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CSC 342

Quiz No.2 PLEASE SUBMIT ON SLACK by 1:40 PM

October 25 , 2021

Please circle around your major: [✓ **Computer Science**] or **Computer Engineering**

NO CORRECTIONS ARE ALLOWED on FRONT page!!!!!

You may use the back page for computations. Please answer all questions. **Not all questions are of equal difficulty. Please review the entire quiz first and then budget your time carefully.**

MAX NUMBER OF POINTS YOU CAN GET IN THIS TEST IS 100.

NOTE: Answers given without justification - NO CREDIT FOR THE QUESTION!!!!!

Question 1. (30 Points) 30/30

Memory model is a linear array of bytes, as shown in Figure 1. The minimal addressable unit in this memory is one byte. Below, Figure 1. depicts a small part of such a memory. The absolute address 0x80000100 is used as a base address and is stored in a register RBase . For clarity, this address is depicted to the left of the corresponding byte.

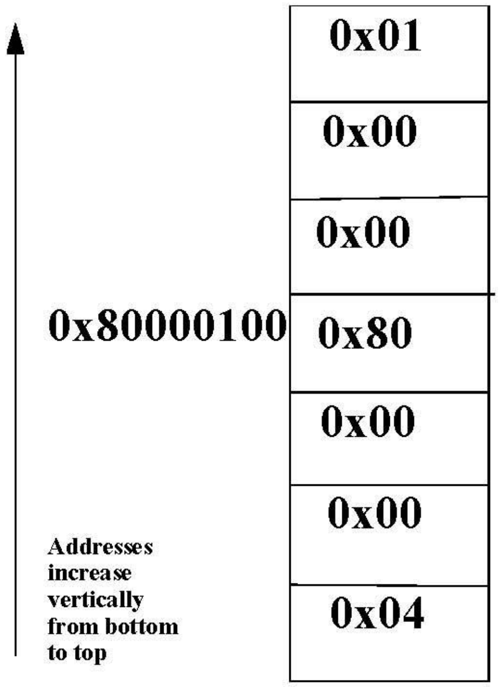

Figure 1. Memory model is a linear array of bytes.

Q.1.1. [5 points] Assume you have a MIPS processor and associated memory, as shown in Figure 1. What is the signed decimal value of the 32 bit integer (word) at the address0x80000100?

Big Endian (least address of word is MSB): 80 00 01 00 … convert to 32 bits

1000 0000 0000 0000 0000 0000 0000 0001 = -2^31 +1

Q.1.2. [5 points] Assume you have an INTEL i7 processor and associated memory, as shown in Figure 1. What is the signed decimal value of the 32 bit integer (word) at the ad-dress 0x80000100?

Little Endian (least address of word is LSB): 01 00 00 80 … convert to 32 bits

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0000 0001 0000 0000 0000 0000 1000 0000 = 2^24 + 2^7

Q.1.3. [5 points] what is the address of a byte containing 0x01? 0x80000103

Q.1.4 [5 points] what is the offset from base address (stored in Register RBase) to the byte containing 0x01? 3

Q.1.5. [5 points] what is the address of a byte containing 0x04? 0x800000FD (0x80000100 – 3 (offset))

Q1.6 [5 points] what is the offset from base address (stored in Register RBase) to the byte containing 0x04? -3

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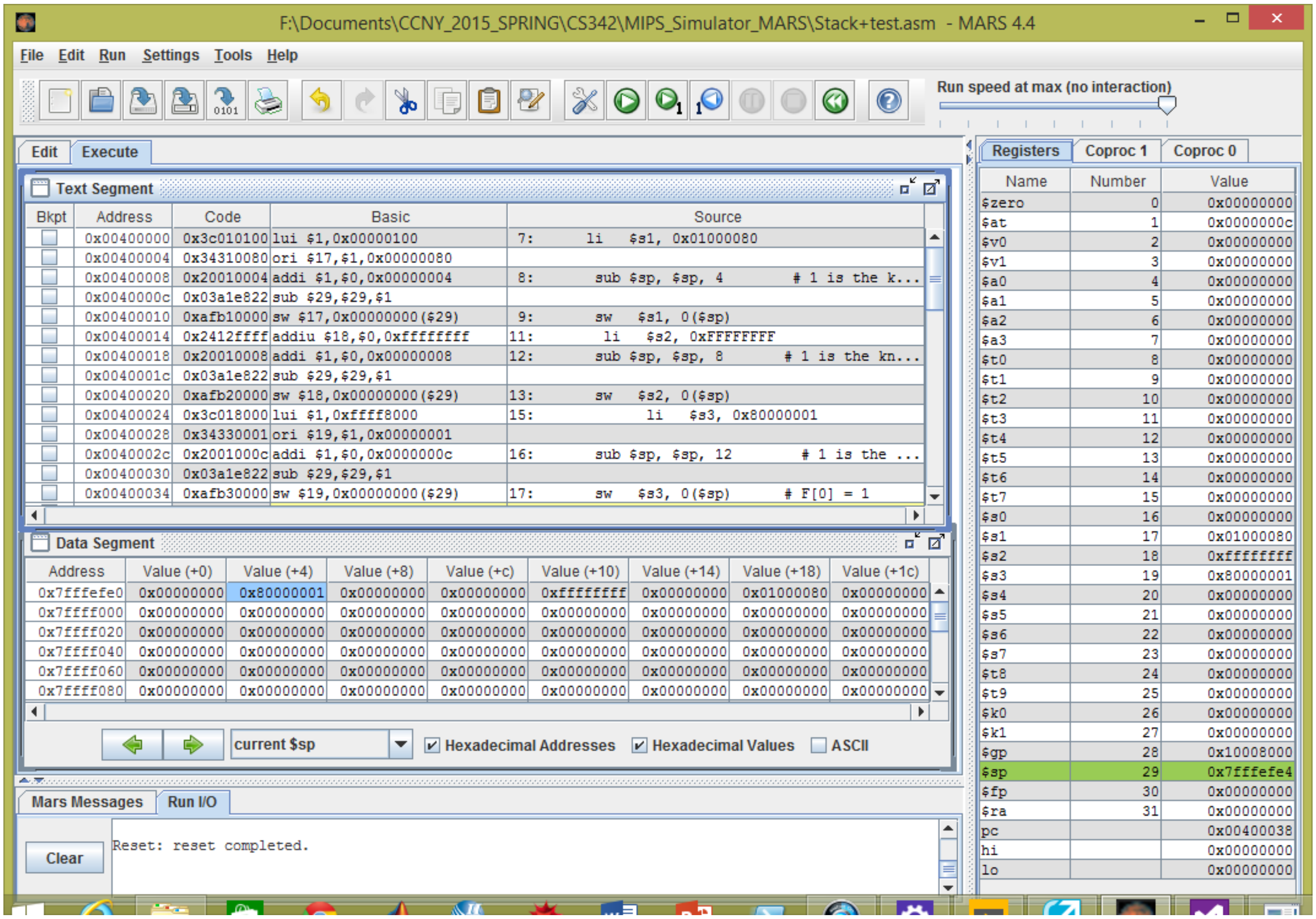
Question 2. (25 Points) 15/25

You are given an instance of a program in MARS MIPS simulator window.


F:\Documents\CCNY_2015_SPRING\CS342\MIPS_Simulator_MARS\Stack+test.asm - MARS 4.4
File Edit Run Settings Tools Help
0101
Run speed at max (no interaction)
Edit Execute
Registers Coproc 1 Coproc 0
Clear

Text Segment

Bkpt	Address	Code	Basic	Source
□	0x00400000	0x3c010100	lui $1,0x00000100	7: li $s1, 0x01000080
□	0x00400004	0x34310080	ori $17,$1,0x00000080	
□	0x00400008	0x20010004	addi $1,$0,0x00000004	8: sub $sp, $sp, 4 # 1 is the k...
□	0x0040000c	0x03a1e822	sub $29,$29,$1	
□	0x00400010	0xafb10000	sw $17,0x00000000($29)	9: sw $s1, 0($sp)
□	0x00400014	0x2412ffff	addiu $18,$0,0xffffffff	11: li $s2, 0xFFFFFFFF
□	0x00400018	0x20010008	addi $1,$0,0x00000008	12: sub $sp, $sp, 8 # 1 is the kn...
□	0x0040001c	0x03a1e822	sub $29,$29,$1	
□	0x00400020	0xafb20000	sw $18,0x00000000($29)	13: sw $s2, 0($sp)
□	0x00400024	0x3c018000	lui $1,0xffff8000	15: li $s3, 0x80000001
□	0x00400028	0x34330001	ori $19,$1,0x00000001	
□	0x0040002c	0x2001000c	addi $1,$0,0x0000000c	16: sub $sp, $sp, 12 # 1 is the ...
□	0x00400030	0x03a1e822	sub $29,$29,$1	
□	0x00400034	0xafb30000	sw $19,0x00000000($29)	17: sw $s3, 0($sp) # F[0] = 1

Data Segment

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x7fffefe0	0x00000000	0x80000001	0x00000000	0x00000000	0xffffffff	0x00000000	0x01000080	0x00000000
0x7ffff000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x7ffff020	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x7ffff040	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x7ffff060	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x7ffff080	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

current $sp ☑ Hexadecimal Addresses ☑ Hexadecimal Values □ ASCII

Mars Messages | Run I/O

```
Reset: reset completed.
```

Name	Number	Value
$zero	0	0x00000000
$at	1	0x0000000c
$v0	2	0x00000000
$v1	3	0x00000000
$a0	4	0x00000000
$a1	5	0x00000000
$a2	6	0x00000000
$a3	7	0x00000000
$t0	8	0x00000000
$t1	9	0x00000000
$t2	10	0x00000000
$t3	11	0x00000000
$t4	12	0x00000000
$t5	13	0x00000000
$t6	14	0x00000000
$t7	15	0x00000000
$s0	16	0x00000000
$s1	17	0x01000080
$s2	18	0xffffffff
$s3	19	0x80000001
$s4	20	0x00000000
$s5	21	0x00000000
$s6	22	0x00000000
$s7	23	0x00000000
$t8	24	0x00000000
$t9	25	0x00000000
$k0	26	0x00000000
$k1	27	0x00000000
$gp	28	0x10008000
$sp	29	0x7fffefe4
$fp	30	0x00000000
$ra	31	0x00000000
pc		0x00400038
hi		0x00000000
lo		0x00000000

2.1. [5 points] What is the signed decimal value of the integer on top of the stack.? 0x800000001 = -2^31+1

2.2 [5 points] What is the value stored in stack pointer register? 0x7FFFEFE4

2.3.1 [2.5 points] Compute the address of an integer stored on the stack at offset +12 from the stack pointer.
7FFFEFE4 + C(12) = 7FFFEFF0

2.3.2 [2.5 points] What is the signed decimal value of the integer at this location? -1
2.4.1 [~~2.5 points~~] Compute the address of an integer stored on the stack at offset **+20** from the stack pointer. 0 points
7FFFEFE4 + 1C(20) = 7FFFF000

2.4.2 [~~2.5 points~~] What is the signed decimal value of the integer at this location? 0 0 points

2.5[~~5 points~~] Can you determine the address of the instruction that will be executed next step? If yes, please write it down.
0x7FFFEFE8 (you add +4 from SP) 0 points

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Question 3. (35 points) 29.5/37

You are using MS Visual Studio development environment. The processor is Intel i7.
In DEBUG mode you display REGISTER, DISASSEMBLY, and MEMORY windows.
Please answer the following questions based on the information displayed in the DEBUG mode windows.

1. *(1 points)* What is the content (what number is stored in EBP) of the base pointer register EBP? 1 point

EBP = 0x006CF9E4

2. *(1 points)* Can you specify the Memory window # where partial ***Stack Frame*** is displayed? If YES , please YES and give the window #. Yes, Memory window #3 1 point If **No,** Please write NO.
3. *(10 points)* Based on the information shown in the screenshots, can you determine if variable ***m*** is static or [✓ local]? Please circle around your choice word. If it is possible, to answer questions 7.5 points

   3.1. What is the offset from base pointer to local variable ***m*** on the stack?

   D4

   3.2. Please list all absolute addresses to the **offsets of** variable ***m*** as used in instructions the program: 0 points

   3.3 What is the address of local variable ***m*** on stack? 0x006CF9B8

   3.4 What is the signed value (in DECIMAL) of local variable ***m*** as you can observe on ***Stack Frame***? -2 (ran out of time)
4. *(10 points)* Based on the information shown in the screenshots, can you determine if variable ***quizint*** is static or [✓ local]? Please circle around your choice word. 7.5 points

   4.1. What is the offset from base pointer to local variable ***quizint*** on the stack? F8

   4.2. Please list all absolute addresses to the offsets of variable ***quizint*** as used in the program: 0 points

   4.3. What is the address of local variable ***quizint*** on stack? 0x006CF9DC

   4.4. What is the signed value (in DECIMAL) of local variable ***quizint*** as you can observe in ***Stack Frame***? 0 points
5. *(10 points)*Based on the information shown in the screenshots, can you determine if variable ***MIPSInt*** is static or [✓ local]? Please circle around your choice word. 7.5 points

   5.1. What is the offset from base pointer to local variable ***MIPSInt*** on the stack? E0

   5.2. Please list all absolute addresses to the offsets of variable ***MIPSInt*** as used in the program:

   5.3. What is the address of local variable ***MIPSInt*** on stack? 0x006CF9C4

   5.4. What is the signed value (in DECIMAL) of local variable ***MIPSInt*** as you can observe in ***Stack Frame***?

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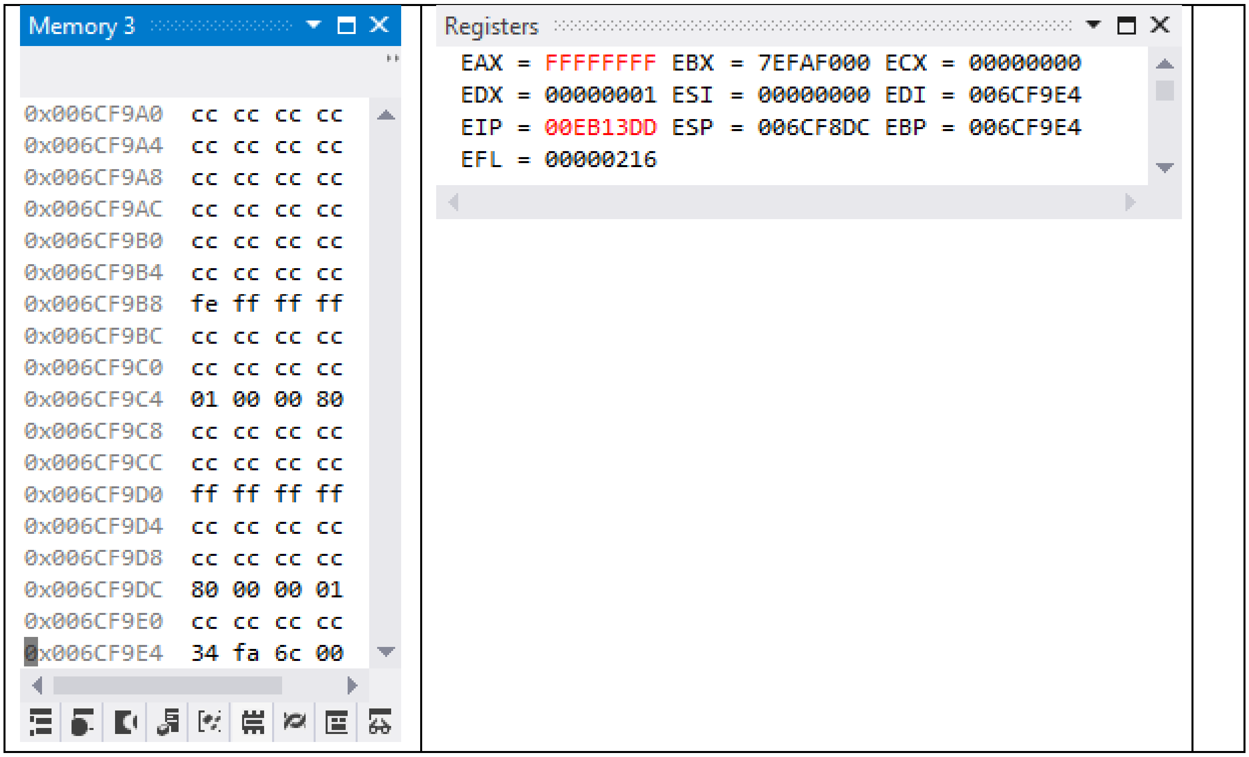
6. *(1 points)* Can you determine the address of the instruction that will be executed next instance?
   EIP = 00EB13DD

7. *(1 points)* What is the assembly code length in bytes?
   Address of last instruction – address of first instruction:
   0x00EB13EB – 0x00EB13A0 = 1D6278B
8. *(1 points)* Can you determine the number of instruction of length 7 bytes? If yes, What is it? 4
9. *(1 points)* Can you determine the number of instruction of length 6 bytes? If yes, What is it? 2
10. *(1 points)* Can you determine the number of instruction of length 5 bytes? If yes, What is it? 2

Question 3. (cont'd)



```
0x006CF9A0  cc cc cc cc
0x006CF9A4  cc cc cc cc
0x006CF9A8  cc cc cc cc
0x006CF9AC  cc cc cc cc
0x006CF9B0  cc cc cc cc
0x006CF9B4  cc cc cc cc
0x006CF9B8  fe ff ff ff
0x006CF9BC  cc cc cc cc
0x006CF9C0  cc cc cc cc
0x006CF9C4  01 00 00 80
0x006CF9C8  cc cc cc cc
0x006CF9CC  cc cc cc cc
0x006CF9D0  ff ff ff ff
0x006CF9D4  cc cc cc cc
0x006CF9D8  cc cc cc cc
0x006CF9DC  80 00 00 01
0x006CF9E0  cc cc cc cc
0x006CF9E4  34 fa 6c 00
```

```
EAX = FFFFFFFF EBX = 7EFAF000 ECX = 00000000
EDX = 00000001 ESI = 00000000 EDI = 006CF9E4
EIP = 00EB13DD ESP = 006CF8DC EBP = 006CF9E4
EFL = 00000216
```

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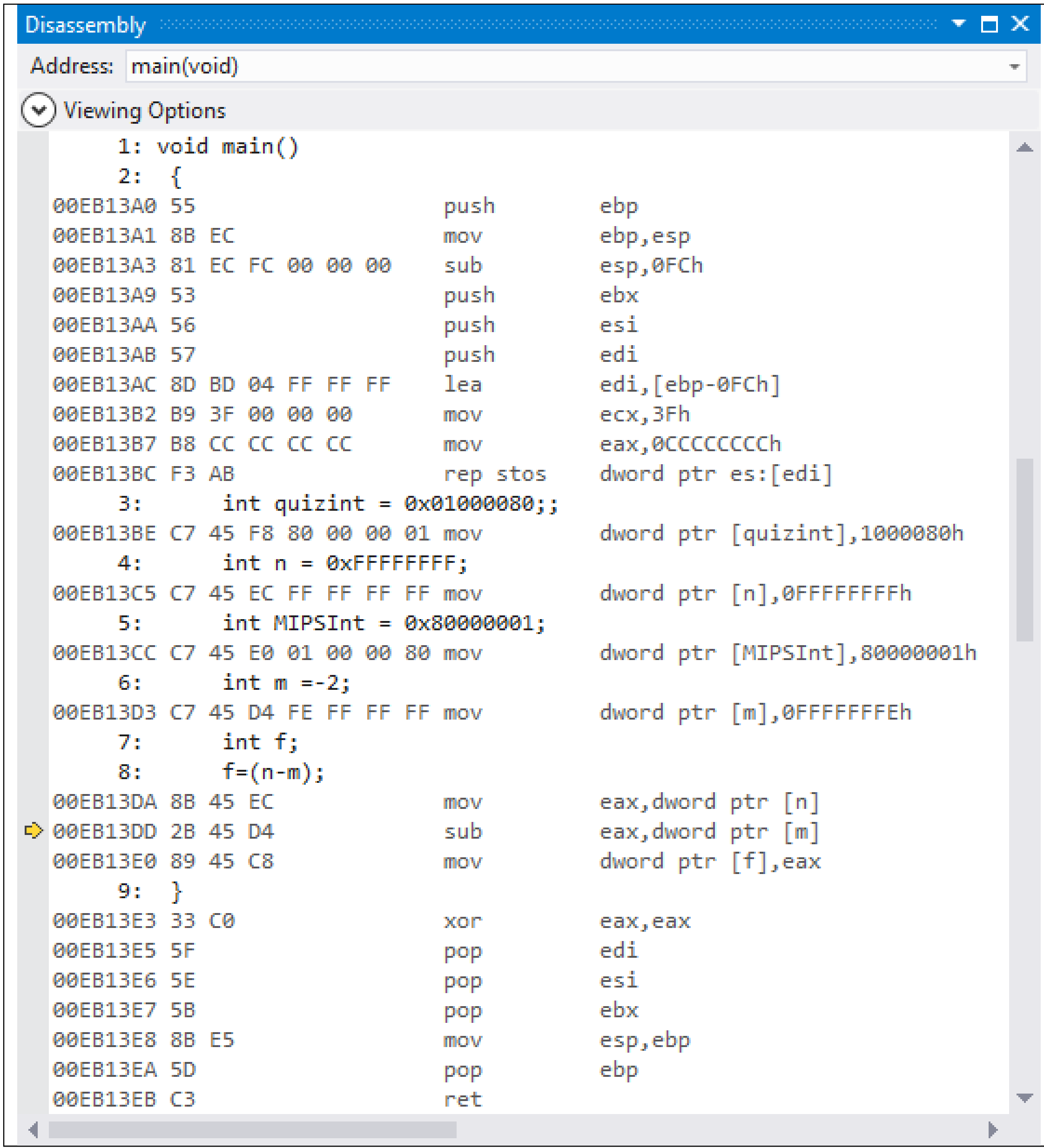
Question 3. (cont'd)



```
     1: void main()
     2:  {
 00EB13A0 55                   push        ebp
 00EB13A1 8B EC                mov         ebp,esp
 00EB13A3 81 EC FC 00 00 00    sub         esp,0FCh
 00EB13A9 53                   push        ebx
 00EB13AA 56                   push        esi
 00EB13AB 57                   push        edi
 00EB13AC 8D BD 04 FF FF FF    lea         edi,[ebp-0FCh]
 00EB13B2 B9 3F 00 00 00       mov         ecx,3Fh
 00EB13B7 B8 CC CC CC CC       mov         eax,0CCCCCCCCh
 00EB13BC F3 AB                rep stos    dword ptr es:[edi]
     3:         int quizint = 0x01000080;;
 00EB13BE C7 45 F8 80 00 00 01 mov         dword ptr [quizint],1000080h
     4:         int n = 0xFFFFFFFF;
 00EB13C5 C7 45 EC FF FF FF FF mov         dword ptr [n],0FFFFFFFFh
     5:         int MIPSInt = 0x80000001;
 00EB13CC C7 45 E0 01 00 00 80 mov         dword ptr [MIPSInt],80000001h
     6:         int m =-2;
 00EB13D3 C7 45 D4 FE FF FF FF mov         dword ptr [m],0FFFFFFFEh
     7:         int f;
     8:         f=(n-m);
 00EB13DA 8B 45 EC             mov         eax,dword ptr [n]
⇨00EB13DD 2B 45 D4             sub         eax,dword ptr [m]
 00EB13E0 89 45 C8             mov         dword ptr [f],eax
     9:  }
 00EB13E3 33 C0                xor         eax,eax
 00EB13E5 5F                   pop         edi
 00EB13E6 5E                   pop         esi
 00EB13E7 5B                   pop         ebx
 00EB13E8 8B E5                mov         esp,ebp
 00EB13EA 5D                   pop         ebp
 00EB13EB C3                   ret
```

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In EACH Questions 4.1-4.2 you are given SIGNED Integers stored in 16 BIT Registers. If there is an overflow, please indicate. ***10/10***

4.1 [5 points] What is the result (hexadecimal, decimal and binary) of the following subtraction:

```
1       … borrow

0x7FFF              32767              0111 1111 1111 1111
-
0xFFFF                   -1            1111 1111 1111 1111
```

HEX: 08000 (overflow)   Decimal: 8*16^3 = 32768   Binary: 1000 0000 0000 0000

4.2 [5 points] What is the result (hexadecimal, decimal and binary) of the following addition:

```
   111 … carry
0x7FFF              32767              0111 1111 1111 1111
+
0xFFFF                   -1            1111 1111 1111 1111
```

HEX: 17FFE   Decimal: 32766   Binary 1 0111 1111 1111 1110