DATA ELEMENT vs SIGNAL ELEMENT

Introduction: Data and signals are like two building blocks of computer networks. All the data transmitted over channel can either be in analog form or digital form. Data are manipulated in the signal form suitable for the transmission channel. Like data elements, signal can also either in analog form or digital form.

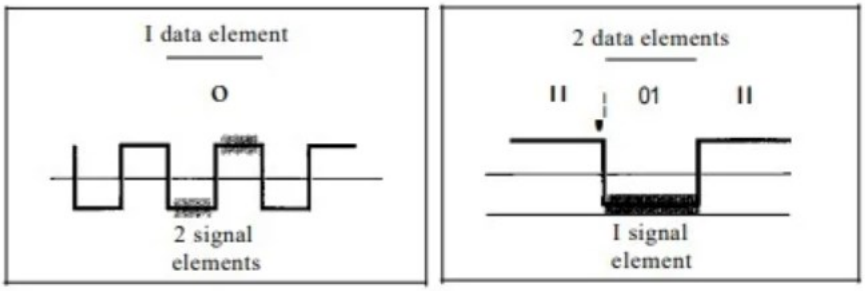
Hence four possible combinations of data and signal are as follows.

• Analog data converted into analog signal form, for example Telephone.

• Digital data converted to analog signal form, for example modem.

• Analog data converted to digital signal form, for example codec.

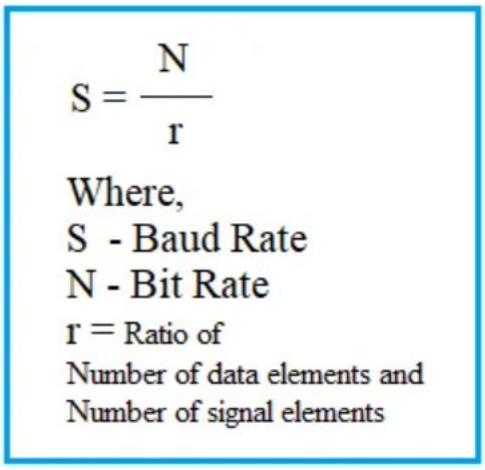
• Digital data converted to digital signal form, for example digital transmitter.



r = 1/2 r = 2

As shown in the figure, 1 data element is represented by two signal elements. Hence ratio 'r' which defines number of data elements carried by each signal element is 1/2. The right side depicts two data elements are represented by one signal element, which gives 'r' equals 2/1 (i.e. 2). QPSK signal has 'r' equals 2, as it maps two bits by one signal waveform.

If four data elements are represented by three signal elements, 'r' equals 4/3. The data rate and signal rate are related by following equation or formula.



Data can be numbers, text, image, audio or video which are stored in computer system. The digital data stored are usually stored as binary ones or zeros.

Signals have three basic parameters viz. amplitude, frequency, bandwidth and phase. Noise and attenuation affect the signal over medium. Signals can either be in electric form or in electromagnetic (EM) form or optical form. There will be continuous signal or discrete signal.

Line coding techniques such as unipolar, polar, bipolar are used to convert data elements (i.e. digital data) to signal elements (i.e. digital signal).

Tabular Difference Between Data And Signal

Following table mentions **difference between data and signal** with respect to various parameters.

Parameters	Data	Signal
• What is it ?	Data is the information we want to transmit.	Signal is the waveform format used to send data over channel.

• Function	Acts as payload of carrier	Acts as carrier which carries data or payload.
• Measurement quantity	Bit rate in bps or Kbps or Mbps or Gbps	Signal rate or baud rate in Baud, KBaud or Mbaud
• Affecting data communication parameter	Speed, Higher the bit rate higher is the speed	Bandwidth, lower the signal rate, lower is the bandwidth
• Format	Analog (Continuous) or digital form (Binary or discrete)	Analog (Electric, EM or Optical) or digital form (i.e. pulse such as NRZ or RZ)