Lab 1

Stuti Patel

Section 15

1. a) -112

   b) 4

   c) -4

2. a) 3841

   b) 0

   c) 17

   d) 15

3. a) 0000 0000 0000 0000 0000 0000 1001 1101

   b) 0000 0000 0000 0000 0000 0000 1100 1111

   c) 1111 1111 1111 1111 1111 1111 0110 1010

   d) 1111 1111 1111 1111 1111 1111 1100 1001

   e) 1111 1111 1111 1111 1111 1111 1111 1101

   f) 0000 0000 0000 0000 0000 0000 0100 0001

4. a) 0100 0001 0110 0000 0000 0000 0000 0000

   b) 0100 0010 0000 0000 0000 0000 0000 0000

   c) 1100 0000 0100 0000 0000 0000 0000 0000

   d) 0100 0011 0000 0000 0000 0000 0000 0000

   e) 1100 0000 1100 0000 0000 0000 0000 0000

   f) 1100 0001 0111 0000 0000 0000 0000 0000

5. a) A0B2C3E5

   b) FAA157E8

6. a) 0110 0110 1100 1100 1111 1111

   b) 0011 0011 0110 0110 1111 1111

   c) 1111 1111 1111 1111 1111 1111

   d) 0001 0010 0011 0100 0101 0110

   e) 1010 1011 1100 1101 1110 1111

7. a) 3368601

   b) 16763938

   c) 3430008

   d) 10066329

   e) 0

8. a) 2C

   b) 26E

   c) 61F

   d) 3E8

   e) 2A5

CPS 125 - Lab 1

Q1. 1100 0010 1110 0000 0000 0000 0000 0000

-ve | Exp bits | fraction bit

a) Negative Decimal.

b) $(00000101)_2 \rightarrow 2^0 + 2^2 + 2^7 = 133$

Exp Bias. $= 127$

$e = 133 - 127 = 6$

c) $m = 110\ 0000\ \ldots$

$= 2^{-1} + 2^{-2} = \frac{3}{4} = 0.75$

$(-1)^s (1+m) \times 2^e$

$(-1)^1 (1+0.75) \times 2^6$

$-(1.75) \times 2^6$

-1.75×2^6

$= -112$

Q1. 1000 0000 1000 0000 0000 0000 0000 0000

a) Positive Decimal

b) $(10000001)_2 \rightarrow 2^0 + 2^7 = 1 + 128 = 129$

Exp base $= 127$

$e = 129 - 127 = 2$

c) $m = 0$

$(-1)^s (1+m) \times 2^e$

$(-1)^0 (1+0) \times 2^e$

1×2^2

$= 4$

1100 0000 1000 0000 0000 0000 0000 0000 * (should be -4 b/c it is the same as previous question)

Check:

a) Negative Decimal

b) $(10000001)_2 \rightarrow 2^0 + 2^7 = 1 + 128 = 129$

Exp Base $= 127$

$e = 129 - 127 = 2$

c) $m = 0$

$(-1)^s (1+m) \times 2^e$

$(-1)^1 (1+0) \times 2^2$

-1×2^2

$= -4$ ✓

Q2. 0000 0000 0000 0000 0000 1111 0000 0001

$= 2^0 + 2^8 + 2^9 + 2^{10} + 2^{11}$

$= 1 + 256 + 512 + 1024 + 2048$

$= 3841$

2048
1024
512
256
+ 1
3841

0000 0000 0000 0000 0000 0000 0000 0000

= zero

0000 0000 0000 0000 0000 0000 0000 0001 $= 2^0 + 2^4$

$2^0 = 1 + 16$

$= 17$

0000 ..... 0000 1111

$= 2^0 + 2^1 + 2^2 + 2^3$

$= 1 + 2 + 4 + 8$

$= 15$

Q3. 157 256 128 64 32 16 8 4 2 1

157 − 128 = 29 − 16 = 13 − 8 = 5 − 4 = 1

2^7 2^4 2^3 2^2 2^0

12-Bit Representation:

0000 1001 1101

207 256 128 64 32 16 8 4 2 1

207 − 128 = 79 − 64 = 15 − 8 = 7 − 4 = 3 − 2 = 1

2^7 2^6 2^3 2^2 2^1 2^0

12-Bit Representation:

0000 1100 1111

~~-150~~

128 64 32 16 8 4 2 1

150 − 128 = 22 − 16 = 6 − 4 = 2

2^7 2^4 2^2 2^1

2's complement: (12-bit representation)

0000 1001 0110

1's complement → 1111 0110 1001

1111 0110 1001 + 1

1111 0110 1010

2's complement: 1111 0110 1010

-55

128 64 32 16 8 4 2 1

55 − 32 = 23 − 16 = 7 − 4 = 3 − 2 = 1

2^5 2^4 2^2 2^1 2^0

2's complement: (8 bit)

0011 0111

1100 1000

1100 1000 + 1

1100 1001

-3

3 − 2 = 1

2^1 2^0

2's complement: (4-bit)

0011

1100 → 1's complement

1100 + 1

1101

65

128 64 32 16 8 4 2 1

65 − 64 = 1

2^6 2^0

2's complement: (8-bit)

0100 0001

1's complement → 1011 1110

1011 1110 + 1

1011 1111

2's complement

Q4. 14.0

$(14)_{10}$ → 14 − 8 = 6 − 4 = 2 → 1110.0

2^3 2^2 2^1

32.0

$(32)_{10}$ → 32 − 32 = 0 → 0010 0000.0

2^5

-3.0

$(3)_{10}$ → 0011

$(-3)_{10}$ → 1100 + 1 = 1101

1101.0

128.0

$(128)_{10}$ → 2^7 → 1000 0000.0

2's complement

-6.0

$(6)_{10}$ → $2^2 + 2^1$ → 0110

$(-6)_{10}$ → 1001 + 1 = 1010

1110.0

-15.0

$(15)_{10}$ → $2^3 + 2^2 + 2^1 + 2^0$ → 1111

$(-15)_{10}$ → 0000 + 1 = 0001

0001.0

5. 1010 0000 1011 0010 1100 0011 1110 0101

$(1010)_2 \rightarrow 2^3 + 2^1 = 10\ (A)$

$(0000)_2 \rightarrow 0$

$(1011)_2 \rightarrow 2^3 + 2^1 + 2^0 = 11\ (B)$

$(0010)_2 \rightarrow 2^1 = 2$

$(1100)_2 \rightarrow 2^3 + 2^2 = 12\ (C)$

$(0011)_2 \rightarrow 2^1 + 2^0 = 3$

$(1110)_2 \rightarrow 2^3 + 2^2 + 2^1 = 14\ (E)$

$(0101)_2 \rightarrow 2^2 + 2^0 = 5$

} A0B2C3E5

1111 1010 1010 0001 0101 0111 1110 1000

$(1111)_2 \rightarrow 2^3 + 2^2 + 2^1 + 2^0 = 15\ (F)$

$(1010)_2 \rightarrow 2^3 + 2^1 = 10\ (A)$

$(1010)_2 \rightarrow 10\ (A)$

$(0001)_2 \rightarrow 2^0 = 1$

$(0101)_2 \rightarrow 2^2 + 2^0 = 5$

$(0111)_2 \rightarrow 2^0 + 2^1 + 2^2 = 7$

$(1110)_2 \rightarrow 2^1 + 2^2 + 2^3 = 14\ (E)$

$(1000)_2 \rightarrow 2^3 = 8$

} FAA157E8

Q6. 66CCFF 128 64 32 16 8 4 2 1

$(6)_{16} \rightarrow 2^2 + 2^1 = 0110$
$(C)_{16} \rightarrow (12)_{10} \rightarrow 1100$
$(F)_{16} \rightarrow (15)_{10} \rightarrow 1111$

} 0110 0110 1100 1100 1111 1111

3366FF

$(3)_{16} \rightarrow 0011$
$(6)_{10} \rightarrow 0110$
$(F)_{16} \rightarrow (15)_{10} \rightarrow 1111$

} 0011 0011 0110 0110 1111 1111

FFFFFF $\rightarrow$ 1111 1111 1111 1111 1111 1111

$(F)_{16} \rightarrow (15)_{10} \rightarrow 1111$

123456

$(1)_{10} \rightarrow 0001$ $(4)_{10} \rightarrow 0100$
$(2)_{10} \rightarrow 0010$ $(5)_{10} \rightarrow 0101$
$(3)_{10} \rightarrow 0011$ $(6)_{10} \rightarrow 0110$

} 0001 0010 0011 0100 0101 0110

ABCDEF

$(A)_{16} \rightarrow (10)_{10} \rightarrow 1010$
$(B)_{16} \rightarrow (11)_{10} \rightarrow 1011$
$(C)_{16} \rightarrow (12)_{10} \rightarrow 1100$
$(D)_{16} \rightarrow (13)_{10} \rightarrow 1101$
$(E)_{16} \rightarrow (14)_{10} \rightarrow 1110$
$(F)_{16} \rightarrow (15)_{10} \rightarrow 1111$

} 1010 1011 1100 1101 1110 1111

Q7. 336699 (16^5 ... 16^1 16^0)

$3 \times 16^5 = 3145728$
$3 \times 16^4 = 196608$
$6 \times 16^3 = 24576$
$6 \times 16^2 = 1536$
$9 \times 16^1 = 144$
$9 \times 16^0 = 9$
$= 3368601$

FFCC22 (5 4 3 2 1 0; 16^5)

$15 \times 16^5 = 15728640$
$15 \times 16^4 = 983040$
$12 \times 16^3 = 49152$
$12 \times 16^2 = 3072$
$2 \times 16^1 = 32$
$2 \times 16^0 = 2$
$= 16763938$

543210
345678

$3 \times 16^5 = 3145728$
$4 \times 16^4 = 262144$
$5 \times 16^3 = 20480$
$6 \times 16^2 = 1536$
$7 \times 16^1 = 112$
$8 \times 16^0 = 8$
$= 3430008$

999999

$9 \times 16^5 = 9437184$
$9 \times 16^4 = 589824$
$9 \times 16^3 = 36864$
$9 \times 16^2 = 2304$
$9 \times 16^1 = 144$
$9 \times 16^0 = 9$
$= 10066329$

000000

$0 \times 16^5 = 0$
$0 \times 16^4 = 0$
$0 \times 16^3 = 0$
$0 \times 16^2 = 0$
$0 \times 16^1 = 0$
$0 \times 16^0 = 0$
$= 0$

Q8. 44 4096 256 16 1

$44 \div 16 = 2.75$ R 2
$2.75 \div 16 = 0.171 = 0$ R 12

2, 12
2C

1567

$1567 \div 16 = 97.9375 = 97$ R 15
$97 \div 16 = 6.0625 = 6$ R 1
$6 \div 16 = 0.375 = 0$ R 6

61F

677

$677 \div 16 = 42.3125 = 42$ R 5
$42 \div 16 = 2.625 = 2$ R 10
$2 \div 16 = 0.125 = 0$ R 2

2A5

622

$622 \div 16 = 38.875 = 38$ R 14
$38 \div 16 = 2.375 = 2$ R 6
$2 \div 16 = 0.125 = 0$ R 2

26E

1000

$1000 \div 16 = 62.5 = 62$ R 8
$62 \div 16 = 3.875 = 3$ R 14
$3 \div 16 = 0.1875 = 0$ R 3

3E8