Generating Normal Pseudo-random Numbers

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Box-Muller Method:

How to simulate two independent Normal random variables with mean μ and variance σ^2?

Generating U, V independent **UNIF**(0, 1) random values.

Then

$$W = \cos(2\pi U)\sqrt{-2\ln(V)}$$

and

$$X = \sin(2\pi U)\sqrt{-2\ln(V)}$$

are such that W and X are **NORM**(0,1) values.

To get Y and Z independent $N(\mu, \sigma^2)$ calculate

$$Y = \mu + \sigma W$$

and

$$Z = \mu + \sigma X$$

The following *PASCAL* code implements the Box-Muller Method.

```
FUNCTION Random2 : Real;
{ This function checks if the random number we take the natural log }
{ of is very small. If so, then we set it equal to something small. }
VAR
  x : Real;
BEGIN
  x := Random;
  IF x <= 0.0001 THEN
    Random2 := 0.0001
  ELSE
    Random2 := x;
END;

PROCEDURE Normal(VAR W, X : REAL);
VAR
  T1, T2 : REAL;
BEGIN
  T1 := 2*Pi*Random;
  T2 := sqrt(-2.0*ln(Random2));
  W := cos(T1)*T2;    { Note W and X are independent }
  X := sin(T1)*T2;    { standard Normals.}
END;
```