ECE/CS/ME 539 – Fall 2024 — Activity 15

1.

Derive the derivatives $\frac{df(x)}{dx}$ of activation functions $f(x)$ as shown below

Name of Activation Function $f(x)$	$f(x)$	$f'(x) = \frac{df(x)}{dx}$
ReLU	$\max(0, x)$	
Sigmoid	$\frac{1}{1+e^{-x/T}}$	
Hyperbolic tangent	$\tanh\left(\frac{x}{T}\right) = \frac{e^{x/T}-e^{-x/T}}{e^{x/T}+e^{-x/T}}$	
Inverse tangent	$\frac{2}{\pi}\tan^{-1}\left(\frac{x}{T}\right)$	

2.

Derive the range (minimum, maximum) of each activation function and its derivative assuming $T = 1$.

Name of Activation Function $f(x)$	$f(x)$	Range of $f(x)$	$f'(x) = \frac{df(x)}{dx}$	Range of $f'(x)$
ReLU				
Sigmoid				
Hyperbolic tangent				
Inverse tangent				