

EE 3724 Test #4 Solutions - Spring '01– Reese

- (5 pts) Convert the following number in single precision floating point format to its decimal value (no exponents allowed in the final decimal value).

Sign bit: 1

Exponent field: 01111110

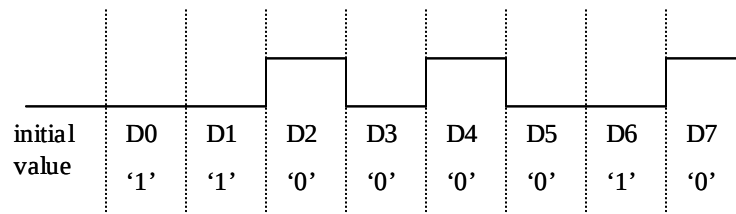
Significand Field: 0100 00000000

Exponent = Exp. Field - 127 = 7Eh - 127 = 126 - 127 = -1

Sign is negative, number = - 1. 0100 * 2^{-1} = -0.101 = - (0.5+0.125) = -0.625

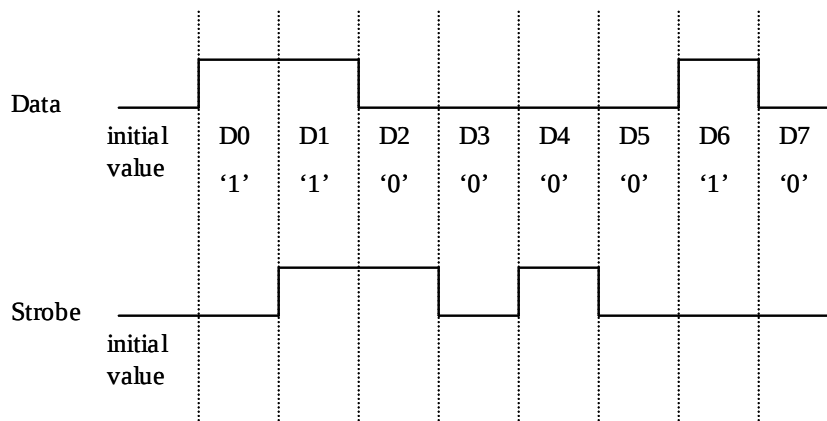
- (5 pts) Draw the waveform for sending an 8 bit value of 43h using **NRZI** encoding. Assume the initial value of the waveform signal is a low voltage.

43h = 01000011 Send LSB first, NRZI encoding



- (5 pts) Draw the waveform for sending an 8 bit value of 43h using **DATA STROBE** encoding. Assume the initial values of both data and strobe are both low voltage. Show the signaling for the 8-data bits only (no framing bits such as start/stop)..

43h = 01000011 Send LSB first



4. (4 pts) For each pair of items, circle the one that would more likely be found in high bandwidth bus:

multiplexed address/data vs. **non-multiplexed address/data**

limited swing voltage signaling vs. full swing (gnd to power rail) signaling

asynchronous data transfer vs. **synchronous transfer**

narrow data width vs. **wide data width**

5. (5 pts) In a peripheral bus, what can be used to limit common mode noise?

Differential data signaling is used to reject common noise.

6. (6 pts) Define latency and throughput.

*Latency is the time from when the operation is started to when the operation is finished.
Throughput is number of operations per unit time. For fixed bandwidth, if throughput is increased, then latency is increased.*

7. (6 pts) What pair of lines must go to every device on a bus if a central arbitration scheme is used to support multiple bus mastering?.

Bus Grant and Bus Request

8. (6 pts) What three pieces of information are needed in a fixed disk to locate a piece of data?

Cylinder, track, sector

9. (5 pts) Convert the number -2.0 to single precision floating point format:

Sign bit: -1

Exponent field: 10000000 (8 bits)

Significand field: 0000...00000 (23 bits)

$$-2.0 = -10.0 \text{ (binary)} = -1.0 * 2^1$$

$$\text{Exponent} = 1 + 127 = 128 = 10000000$$

Significand is all zeros because everything to the right of the decimal point is zero.

10. (4 pts) How do you compute the number of horizontal lines in a raster display?

Horizontal Sync/Vertical Sync

11. (4 pts) In the IEEE floating point format, what field do I add bits to if I want to extend the precision of a floating point number?

Significand

12. (5 pts) The USB signaling protocol is called a synchronous protocol but there is no clock signal in the cable. How does USB maintain data synchronization?

NRZI encoding ensures a transition for every '0' bit. Bit stuffing is used to ensure that there are enough transitions in the signal waveform within a fixed time period in order to maintain clock synchronization (for every six consecutive '1' bits, stuff in a '0' bit).

13. (20 pts) Write a subroutine that will count the number of WORDS in a string. A word is any set of ASCII characters separated by ONE OR MORE 'space' characters (a space character has the ASCII value of 20h). You can assume the strings only have letters or spaces in them. The string is terminated by a zero byte (00h) and the starting address of the string is passed in BX. Return the number of words in the string in register 'AX' (you can assume there is less than 65535 words in the string). Example: " A lazy person am I" has 5 words. The first letter of the string can be a space or the end of the string.

```
wdcnt      proc
            xor    ax, ax
lp1:        mov    cl, [bx]      ;space loop
            cmp    cl, 0
            je     exit
            inc    bx
            cmp    cl, 20h
            je     lp1          ;loop while a space
            inc    ax            ; found a letter, inc word cnt
lp2:        mov    cl, [bx]      ;letter loop
            cmp    cl, 0
            je     exit
            inc    bx
            cmp    cl, 20h
            jne    lp2          ;loop while a letter
            jmp    lp1

exit:       ret
```

14.

(20 pts) Write a subroutine called SIGNED_SATADD that will do a signed 8-bit saturated addition of the values passed in AH, AL with the result passed back in AL:

AL = AH + AL (signed 8-bit saturating addition).

If an overflow occurs during the addition, then the number has to be clamped to the maximum negative or maximum positive 8 bit value. The jump instruction 'jo' (jump on overflow) may prove useful.

```
satadd    proc
          add  al,ah          ;result in al
          jo   dosat
          ret

dosat:
          test ah, 080h       ; see if negative
          je   oper_pos
          mov  al, 80h        ;saturate to max negative
          ret

oper_pos: mov  al, 07fh       ;saturate to max positive
          ret

satadd    endp
```