved pattern	111

FIGURE 6.1: Excess-3 encoding, sorted by excess-3 ordering.

000	0
001	1
010	2
011	3
100	4
101	5
110	6
111	7

FIGURE 6.2: Representable numbers of a 3-bit unsigned integer format.

FIGURE 6.3: Representable numbers of a 3-bit unsigned integer format.

		No-zero		Abrupt underflow		Denorm	
E	*M*	*S* = 0	*S* = 1	*S* = 0	*S* = 1	*S* = 0	*S* = 1
00	00	2^{-1}	$-(2^{-1})$	0	0	0	0
	01	$2^{-1} + 1*2^{-3}$	$-(2^{-1} + 1*2^{-3})$	0	0	$1*2^{-2}$	$-1*2^{-2}$
	10	$2^{-1} + 2*2^{-3}$	$-(2^{-1} + 2*2^{-3})$	0	0	$2*2^{-2}$	$-2*2^{-2}$
	11	$2^{-1} + 3*2^{-3}$	$-(2^{-1} + 3*2^{-3})$	0	0	$3*2^{-2}$	$-3*2^{-2}$
01	00	2^{0}	$-(2^{0})$	2^{0}	$-(2^{0})$	2^{0}	$-(2^{0})$
	01	$2^{0} + 1*2^{-2}$	$-(2^{0} + 1*2^{-2})$	$2^{0} + 1*2^{-2}$	$-(2^{0} + 1*2^{-2})$	$2^{0} + 1*2^{-2}$	$-(2^{0} + 1*2^{-2})$
	10	$2^{0} + 2*2^{-2}$	$-(2^{0} + 2*2^{-2})$	$2^{0} + 2*2^{-2}$	$-(2^{0} + 2*2^{-2})$	$2^{0} + 2*2^{-2}$	$-(2^{0} + 2*2^{-2})$
	11	$2^{0} + 3*2^{-2}$	$-(2^{0} + 3*2^{-2})$	$2^{0} + 3*2^{-2}$	$-(2^{0} + 3*2^{-2})$	$2^{0} + 3*2^{-2}$	$-(2^{0} + 3*2^{-2})$
10	00	2^{1}	$-(2^{1})$	2^{1}	$-(2^{1})$	2^{1}	$-(2^{1})$
	01	$2^{1} + 1*2^{-1}$	$-(2^{1} + 1*2^{-1})$	$2^{1} + 1*2^{-1}$	$-(2^{1} + 1*2^{-1})$	$2^{1} + 1*2^{-1}$	$-(2^{1} + 1*2^{-1})$
	10	$2^{1} + 2*2^{-1}$	$-(2^{1} + 2*2^{-1})$	$2^{1} + 2*2^{-1}$	$-(2^{1} + 2*2^{-1})$	$2^{1} + 2*2^{-1}$	$-(2^{1} + 2*2^{-1})$
	11	$2^{1} + 3*2^{-1}$	$-(2^{1} + 3*2^{-1})$	$2^{1} + 3*2^{-1}$	$-(2^{1} + 3*2^{-1})$	$2^{1} + 3*2^{-1}$	$-(2^{1} + 3*2^{-1})$
11	Reserved pattern						

FIGURE 6.4: Representable numbers of no-zero, abrupt underflow, and denorm formats.

FIGURE 6.5: Representable numbers of the no-zero representation.

FIGURE 6.6: Representable numbers of the abrupt underflow format.

FIGURE 6.7: Representable numbers of a denormalization format.

Exponent	Mantissa	Meaning
11…1	≠ 0	NaN
11…1	= 0	$(-1)^S * \infty$
00…0	≠ 0	denormalized
00…0	= 0	0

FIGURE 6.8: Special bit patterns in the IEEE standard format.

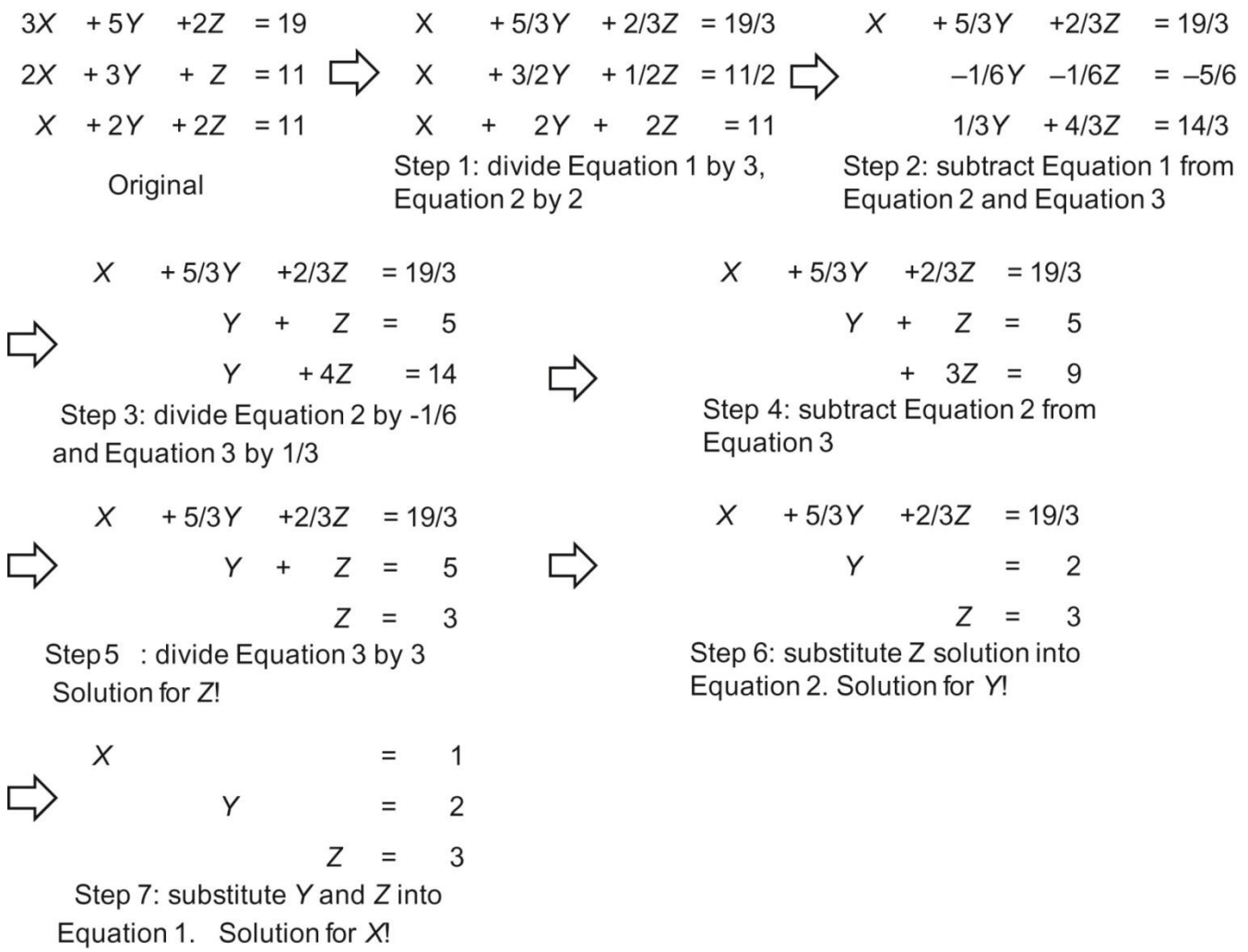

FIGURE 6.9: Gaussian elimination and backward substitution for solving systems of linear equations.

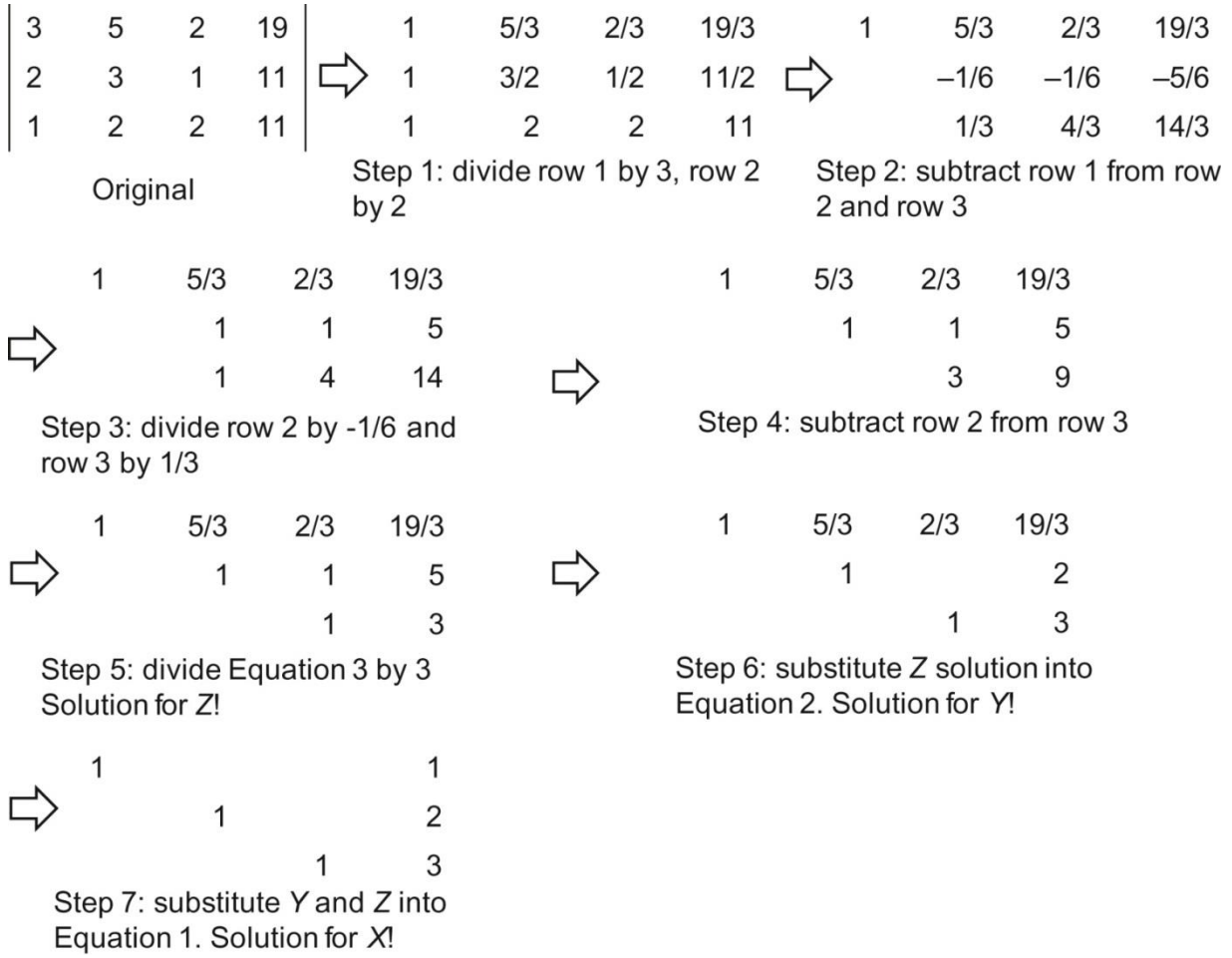

FIGURE 6.10: Gaussian elimination and backward substitution in matrix view

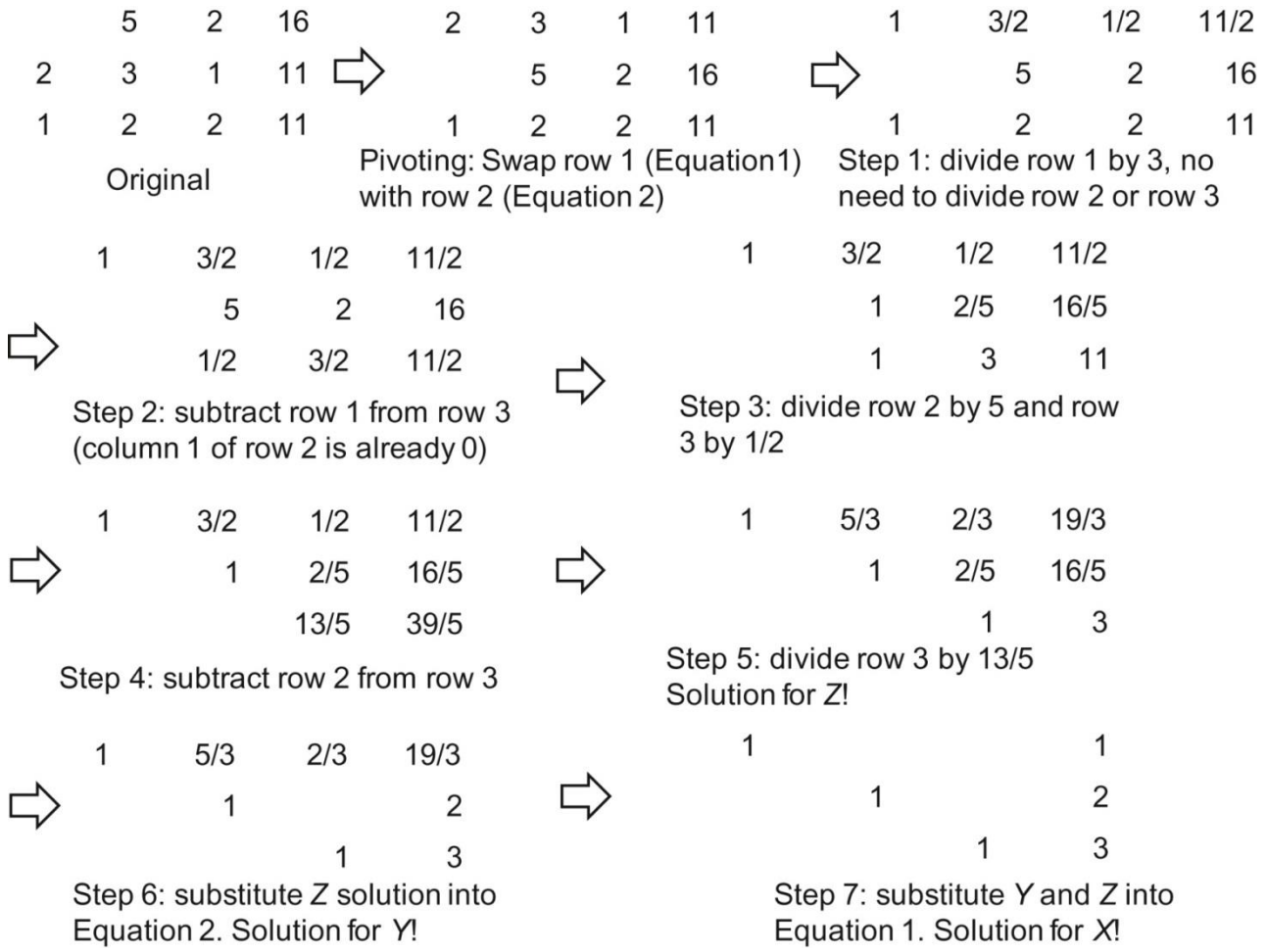

FIGURE 6.11: Gaussian elimination with pivoting.