1 (1) $2^{16}/2^8 = 2^8 = 256$

8 bit data line is 256 time slower thar 16 bit data line

(2) $2 \cdot 2^{16}/2^{10} = 128$ kByte

(3) 128 kByte $= 2^{17}$ Byte $= 2^{17}$ cell

width is 17

(4) 8 kByte $= 2^{13}$ Byte $= 2^{13}$ cell

If data line is 16 address line is 12

If data line is 8 address line is 13

2. $1 \cdot 2 + 2 \cdot 5 = 12$ $3 \cdot 1 = 3$ $1 \cdot 6 + 2 \cdot 1 = 8$

$1 \cdot 3 + 2 \cdot 4 = 11$ $8 + 2 = 10$

$12 + 3 + 11 = 26$

$CPI = 26 \cdot 0.1 + (26+10) \cdot 0.2 + (26+10 \cdot 2) \cdot 0.3 + (26+10 \cdot 3) \cdot 0.2 + (26+10 \cdot 4) \cdot 0.1 + (26+10 \cdot 5$

$= 2.6 + 7.2 + 13.8 + 11.2 + 6.6 + 7.6$

$= 49$

$49 \div (1.6 \cdot 10^6) \cdot 10^6 = 30.625$ μs

3 (1) $0 = (00)_3$ $1 = (01)_3$ $2 = (02)_3$ $3 = (10)_3$ $4 = (11)_3$ $5 = (12)_3$ $6 = (20)_3$

$7 = (21)_3$ $8 = (22)_3$

(2) $K_3 + (-K_3) = (00)_3 + \text{Carray} = (100)_3 = 9$

(3) $-1 = (22)_3$ $-2 (21)_3$ $-3 = (20)_3$ $-4 (12)_3$

conversion should be $(K)_3 + (-K)_3 = 3^{bit+1}$

(4) + Range $= 40$ · -Range $= -40$

$3^4/2 = 40.5$

ignore 0.5 the range should be -40 - 40

4. use index: $1=(001)_2$ $2=(010)_2$ $3=(011)_2$ $4=(100)_2$ $5=(101)_2$ $6=(110)_2$

so the length is 3 bits

$0.45 \cdot \log_2 \frac{1}{0.45} + 0.16 \cdot \log_2 \frac{1}{0.16} + 0.13 \log_2 \frac{1}{0.13} + 0.12 \log_2 \frac{1}{0.12} + 0.09 \log_2 \frac{1}{0.09} + 0.05 \log_2 \frac{1}{0.05}$

$= 0.5184 + 0.423 + 0.383 + 0.3127 + 0.216 + 0.367 \approx 2.22$

efficiency is about 2.22