Assignment 2

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Download all python codes from

https://github.com/vaibhavchhabra25/AI1103-course/blob/main/Assignment-2/Codes/simulation_code.py

and latex codes from

https://github.com/vaibhavchhabra25/AI1103-course/blob/main/Assignment-2/main.tex

1 Problem

Consider two identically distributed zero-mean random variables U and V. Let the cumulative distribution functions of U and 2V be F(x) and G(x) respectively.
Then, for all values of x

1) $F(x) - G(x) \leq 0$
2) $F(x) - G(x) \geq 0$
3) $(F(x) - G(x))x \leq 0$
4) $(F(x) - G(x))x \geq 0$

2 Solution

If X is a random variable, the cumulative distribution functions of U and 2V can be written in terms of X as

$$F(x) = \Pr(X \leq x) \tag{2.0.1}$$

$$G(x) = \Pr(2X \leq x) \tag{2.0.2}$$

Or,

$$G(x) = \Pr(X \leq x/2) \tag{2.0.3}$$

So, on subtracting we get,

$$F(x) - G(x) = \Pr(X \leq x) - \Pr(X \leq x/2) \tag{2.0.4}$$

For $x \geq 0$

$$F(x) - G(x) \geq 0 \tag{2.0.5}$$

And for $x \leq 0$

$$F(x) - G(x) \leq 0 \tag{2.0.6}$$

So, we can write

$$(F(x) - G(x))x \geq 0 \tag{2.0.7}$$

which is true for all values of x.
So, option 4 is correct.