DATA COMMUNICATION ASSIGNMENT

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QUESTION 1

Give reason why baseband signal cannot be directly transmitted in a wireless system. Explain how FHSS spreads the baseband signal for transmission.

ANSWER

A baseband signal is an original transmission signal that has not been modulated, or has been demodulated to its original frequency. A baseband signal can be transmitted over a pair of wires, coaxial cables, or optical fibers. But a baseband signal cannot be directly transmitted in a wireless system due to 3 main reasons:

(i) Antennas

An antenna must be the order of magnitude of the wavelength signal in size to be effective.

(ii) Frequency Division Multiplexing (FDM)

Using only baseband transmission, FDM could not be applied.

(iii) Medium Characteristics

Path loss, penetration of obstacles, reflection, scattering & diffraction. All the effects depend on the wavelength of a signal.

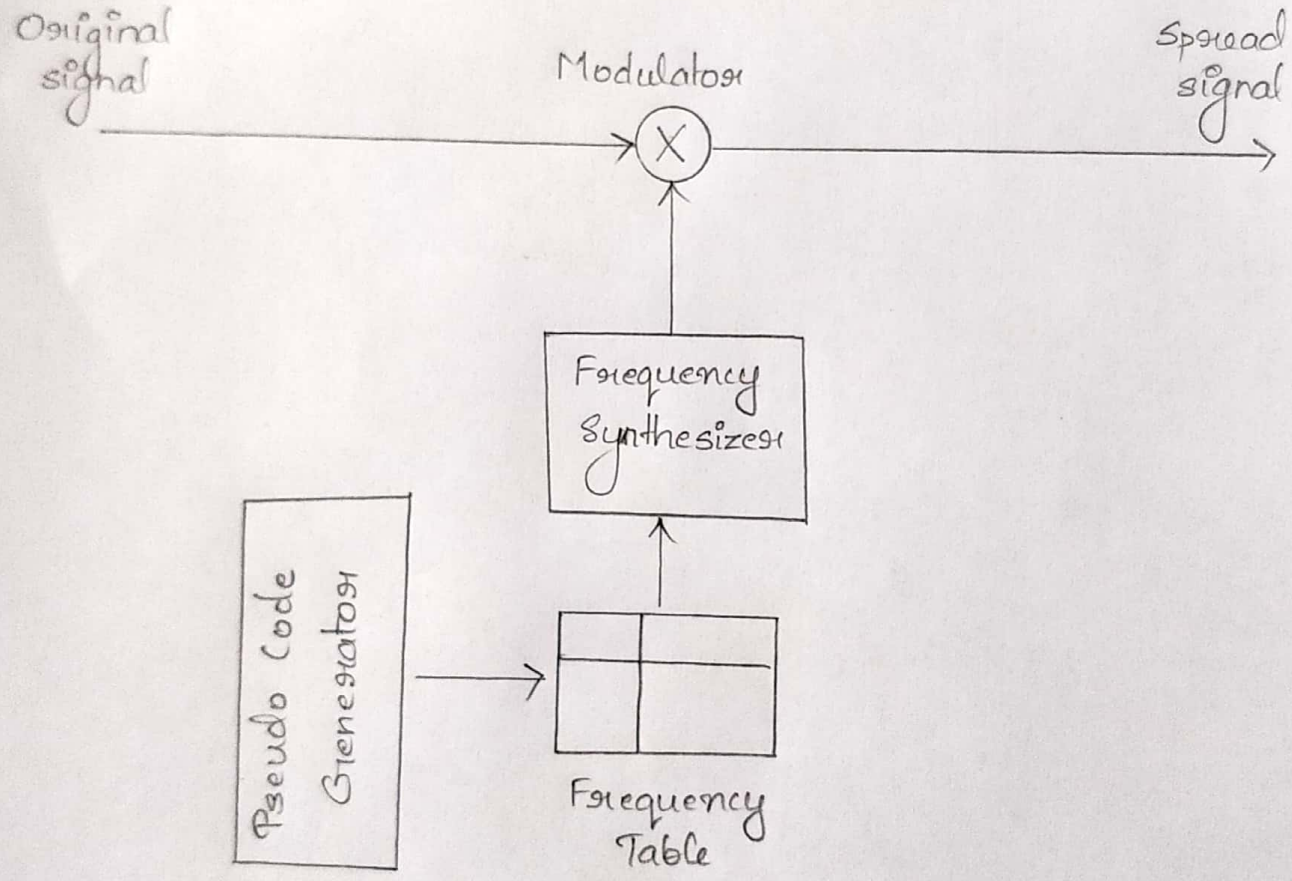
Frequency Hopping Spread Spectrum

In a frequency hopping (FH) system, the frequency is not constant in each time chip; instead it changes from chip to chip.

Frequency hopping systems can be divided into fast-hop or slow-hop. A fast-hop FH system is the kind in which hopping rate is greater than the message bit rate & in the slow-hop system the hopping rate is smaller than the message bit rate. This differentiation

is due to the fact that there is a considerable difference between these two FH types. The FH receiver is usually non-coherent.

The incoming signal is multiplied by the signal from the PN generator identical to the one at the transmitter. Resulting signal from the mixer is a binary FSK, which is then demodulated in a "regular" way. Error correction is then applied in order to recover the original signal. The timing synchronization is accomplished through the use of early-late gates, which control the clock frequency.



QUESTION 2

Compare & contrast datagram & virtual circuit packet switched network.

ANSWER

Virtual Circuit Network	Datagram Network
(i) They are connection-oriented, which means that there is a reservation of resources like buffers, bandwidth etc. for the time during which the newly setup VC is going to be used by a data transfer session.	(i) It is connection-less service. There is no need for reservation of resources as there is no dedicated path for a connection session.
(ii) It uses a fixed path for a particular session, after which it breaks the connection & another path has to be set up for the next session.	(ii) It is a true packet switched network. There is no fixed path for transmitting data.
(iii) All packets follow the same path & hence a global header is required only for the 1st packet of connection & other packets will not require it.	(iii) Every packet is free to choose any path, & hence all the packets must be associated with a header containing information about the source & the upper layer data.
(iv) Packets reach in order to the destination as data follows the same path.	(iv) Data packets reach the destination in random order, which means they need not reach in the order in which they were sent out.
(v) They are highly reliable.	(v) Datagram networks are not as reliable as virtual circuits.
(vi) Implementation of virtual circuits is costly as each	(vi) But it is always easy & cost-efficient to implement datagram networks as there is no need of reserving resources & making

time a new connection has to be set up with reservation of resources & extra information handling at routers.	a dedicated path each time an application has to communicate.

QUESTION 3

What are the advantages of packet switching compared to circuit switching?

ANSWER

In packet switching, messages are divided into smaller pieces called packets. Each packet includes source & destination address information so that individual packets can be routed through the internetwork independently.

There are 2 approaches of packet switching:

(i) Datagram Approach

In this approach, each packet is treated independently from all others.

(ii) Virtual Circuit Approach

In this approach, the relationship between all packets belonging to a message or session is preserved.

Advantages of Packet Switching compared to Circuit Switching

(i) Very little setup or tear down time.

(ii) It is more flexible, i.e., packets can be routed through any switching node.

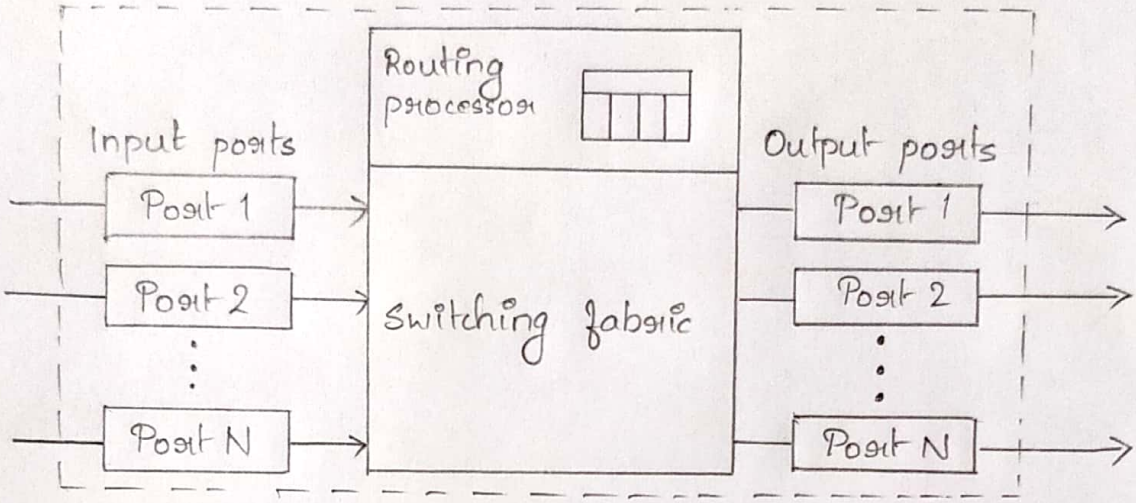
(iii) Improved bandwidth.

(iv) Small sized packet reduces transmission delay.

QUESTION 4

List the components of packet switch & write their functions.

ANSWER



(i) Input Ports

An input port performs the physical & data link functions of the packet switch. The bits are constructed from the received signal. The packet is decapsulated from the frame. Errors are detected & corrected. The packet is now ready to be routed by the network layer.

(ii) Output Ports

The output port performs the same functions as the input port, but in the reverse order. First the outgoing packets are queued, then the packet is encapsulated in a frame, & finally the physical layer functions are applied to the frame to create the signal to be sent on the line.

(iii) Routing Processor

The routing processor performs the functions of the network layer. The destination address is used to find the address of

the next hop, &, at the same time, the output port number from which the packet is sent out.

(iv) Switching Fabrics

The most difficult task in a packet switch is to move the packet from the input queue to the output queue. The speed with which this is done affects the size of the input/output queue & the overall delay in packet delivery.

Some of these fabrics are:

(a) Crossbar Switch

The simplest type of switching fabric is the crossbar switch.

(b) Banyan Switch

A banyan switch is a multistage switch with micro switches at each stage that route the packets based on the output port represented as a binary string.

(c) Batcher-Banyan Switch

Batcher designed a switch that comes before the banyan switch & sorts the incoming packets according to their final destinations. The combination is called the Batcher-banyan switch.