1.1 Conversions

a. **(i)** 0b10001110 —> decimal —> (0*2^0) + (1*2^1) + (1*2^2) + (1*2^3) + (0*2^4) + (0*2^5) + (0*2^6) + (1*2^7) = **142**

0b10001110 —> hexadecimal —> (1000 = 8) + (1110 = E) —> **8E**

(ii) 0xC3BA —> decimal —> A = 10
B = 11
C = 12

(A*16^0) + (B*16^1) + (3*16^2) + (C*16^3) = **50106**

0xC3BA —> binary —> A = 1010
B = 1011
C = 1100
3 = 0011

1100 0011 1011 1010 —> **110001110111010**

(iii) 81—> binary—> 64 +16 + 1
26 + 24 + 20 = **0b1010001**

81 —> hexadecimal —> 0101 0001 = 51

(iv) 0b100100100 —> decimal —> (1*2^2) + (1*2^5) + (1*2^8) = **292**

0b100100100 —> hexadecimal —> 0001 0010 0100 —> **124**

(v) 0xBCA1 —> decimal —> A = 10
B = 11
C = 12
(1*16^0) + (A*16^1) + (C*16^2) + (B*16^3) = 1 + 160 + 3072 + 45056 = **48289**

0xBCA1 —> binary —> A = 1010
B = 1011
C = 1100
1 = 0001

BCA1 = 1011 1100 1010 0001 —> **1011110010100001**

(vi) 0 —> binary —> 0*2^0 = **0**
0 —> hexadecimal —> 0000 = **0**

(vii) 42 —> binary —>

42/2 =21 Remainder 0

21/2 =10 Remainder 1
10/2 = 5 Remainder 0
5/2 = 2 Remainder 1
2/2 = 1 Remainder 0
1/2 = 0 Remainder 1
42 —>0b101010
42 —> hexadecimal —> 0010 1010 —> **2A**

(viii) 0xBAC4 —> binary —> A = 1010
B = 1011
C = 1100

1011 1010 1100 0100 —> **1011101011000100**
(4*16^0) + (12*16^1) + (10*16^2) + (11*16^3) = **47812**

b. 2^14 = (2^10)*(2^4) —> (Ki)*(2^4) —> **16Ki**
2^43 = (2^40)*(2^3) —> (Ti)*(2^3) —> **8Ti**
2^23 = (2^20)*(2^3) —> (Mi)*(2^3) —> **8Mi**
2^58 = (2^50)*(2^8) —> (Pi)*(2^8) —> **256Pi**
2^64 = (2^60)*(2^4) —> (Ei)*(2^4) —> **16Ei**
2^42 = (2^40)*(2^2) —> (Ti)*(2^2) —> **4Ti**

c. 2Ki = (2^1)*(2^10) —> **2^11**
512Pi = (2^9)*(2^50) —> **2^59**
256Ki = (2^8)*(2^10) —> **2^18**
32Gi = (2^5)*(2^30) —> **2^35**
64Mi = (2^6)*(2^20) —> **2^26**
8Ei = (2^3)*(2^60) —> **2^63**

2.2 Exercises

1. Largest 8-bit number is 11111111 —> 255, 11111111 + 1 = 100000000 —> 256

2. 0 is 00000000
3 is 00000011 —> (1*2^0) + (1*2^1)
-3 is two's complement of 3 —> 00000011 —> two's complement —> 11111101

3. 42 is 0101010 —> (1*2^1) + (1*2^4) + (1*2^5)
-42 is two's complement of 42 —> 0101010 —> two's complement —> 1010110

4. Largest integer that can be represented by an 8-bit number is 255.
Largest number that can be represented with 2's complement is 127.

5. 42 is 0101010, 42 in two's complement —> 1010110
0101010 + 1010110 = 0

6.

3.1 Exercises

1. Since the variable can only take 3values:
log2^3 = 2 bits.

2. TiB = 2^40; 2 TiB = 2*2^40 = 2^41 bytes.
so the dress needs to be 41 bits long.

3. If the variable can only take one value;
Then we only need 1 bit to represent it.