2280 A1 Solutions

1. 0x434F4050 is 0100 0011 0100 1111 0100 1101 0101 0000
↑ non-negative
⇒ same # unsigned, 1's comp & 2's comp

number = $2^4 + 2^6 + 2^8 + 2^{10} + 2^{11} + 2^{14} + 2^{16} + 2^{17} + 2^{18} + 2^{19} + 2^{22} + 2^{24} + 2^{25} + 2^{30}$
= 1 129 270 608

IEEE:

0	100 0011	0	100 1111 0100 1101 0101 0000
↑ sign	↑ exp		↑ mantissa

exponent: 100 0011 0 = 13
∴ 134 − 127 = 7

∴ number is
$1.10011110100110101010000 \times 2^7$
$= 11001111.01001101010000$
$= 2^7 + 2^6 + 2^3 + 2^2 + 2^1 + 2^0 + 1/2^2 + 1/2^5 + 1/2^8 + 1/2^{10} + 1/2^{17}$
$= 207 + 0.25 + 0.03125 + 0.015625 + 0.00390625 + 0.000976562 + 0.00024414$
$= 207.302001953125$
or 207.3020 (to 7 sig. digits)

ASCII: x43 = 'C', x4F = 'O', x4D = 'M', x50 = 'P'
⇒ "COMP"

x55544552 is
0101 0101 0101 0100 0100 0101 0101 0010
number is positive, so:
$2^1 + 2^4 + 2^6 + 2^8 + 2^{10} + 2^{14} + 2^{18} + 2^{20} + 2^{22} + 2^{24} + 2^{26} + 2^{28} + 2^{30}$
= 1 431 586 130

IEEE:
sign is pos.

exp bits are: 10101010 = 170
∴ 170 − 127 = 43

∴ number is
$1.10101000100001010101000 \times 2^{43}$
$= 11010100010000101010100010\underbrace{0\ldots0}_{20 \text{ zeros}}$
$= 2^{21} + 2^{24} + 2^{26} + 2^{28} + 2^{30} + 2^{34} + 2^{38} + 2^{40} + 2^{42} + 2^{43}$
$= 1.4587140 \times 10^{13}$
(to 7 sig. digits)

ASCII: "UTER"

note: IEEE #'s should have 7 digits but not rounding is acceptable.

2. a) 1012/2 = 506 R 0
506/2 = 253 R 0
253/2 = 126 R 1
126/2 = 63 R 0
63/2 = 31 R 1
31/2 = 15 R 1
15/2 = 7 R 1
7/2 = 3 R 1
3/2 = 1 R 1
1/2 = 0 R 1

16-bit 2's comp is 0000 0011 1111 0100
or 0x03F4.

b) 4000/2 = 2000 R 0
2000/2 = 1000 R 0
1000/2 = 500 R 0
500/2 = 250 R 0
250/2 = 125 R 0
125/2 = 62 R 1
62/2 = 31 R 0
31/2 = 15 R 1

4000 ⇒ 0000 1111 1010 0000

−4000:
1111 0000 0110 0000
−or−
0xF060

31 / 2 = 15 R 1
15 / 2 = 7 R 1
7 / 2 = 3 R 1
3 / 2 = 1 R 1
1 / 2 = 0 R 1

3. a) 1100 (-4) — no overflow
+0100 (4) — there is a carry out, which is ignored
(1) 0000 (0)

b) 1000 (-8) should be -9,
+1111 (-1) ∴ overflow occurred
(1) 0111 (-7)

4. sign extend to 8 bits

a)
1111 1001 (-7)
+0011 0101 (53)
(1) 0010 1110 (46)

b)
0000 0111 (7)
+1110 1101 (-19)
(0) 1111 0100 (-12)

5. $-57.125 = -111001.001$
$= -1.11001001 \times 2^5$
exp: $5 + 127 = 132 = 1000\ 0100_2$

sign: neg. so encoding is 1

mantissa: 1100 1001 0000 0000 0000 0000 One too many 0s

encoding: 1 | 10000100 | 1100 1001 0000 0000 0000 0000
sign exp mantissa
or 0xC2648000 One too many 0s

6. a) NOT (NOT (1101)) = 1101

b) (0110 OR 0000) AND 1111 = 0110 AND 1111
= 0110