1. Assuming integers are represented as 16-bit words and negative numbers are represented using the 2's complement representation, convert the following hexadecimal numbers to decimal numbers (show your work).

a. FEED, b. BAD1, c. 2DAD

**Answer a :**

$$FEED(Hex)=1111,1110,1110,1101(binary)=1111,1110,1110,1101-1$$
$$=1111,1110,1110,1100\rightarrow(inverse)-0000,0001,0001,0011=$$
$$1\times2^{8}+0\times2^{7}+0\times2^{6}+0\times2^{5}+1\times2^{4}+0\times2^{3}+0\times2^{2}+1\times2^{1}+1\times2^{0}=-(256+16+2)=-275(decimal)$$

**Answer b:**

$$BAD1(Hex)=1011,1010,1101,0001(binary)=1011,1010,1101,0001-1$$
$$=1011,1010,1101,0000\rightarrow(inverse)$$
$$-(0100,0101,0010,1111)=-(1\times2^{14}+1\times2^{10}+1\times2^{8}+1\times2^{5}+1\times2^{3}+1\times2^{2}+1\times2^{1}+1\times2^{0})=-(16384+1024+256+32+8+4+2+1)=-17711(decimal)$$

**Answer c:**

$$2DAD(Hex)=0010,1101,1010,1101(binary)=1\times2^{13}+1\times2^{11}+1\times2^{10}+1\times2^{8}+1\times2^{7}+1\times2^{5}+1\times2^{3}+1\times2^{2}+1\times2^{0}=8192+2048+1024+256+128+32+4+1=11685(decimal)$$

2. Assuming integers are represented as 32-bit words and negative numbers are represented using the 2's complement representation, convert the following decimal numbers to hexadecimal numbers (show your work).

a. -1954, b. 15343

**Answer a:**

$$1954(decimal)=(0000,0000,0000,0000,0000,0111,1010,0010)$$
$$\rightarrow1111,1111,1111,1111,1111,1000,0101,1110(-1954_{10})=$$
$$FFFF,F85E(Hex)$$

**Answer b:**

$$15343(\text{decimal})=0000,0000,0000,0000,0011,1011,1110,1111=00003BEF(\text{Hex})$$

3. Represent following floating point numbers in IEEE single-precision (32-bit) format:

a. -0.1875, b. 0.46875

**Answer a:**

**The first step, we find that this floating point is negative, so** $S=1$**. And then, we convert the** $0.1875$**to** $1.5\times2^{-3}$**.After that, we convert the** $0.5$ **to** $F=100{,}0000{,}0000{,}0000{,}0000{,}0000$ **fraction part and the Exponent part for this case is** $127-3=124_{10}=0111{,}1100_2$**.**

**So in conclusion:**

**S=1**

**E=0111,1100**

**F=100,0000,0000,0000,0000,0000**

**Answer b:**

**The first step, we find that this floating point is negative, so** $S=0$**. And then, we convert the** $0.46875$**to** $1.875\times2^{-2}$**. After that, we convert the** $0.875$ **to** $F=110{,}0000{,}0000{,}0000{,}0000$ **and the Exponent part for this case is** $127-2=125_{10}=0111{,}1101_2$**.**

**So in conclusion:**

**S=0**

**E=0111,1101**

**F=110,0000,0000,0000,0000**

Show the steps done to reach the answer for each (i.e. how to get the S-bit, the exponent, and the fraction field of the answer).

4. What is the decimal value of the following IEEE single-precision (32-bit) floating point numbers (which are shown in hexadecimal)?

a. 3F400000, b. BE000000

**Answer a: For the first step, we convert the Hexadecimal to binary which is** $0011{,}1111{,}0100{,}0000{,}0000{,}0000{,}0000{,}0000$**. After this, we separate three section.**

$0|011,1111,0|100,0000,0000,0000,0000,0000$. **We can indicate that this is the positive decimal number, since the first sign section number is 0. For the exponent section we have 0111,1110 which stand for decimal** $126_{10}$. **So this is the power of** $126-127=-1$. **Since the actual fraction is**$1.100,0000,0000,0000,0000,0000=1+1\times2^{-1}=1.5_{10}$.**So the actual decimal is** $1.5\times2^{-1}=0.75$

**Answer B:**

**For the first step, we convert the Hexadecimal to binary which is** $1011,1110,0000,0000,0000,0000,0000,0000$. **After this, we separate three section.**
$1|011,1110,0|000,0000,0000,0000,0000,0000$. **We can indicate that this is a negative decimal number, since the first sign section number is 1. For the exponent section we have 0111,1100 which stand for decimal** $124_{10}$. **So this is the power of** $124-127$**=-3. Since the actual fraction is**$1.000,0000,0000,0000,0000,0000=1_2=1_{10}$. **So the actual decimal is** $-1\times2^{-3}=-0.25$.
Show the steps done to reach the answer for each.

Note: Do NOT omit the leading zeros (0s) in your answers.