**CSCI 360 Number Types and Decimal Numbers**

**There are three ways to store numbers on the mainframe. They are:**

1. Binary
2. Zoned Decimal
3. Packed Decimal

We have already seen how binary numbers look in storage. Let now look at the other types.

**There are two formats for decimal numbers:**

1. Zoned Decimal
2. Packed Decimal

**Zoned Decimal Numbers**

- Generally used for input/output

- Represent one decimal digit per byte

- Each byte of is made up of two hex digits

left -> zone digit right -> numeric digit

- The numeric digit is the number represented by the byte

- The zone digit of all but the RIGHTMOST byte must be F

- The zone digit of the rightmost byte is used to indicate the sign

of the number

F, A, C, or E positive number (just remember the word "FACE")

B or D negative number

F1F2F3F4 zoned decimal representation of +1234

F1F2F3B4 zoned decimal representation of -1234

- Can be generated on a DC statement by using a storage class of Z

- the initial value can contain a sign or a decimal point

- if the sign is omitted, assumed to be positive

- if plus sign is specified, rightmost zone digit is C

- if negative sign is specified, rightmost zone digit is D

- if a decimal point is specified, treated as an implied

decimal point

DC 2Z'-1' D1D1

DC Z'+2' C2

DC Z'2' C2

DC ZL3'4' F0F0C4

DC 2ZL2'-9' F0D9F0D9

DC Z'1.10' F1F1C0

- Maximum zoned decimal number can have 16 digits

**Packed Decimal Numbers**

- Used for arithmetic

- Each byte, except for the rightmost, represents two decimal digits

- The rightmost byte contains a decimal digit and the sign digit

left -> numeric digit right -> sign digit

- The sign digit is used to indicate the sign of the number

F, A, C, or E positive number

B or D negative number

- To represent a number:

1. Move the sign to the right (end) of the number

2. If there is an even number of digits, add a zero on the left

3. Change the sign to an appropriate sign digit

To represent -1234:

1. 1234-

2. 01234-

3. 01 23 4D

- Can be generated on a DC statement by using a storage class of P

- the initial value can contain a sign or a decimal point

- if the sign is omitted, assumed to be positive

- if plus sign is specified, rightmost sign digit is C

- if negative sign is specified, rightmost sign digit is D

- if a decimal point is specified, treated as an implied

decimal point

DC 2P'-1' 1D1D

DC P'+2' 2C

DC P'2' 2C

DC PL3'4' 00004C

DC 2PL2'-9' 009D009D

DC P'1.10' 110C

- Maximum packed decimal number can have 31 digits