

CSC231 - Assembly

Week #4

Dominique Thiébaud
dthiebaut@smith.edu

Exercise

```
a      section .data
      db      10
b      db      0
c      dw     0x1234
d      dw     0
e      dd     0
f      dd     0x12345678

      section .text
```

Swap a and b.
Then c and d.
Then e and f.



*typical
midterm
question!*

Exercise

```
a      section .data
b      db      10
c      db      0
d      dw      0x1234
e      dw      0
f      dd      0xcdef
       dd      0x12345678

       section .text
```

Set the least significant byte of **e** and **f** to 00.



*typical
midterm
question!*

Exercise

a
b
c
d
e
f

```
section .data
```

```
db
```

```
db
```

```
dw
```

```
dw
```

```
dd
```

```
db
```

```
section .text
```

99

88

77

66

55

44

33

22

1f

1a

11

00

hex

reconstruct
the declarations
of a, b, c, d, e
and f.



a

typical
midterm
question!

Exercise

a
b
c
d
e
f

section .data

db

db

dw

dw

dd

db

section .text

99
88
77
66
55
44
33
22
31
26
11
00

dec

reconstruct
the declarations
of a, b, c, d, e
and f.



*typical
midterm
question!*

a

Follow a step
by step execution
of a program

```

8
9
10 00000000 03000000      a      dd  3
11 00000004 05000000      b      dd  5
12 00000008 00000000      sum     dd  0
13
14      ;;;
15      ;;; code area
16      ;;;
17
18      section .text
19      global  _start

20 00000000 A1[00000000]      _start: mov  eax, dword[a]      ;eax <-- a
21 00000005 0305[04000000]      add  eax, dword[b]      ;eax <-- eax+b = a+b
22 0000000B 83E801      sub  eax, 1      ;eax <-- eax-1 = a+b-1
23 0000000E A3[08000000]      mov  dword[sum], eax      ;sum <-- eax = a+b-1

24      ;;; exit()
25 00000013 B801000000      mov   eax,1
26 00000018 BB00000000      mov   ebx,0
27 0000001D CD80      int   0x80      ; final system call

```

```
a      dd  3
b      dd  5
sum    dd  0

100 mov  eax, dword[a]
105 add  eax, dword[b]
10A sub  eax, 1
10E mov  dword[sum], eax
```

eax

ebx

ecx

edx

eip

Tick!

```
a      dd  3
b      dd  5
sum    dd  0

100 mov  eax, dword[a]
105 add  eax, dword[b]
10A sub  eax, 1
10E mov  dword[sum], eax
```

```
a      dd  3
b      dd  5
sum    dd  0

100 mov  eax, dword[a]
105 add  eax, dword[b]
10A sub  eax, 1
10E mov  dword[sum], eax
```

eax

ebx

ecx

edx

eip

eax

ebx

ecx

edx

eip

Tick!

```
a      dd      3
b      dd      5
sum    dd      0

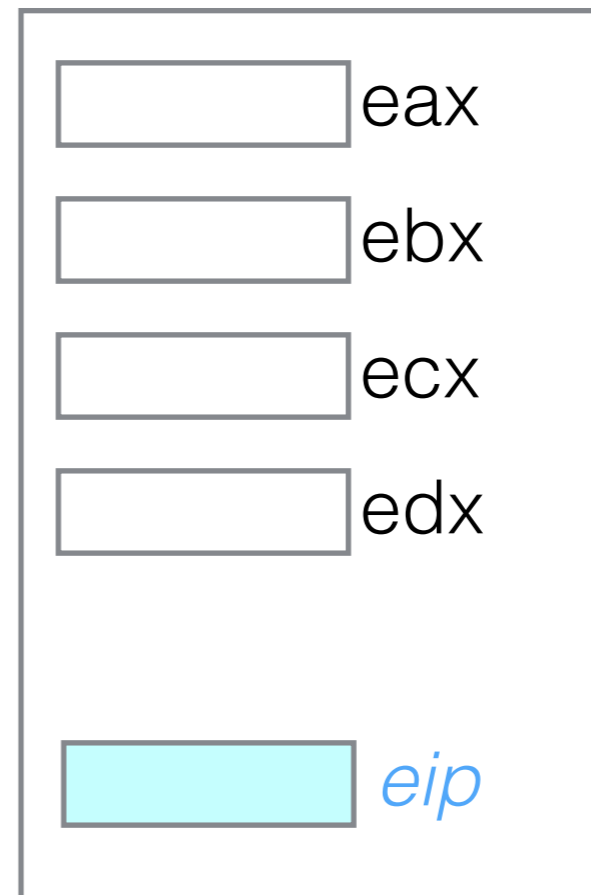
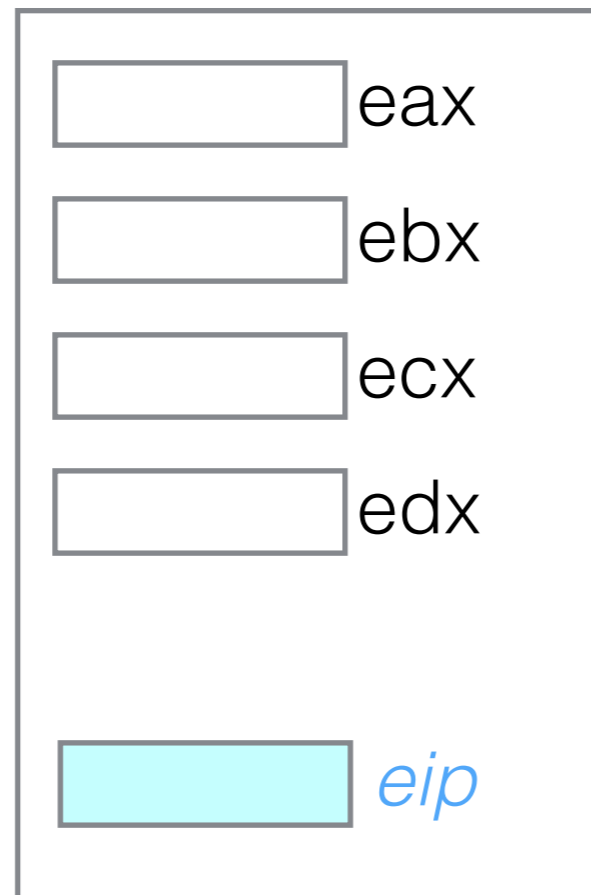
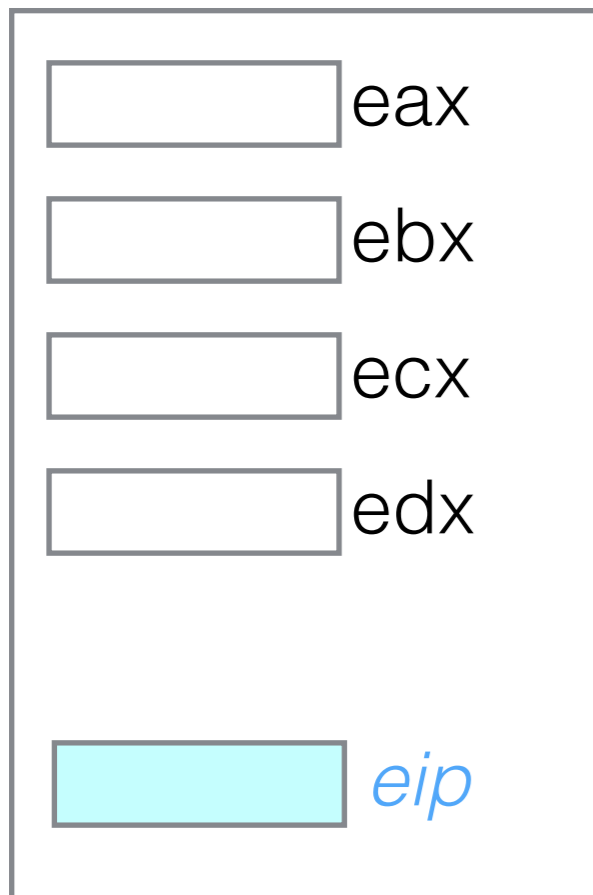
100 mov  eax, dword[a]
105 add  eax, dword[b]
10A sub  eax, 1
10E mov  dword[sum], eax
```

```
a      dd      3
b      dd      5
sum    dd      0

100 mov  eax, dword[a]
105 add  eax, dword[b]
10A sub  eax, 1
10E mov  dword[sum], eax
```

```
a      dd      3
b      dd      5
sum    dd      0

100 mov  eax, dword[a]
105 add  eax, dword[b]
10A sub  eax, 1
10E mov  dword[sum], eax
```



Tick!

```
a      dd      3
b      dd      5
sum    dd      0

100 mov  eax, dword[a]
105 add  eax, dword[b]
10A sub  eax, 1
10E mov  dword[sum], eax
```

```
a      dd      3
b      dd      5
sum    dd      0

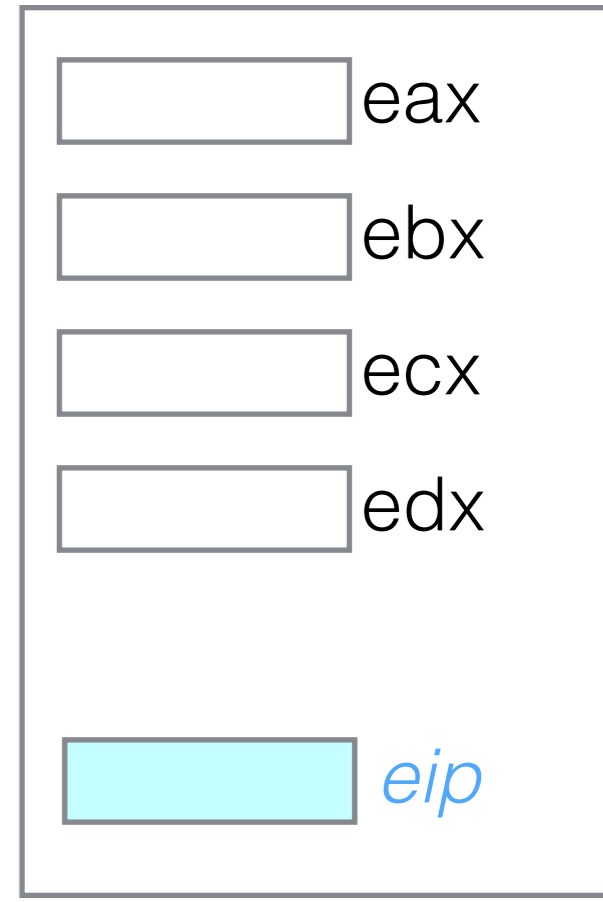
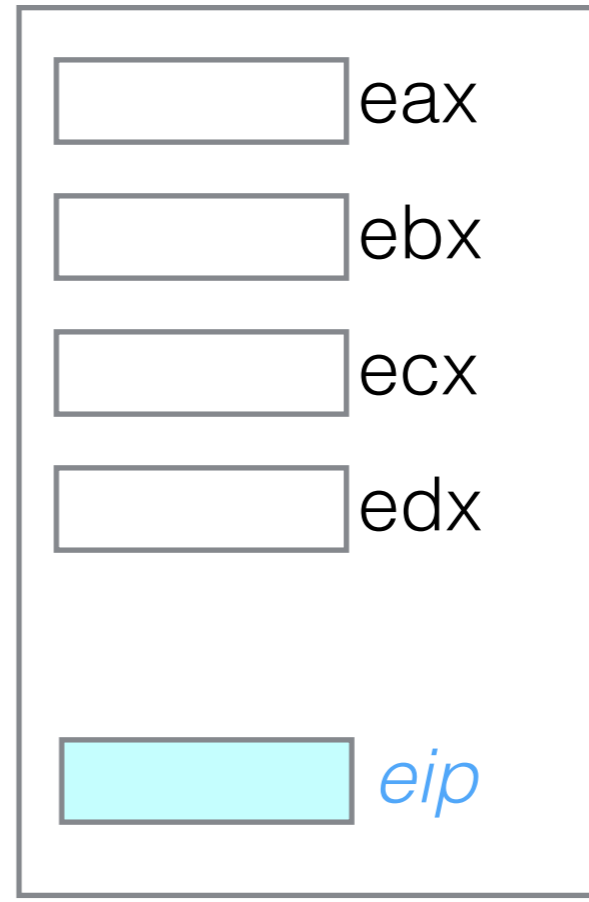
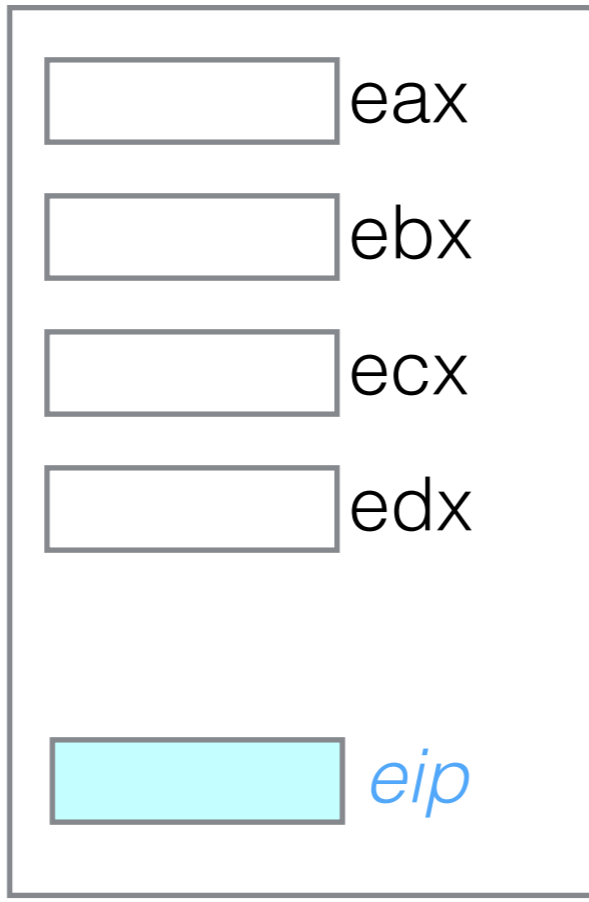
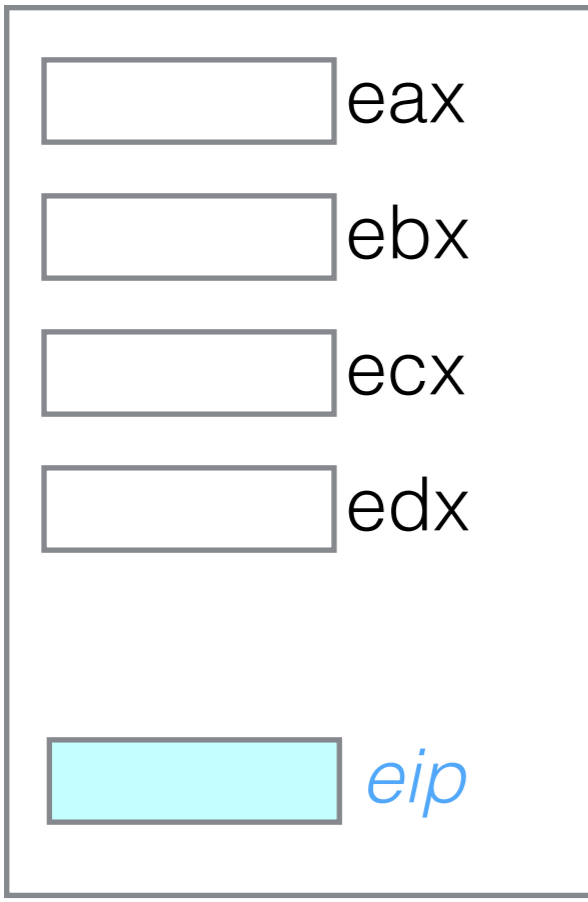
100 mov  eax, dword[a]
105 add  eax, dword[b]
10A sub  eax, 1
10E mov  dword[sum], eax
```

```
a      dd      3
b      dd      5
sum    dd      0

100 mov  eax, dword[a]
105 add  eax, dword[b]
10A sub  eax, 1
10E mov  dword[sum], eax
```

```
a      dd      3
b      dd      5
sum    dd      0

100 mov  eax, dword[a]
105 add  eax, dword[b]
10A sub  eax, 1
10E mov  dword[sum], eax
```



Streamlined manageability.

Available with Windows 10 Pro. Free your workspace from clutter with the OptiPlex 3030 All-in-One desktop featuring an optional touch screen for easy navigation without a mouse.

Starting at \$669⁰⁰

★ [Get up to \\$33 back](#) in rewards

Save



Like 15 + 15

Configurations

Features & Design

Drivers, Manual

Processor

Help Me Choose

OptiPlex

Intel® Pentium® G3250 Processor (Dual Core, 3MB, 3.20GHz w/HD Graphics)

▶ 2 Specifications

Frequency: 3.2 GHz

cycle: $1/3.2 \text{ GHz}$
 $= 0.3125 \text{ ns}$

sec

ms

us

ns

Arduino



Clock speed: **16 MHz**

~1/200 speed of
Pentium

```
;hello.asm
; turns on an LED which is connected to PB5 (digital out 13)

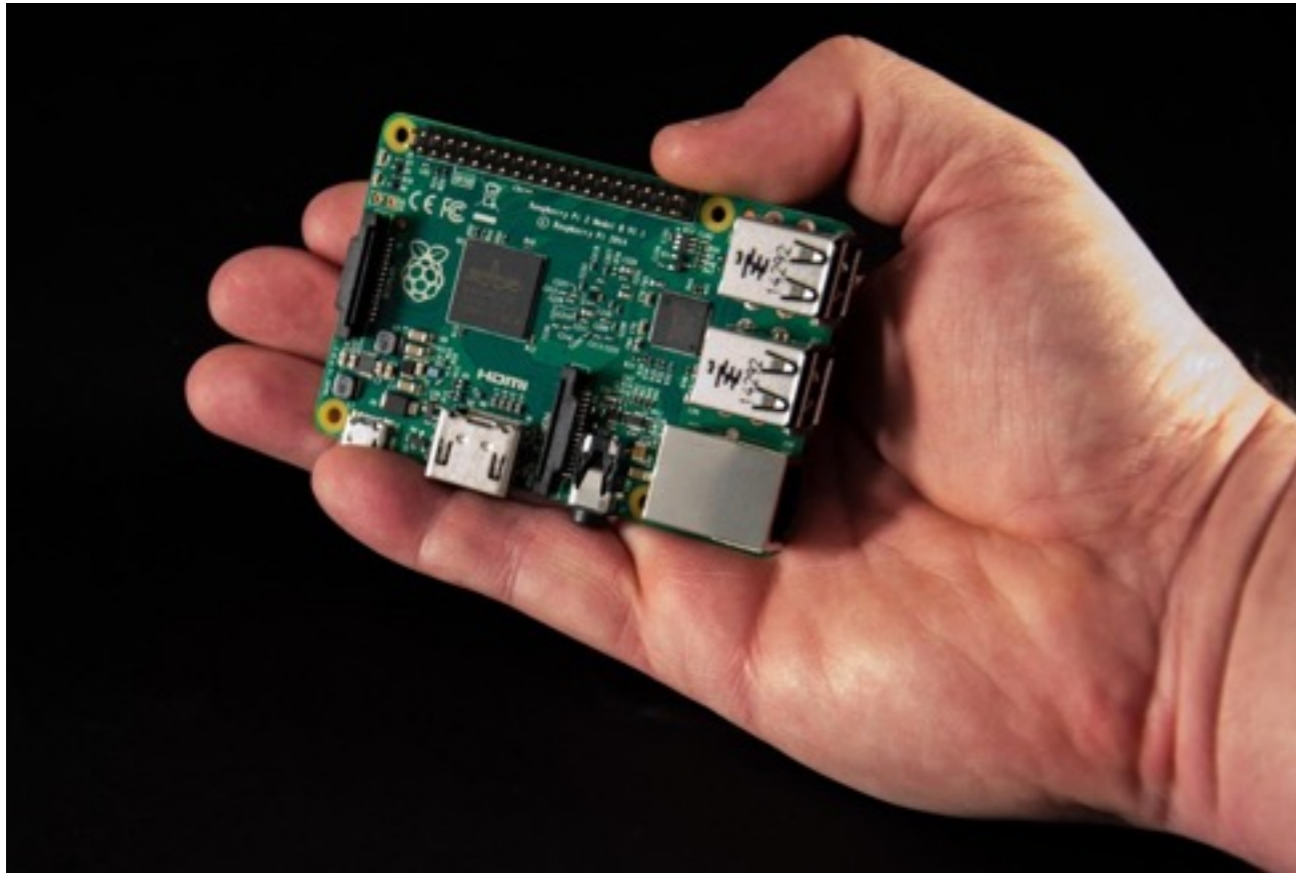
.include "m328Pdef.inc"

    ldi r16,0b00100000
    out DDRB,r16
    out PortB,r16
Start:
    rjmp Start
```



http://www.science.smith.edu/dftwiki/index.php/Comparing_Different_Computers_with_N_Queens_Program

Raspberry Pi



Clock speed: **1.2 GHz**

~1/3 speed of Pentium

```
/* -- first.s */
/* This is a comment */
.global main /* 'main' is our entry point and must be global */

main:          /* This is main */
    mov r0, #2 /* Put a 2 inside the register r0 */
    bx lr      /* Return from main */
```



http://www.science.smith.edu/dftwiki/index.php/Comparing_Different_Computers_with_N_Queens_Program

NUMBER SYSTEMS

Decimal

- Number of digits, the base
- Count in decimal
- Express number as sum of products
- Add two digits
- Add two numbers

Binary

- Number of digits, the base
- Count in binary
- Express number as sum of products
- Add two digits
- Add two numbers

Base 3

- Number of digits, the base
- Count in base 3
- Express number as sum of products
- Add two digits
- Add two numbers

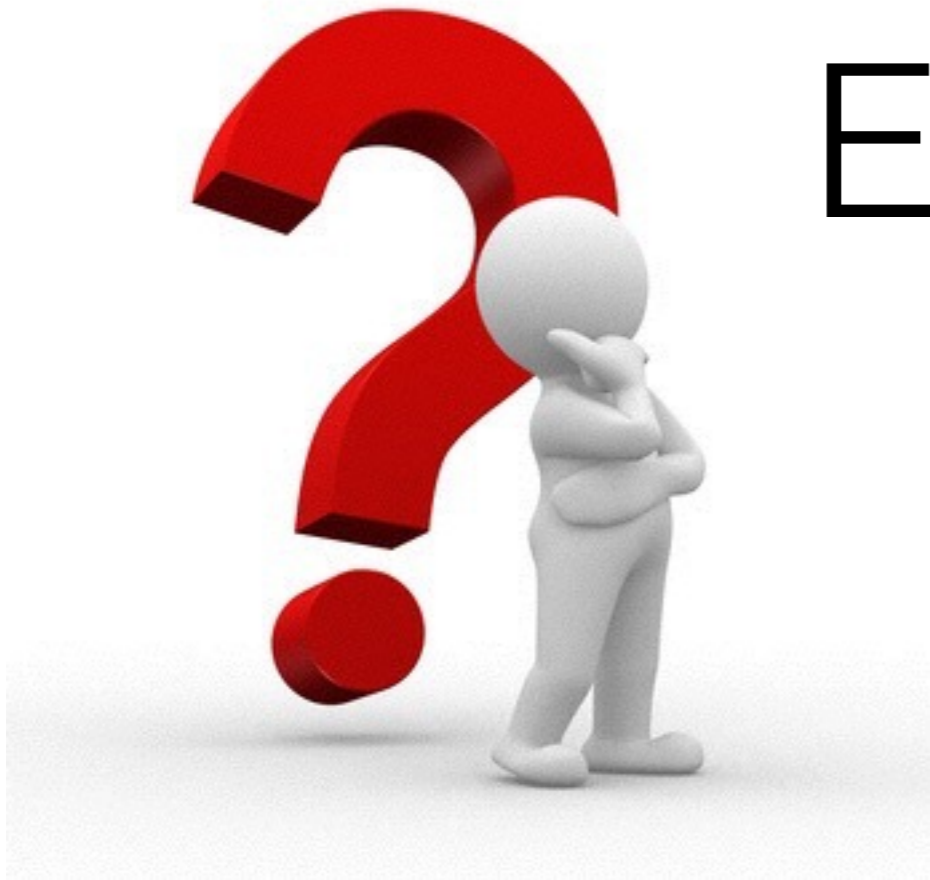
Hexadecimal

- Number of digits, the base
- Count in hex
- Express number as sum of products
- Add two digits
- Add two numbers

Conversion

- binary to decimal
- decimal to binary
- binary to hex
- hex to binary
- decimal to hex
- hex to decimal

Exercises



[http://www.science.smith.edu/dftwiki/index.php/
CSC231_Review_of_hexadecimal_number_system](http://www.science.smith.edu/dftwiki/index.php/CSC231_Review_of_hexadecimal_number_system)