

5 LTI Machine?

If you put a sequence of five numbers into a certain machine, it responds with a five-number sequence; this exchange constitutes one experiment. For each possible machine characteristic below, give enough sets of input-output sequences (that is, "experiments") that would demonstrate it:

1. Linear, time-invariant

A solution: $[1,1,1,1,1] \rightarrow [3,2,2,1,0]$ and $[0,2,2,2,2] \rightarrow [0,6,4,4,2]$.

2. Linear, time-varying

A solution: $[1,1,0,0,0] \rightarrow [0,3,2,1,0]$ and $[0,2,2,0,0] \rightarrow [0,6,4,2,0]$.

3. Nonlinear, time-invariant

A solution: $[1,2,3,0,0] \rightarrow [5,4,3,0,0]$ and $[0,2,4,6,0] \rightarrow [0,4,3,2,0]$. *Note this is a static mapping; a dynamic system would take more trials to determine that it was both nonlinear and time-invariant.*

4. Nonlinear, time-varying

A solution: $[2,3,4,0,0] \rightarrow [1,1,0,1,1]$ and $[0,4,6,8,0] \rightarrow [0,0,3,0,3]$. *A time-varying system cannot be a static map, so we have to have dynamics. However, similarly to the above case, there is a limit to what can be deduced with only two trials.*

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