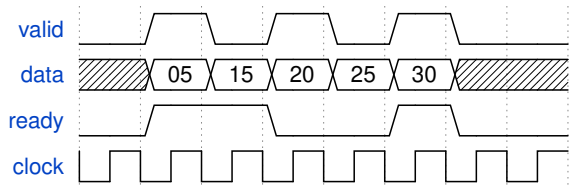
Solutions to Quiz 3

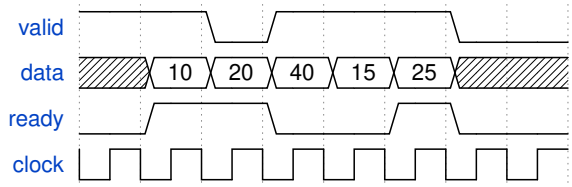
There were two version of each question. The values and the answers for all versions are given below.

Question 1

The following timing diagram shows the values on a valid/ready interface:



or:



What values were transferred over the interface on data?

Answers

Data is transferred only when both **`valid`** and **`ready`** are asserted.

In the first diagram the values on **`data`** when this is the case are 05 and 30. In the second diagram the values transferred are 10 and 25.

Question 2

Dolphins can emit sounds up to about 150 (or 125) kHz. What sampling frequency would be required to record these sounds?

How many bits of resolution would be required if the recording required a signal-to-noise ratio of 40 (or 53) dB,

Answers

The sampling frequency must be more than twice the highest frequency. If the highest frequency is 150 kHz then the sampling rate must be > 300 kHz. If the highest frequency is 125 kHz then the sampling rate must be > 250 kHz.

The equation for quantization SNR in dB is $1.76 + 6n$. Setting this equal to the required SNR and solving for n: $n \geq {}^{(40-1.76)}/_{6} = 6.37$ so we would need to use 7 bits (or $n \geq {}^{(53-1.76)}/_{6} = 8.54$ so we need to use 9 bits).

Question 3

Draw the waveform that would transmit the 8-bit value 8'h35 (or 8'h53) from master to slave (or slave to master) over an SPI interface using the conventions used the lecture notes. Include the following signals: $\overline{\texttt{SS}}$, **`MOSI`** (or **`MISO`**), and **`SCLK`**.

Answers

The data is transmitted most-significant-bit-first over **`MOSI`** from master to slave (the bits 8'h35 = 8'b0011_0101) and over **`MISO`** from the slave to the master (the bits 8'h53 = 8'b0101_0011) on each rising edge of **`SCLK`** while $\overline{\texttt{SS}}$ is asserted (low):