Department of Electrical and Computer Engineering

Computer Engineering

Course ECSE-322B

Problem Set 7

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1. Two computers are to be connected together via a serial link. There are two possible choices for the protocol to be used for communication; either full RS232 or the use of Start and Stop bits.

(a) Explain the advantages and disadvantages of each protocol

(b) If the user chose a Start/Stop bit protocol with 7 bits of data, no parity and 2 stop bits, what percentage of the transmission time would be taken up in the protocol?

(c) Given your answers to parts (a) and (b), which protocol would you recommend if the intention was to use the link to move large volumes of data continuously?

(d) Would you make the same recommendations if the link was to be used occasionally so that one computer could access a printer connected to the other computer? Give your reasons for this decision.

2. What is the basic difference between an interrupt priority established via a polled interrupt system and that created by a vectored interrupt system? Which of the two is likely to be more efficient and why?

3. Design the basic circuit for a daisy chained Interrupt Acknowledge circuit, i.e. the intention is that the Interrupt Acknowledge signal should be blocked by a device which has interrupted and is waiting for service, but should be passed on by any devices which have not interrupted.

4. A low-speed I/O device provides (on average) one byte of information every second. The device is scanned by the CPU regularly every 50 ms (programmed I/O). Some analysis indicates that each time the CPU scans the device it consumes about 20 microseconds of its time. Calculate the improvement ratio (in terms of CPU time) if we equip the I/O device with interrupt

capability. Assume the interrupt service routine and associated overheads amount to 40 microseconds.

5. An asynchronous serial communication controller (SCC) is programmed for a character length of seven bits, odd parity, and one stop bit. The transmission rate is 1200b/s.

(a) Illustrate the overall character format (including start and stop bits).

(b) Up to how many characters can be transmitted per second?

(c) The system is designed such that the SCC causes an interrupt whenever ready to accept or deliver another character. At what rate will the CPU be interrupted if we communicate in full duplex mode?

(d) Our system exchanges with some other system two 64-character-long blocks per second (on the average). The servicing of an SCC interrupt takes a total of about 83 microseconds. Determine (on a percent basis) what fraction of CPU time is consumed for serial I/O

6. How many characters per second can be transmitted over a 1200 baud line in each of the following modes? (Assume a character code of 8 bits)

(a) Synchronous serial transmission
(b) Asynchronous serial transmission with two stop bits
(c) Asynchronous serial transmission with one stop bit.

What is the difference between synchronous and asynchronous serial transfer of information?

7. A TV monitor has a vertical scanning rate of 70 Hz. The vertical and horizontal blanking intervals are 0.5 milliseconds and 3 microseconds, respectively. The dot clock is set at 68.5 Mhz and the horizontal scanning rate is 55.7 Khz.

(a) What is the resolution of this monitor? (i.e. how many dots horizontally by how many vertically)

(b) What fraction of the frame time is actually used for displaying visible dots?

8. A TV monitor has a 60Hz frame refresh rate and a horizontal scanning frequency of 33720 Hz.

(a) Up to how many scan lines could it possibly provide per frame?

(b) Suppose we use this monitor in an application requiring a resolution of 512 by 512. How many scan lines correspond to the vertical blanking interval? What is the duration of this interval?

(c) How long is the usable portion of a scan line (in terms of time) given that we waste only 4 microseconds for horizontal blanking?

(d) What would the dot clock frequency be?

9. Consider an alphanumeric CRT display employing a 7 x 9 character font and a 9 x 12 character block. The display format is 80 x 24. The vertical and horizontal scanning rates are 60 and 18000 Hz, respectively.

(a) How many usable scan lines do we need?

(b) Usually, the horizontal blanking time is chosen to be an integral number of periods of the character clock. Here we assume it corresponds to 20 periods of the character clock. Determine the length of the usable portion of a scan line (in terms of time).

(c) What is the frequency of the character clock?

(d) What is the frequency of the dot clock?

(e) The vertical; blanking interval is itself chosen to be an integral number of scan line periods. Verify that this is indeed true. What would you vary slightly if it was not?