AI1103: Challenge Problem 3

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Challenge Problem 3

Let $X_1, X_2, X_3, X_3, X_4, X_5$ be i.i.d. random variables having a continuous distribution function. Then $\Pr(X_1 > X_2 > X_3 > X_4 > X_5 | X_1 = max(X_1, X_2, X_3, X_4, X_5)$

Solution

In the world where X_1 is the max value, we simply need to find:

$$\Pr(X_2 > X_3 > X_4 > X_5) \tag{0.0.1}$$

Since each of the random variables and identical and independent of each other and have continuous distribution function.

$$f_{X_2}(x_2) = f_{X_3}(x_3) = f_{X_4}(x_4) = f_{X_5}(x_5) = f_X(x) \tag{0.0.2}$$

If we choose the values for each random variable then they can be arranged in 4! ways but only 1 way is there to put them:

$$X_2 > X_3 > X_4 > X_5 \tag{0.0.3}$$

the probability then would be:

$$\Pr(X_2 > X_3 > X_4 > X_5) = \frac{1}{4!} \tag{0.0.4}$$

$$= \frac{1}{24} \tag{0.0.5}$$

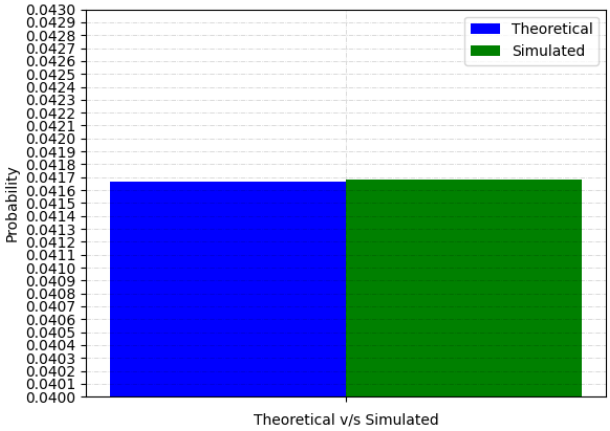

Fig. 0