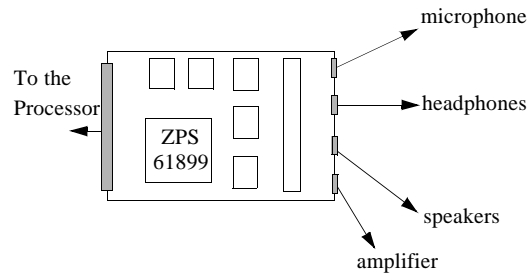
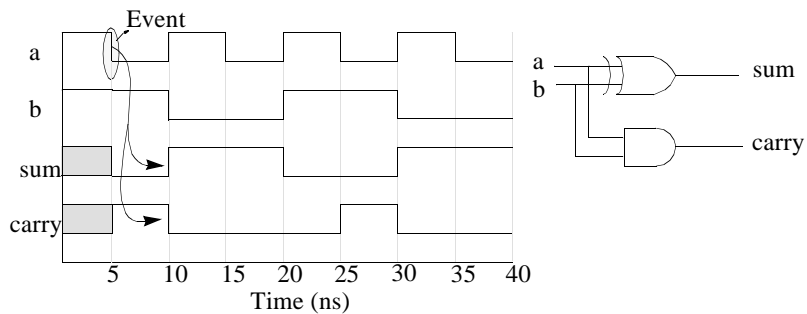


Describing Systems



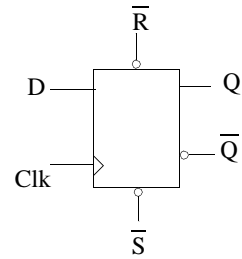
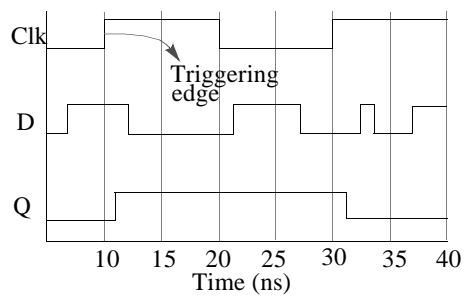
- System: "An assemblage of objects united by some form or regular interaction or dependence"
- What aspects of a digital system do we want to describe?
 - interface
 - function: behavioral and structural

Attributes of Digital Systems



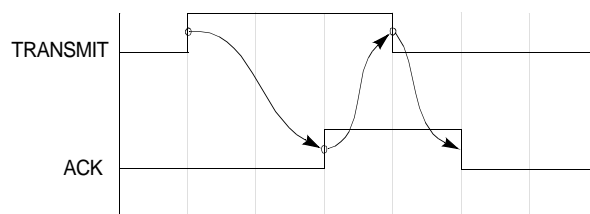
- Digital systems are about *signals* and their *values*
- *Events*, *propagation delays*, *concurrency*
- Time ordered sequence of events produces a *waveform*

Attributes of Digital Systems: Timing



- *Timing*: computation of events takes place at specific points in time
- Need to “wait for” an event: in this case the clock
- Timing is an attribute of both synchronous and asynchronous systems

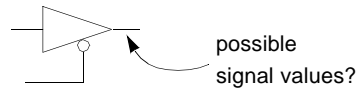
Attributes of Digital Systems: Timing



- Example: Asynchronous communication
- No global clock
- Need to “wait for” events on specific signals

Attributes of Digital Systems: Signal Values

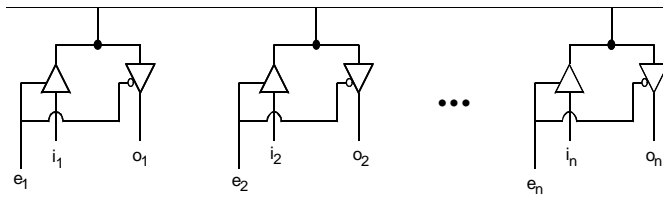
- We associate logical values with the state of a signal



- Signal Values: IEEE 1164 Value System

Value	Interpretation
U	Uninitialized
X	Forcing Unknown
0	Forcing 0
1	Forcing 1
Z	High Impedance
W	Weak Unknown
L	Weak 0
H	Weak 1
-	Don't Care

Attributes of Digital Systems: Shared Signals



- Shared Signals
 - multiple drivers
- How is the value of the signal determined?
 - arbitration protocols
 - wired logic

Modeling Digital Systems

- We seek to describe attributes of digital systems common to multiple levels of abstraction
 - events, propagation delays, concurrency
 - waveforms and timing
 - signal values
 - shared signals
- Hardware description languages must provide constructs for naturally describing these attributes of a specific design
 - simulators use such descriptions for “mimicing” the physical system
 - synthesis compilers use such descriptions for synthesizing manufacturable hardware specifications