

EECS20n, Quiz 1, 9/7/04, Solution

1. For each expression indicate whether the expression is well-formed; if it is well-formed, indicate whether it is an assertion; if it is an assertion, indicate its truth value True or False.

Expression	Well-formed (Y or N)	Assertion (Y or N)	Truth value (T or F)
$x \geq 4 \implies x \geq 3$	Y	Y	Y
$x \geq 5 \wedge y \leq 6$	Y	N	
$5 \wedge x$	N		
$\exists x, x > 3$	Y	Y	Y
$\forall x, x > 3$	Y	Y	N

2. Indicate whether the following statements are **true** or **false**. Put a box around your answer.

(a) There exists a function $f : [0, 1] \rightarrow [0, 1]$ whose graph is $\text{graph}(f) = \{(x, x) \mid x \in [0, 1]\}$

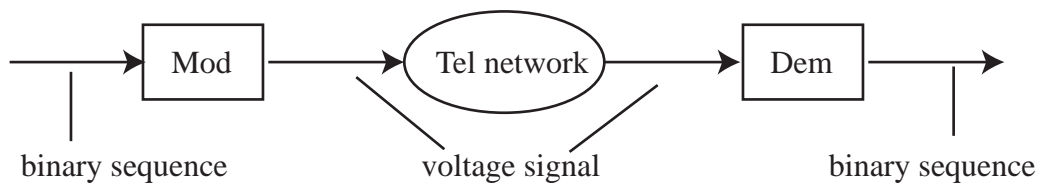
True

(b) Let $f: \text{Reals} \rightarrow \text{Reals}$ and $g: \text{Reals} \rightarrow \text{Reals}$. Define the functions $f + g$ by $\forall x \in \text{Reals}, (f + g)(x) = f(x) + g(x)$, and $g \circ f$ by $\forall x \in \text{Reals}, (g \circ f)(x) = f(g(x))$. Then

$$f + g = g + f \quad \text{True}$$

$$f \circ g = g \circ f \quad \text{False}$$

3. The following figure represents an interconnection of three systems: a modulator (mod) that transforms a binary sequence into a sound-like voltage, a telephone network that transmits voltage waveforms, and a demodulator that transforms sound-like voltage into a binary sequence.



Define appropriate signal spaces of binary sequences and voltage signals in the form $[Domain \rightarrow Range]$:

$$\text{Binary Sequences} = [Nats \rightarrow \{0, 1\}]$$

$$\text{Voltage Signals} = [\text{Time} \rightarrow \text{Volts}] = [\text{Reals} \rightarrow \text{Reals}]$$