

The following BASIC code generates 10,000 values of a random variable X and calculates the sample average, the sample variance, and the fraction of sample values that lie in the interval $(a, b]$. Adapt this simulation program (you may use BASIC or any other language) to:

1. Calculate the values needed to fill in the table for $E(X)$, $V(X)$ and $P(a < X \leq b)$, where a and b are specified in Homework 0. Show all theoretical calculations.
2. For each case, on a separate page, draw the graph of the theoretical distribution function $F_x(t)$, fill in the table describing $F_x(t)$, and plot the simulation values given in the table on the same graph as the theoretical distribution function.

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100 FOR i = 1 TO 10000

generate X

200 S1 = S1 + X
300 S2 = S2 + X^2
400 IF (X > a) AND (X <= b) THEN c = c + 1
500 NEXT i
600 PRINT S1/10000, S2/10000 -(S1/10000)^2, c/10000

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Case	X	$E(X)$		$V(X)$		$P(a < X \leq b)$	
		theory	simulation	theory	simulation	theory	simulation
1	$X \sim U(0,1)$						
2	$f_x(t) = \begin{cases} 0 & (t < 0) \\ 2e^{-2t} & (t \geq 0) \end{cases}$						
3	$P(X=1/2) = 1$						
4	$P(X = 0.4) = 0.8$ $P(X = 0.9) = 0.2$						

Distribution Function $F_x(t)$

t	1		2		3		4	
	theory	simulation	theory	simulation	theory	simulation	theory	simulation
-0.25								
0.00								
0.25								
0.50								
0.75								
1.00								
1.25								
1.50								

