Module 13 Example Set 2

1. Register EBP contains the memory address of a sixty-four bit two's complement integer on an IA-32 processor system. The address in EBP corresponds to the low part of the 64-bit integer. Show a sequence of IA-32 instructions that subtract the 64-bit integer in memory from the 64-bit integer contained in the EDX,EAX register pair (EAX contains the low part of the subtrahend).

```
SUB    EAX,[EBP]        subtract the low parts
SBB    EDX,[EBP+4]      subtract high parts including any borrow
```

2. What is the effect produced by the following IA-32 instruction?

```
PADDB    MM2,MM4
```

This instruction interprets the contents of the MM2 and MM4 registers as a packed group of eight bytes and generates eight 8-bit sums by adding in parallel the corresponding bytes in the two registers.

3. What is the 80-bit extended precision floating point representation of the decimal number -2.75? Express the answer is hex.

The value is negative, so the sign bit = 1.
2.75 decimal = binary 10.11 = $1.011*2^1$
So the fraction is 011 followed by sixty 0 bits
The characteristic = 1 + 16383 = 16384 = 0x4000
So the 80-bit representation is
1 100000000000000 1 011 followed by sixty 0 bits
or 0xC000B000000000000000

4. If the IA-32 floating point register ST(0) contains the floating point representation of the decimal number -2.75, what effect does the following instruction have? Show in hex, the contents of any memory locations that are changed.

```
FISTP    [EAX]
```

This instruction stores the integer part of -2.75 into memory as a 32-bit two's complement integer. The integer is stored at the memory address contained in the EAX register. The 32-bit pattern stored is 0xFFFFFFFE. The "P" suffix means that ST(0) will be popped from the floating point stack.

5. Assume that prior to executing the instruction shown below, EBP contains the number 0x4ABC4, ESI contains 0x20 and EAX contains 0xFFFFFFF0. What is the contents of these three registers after the instruction is executed?

```
LEA   EAX,[EPB + ESI*4 + 60]
```

This instruction overwrites the EAX register with the value 0x4ABC4 + 0x20*4 + 60 = 0x4ABC4 + 0x80 + 0x3C = 0x4AC80

6. Show, in hex, the final contents of any data registers that are modified by the following instructions:

```
MOV   EAX,-511
CDQ
```

The MOV instruction puts the two's complement representation of -511 into the EAX register. The CDQ instruction uses sign extension to convert the 32-bit signed integer in EAX into the equivalent 64-bit signed integer in the EDX,EAX register pair. That is, the 32-bit quadword in EAX is converted into the equivalent double quadword in EDX,EAX.
So EDX = 0xFFFFFFFF and EAX = 0xFFFFFE01