Department of Electrical and Computer Engineering

Course ECSE-322 Computer Engineering

Problem Set 4 Solutions

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1. *Name 5 components (capabilities) that should be present in any information processing system*

   Any information processing system (or computer system) has to be able to:

   a. Acquire data
   b. Transmit data
   c. Manipulate data
   d. Store data
   e. Output data

   These capabilities are usually implemented as components within the system.

2. *In a simple communications system, describe how the reliable transmission of information can take place.*

   Reliable transmission of information implies that the receiver gets what the transmitter sent. The first step is to make sure that the receiver (and the transmitter) is identified. The receiver is the destination for the information. The next step is that the information is encoded into a form that can be transmitted and the form of the encoding may well depend on the communications medium chosen. Thus writing may be used if the transmission medium is paper; electrical signal might be used if the system uses electrical circuits. Both ends of the system (the receiver and transmitter) have to agree on the channel being used and the encoding applied. The rate at which data is provided may well

be important – if data arrives at a receiver faster than it can be handled (either stored or manipulated) then information may be lost. There has to be an agreed upon identifier for the beginning of a message so that the receiver is aware that a message is coming; and there needs to be a well defined end. Finally, depending on the type of communications system, the transmitter needs to be able to control the communications medium. For example, in a lecture, the lecturer needs control over the audio channel. To ensure that the information received was that sent, there may also be a need to send it back so that the receiver can see any errors that might have occurred in the round trip.

3. *What is the difference between an "open-loop" and a "closed-loop" communications system?*

   In an "open-loop" system, information (data) is transmitted to the receiver and it is assumed that it arrives intact and is stored. The transmitter gets no confirmation from the receiver. In a "closed-loop" system, the receiver informs the transmitter that it has received the message. For total security, the entire message may be returned by the receiver so that the transmitter can look for transmission errors over the round trip.

4. *Describe what is meant by a synchronous system and give an example of such a system that you use every day.*

   A synchronous system is one which uses a clock to control events. Thus, for message transmission, both the transmitter and receiver see the same clock signal and agree what operations should take place when. Thus to transmit a message, it might be agreed that messages will be sent during a clock pulse and will start at the beginning of the pulse and finish at the end. Synchronous systems are used for all sorts of daily tasks from leaving the house in the morning to arriving in a particular room at a particular time for a specific lecture. In this case, the synchronizing mechanism is implemented through the global time system, i.e. the way time is specified everywhere in the world.

5. *Explain why an asynchronous system is inherently slower than a synchronous system. What is meant by "overhead"?*

   In an asynchronous system, there is no clock so there is no default method for agreeing on when something should happen. In this case, messages are passed through a sequence of "cause-and-effect" situations, i.e. a signal is sent that a message is coming, the receiver continuously monitors the signal channel and then gets ready to receive the message. When transmission is complete, another signal is sent. In some cases, the start up and termination may be almost conversations – the transmitter inquires as to whether the transmitter is available, the transmitter replies that it is, etc… An everyday example of an

asynchronous communications system might be the telephone network. Because of the set up time for an asynchronous system, it is inherently slower than a synchronous system which has no set up (assuming the same rates for message transmission in both cases). Overhead refers to all the work that needs doing in an asynchronous system to set up the transmission of the message – it is not really part of the message (which is the only bit you actually wanted to transmit), The goal in most asynchronous systems is to try to keep the overhead down to much less than the message.