DATA Step Information - Random Number Generators

There are many different random number generators. We will examine a few of them. For any random number generator, you will need to supply a seed value for the function. The seed value for any of the random number generator functions must be integers between 0 and $2^{31} - 1$.

Random number generators are functions used in the DATA step of a SAS program. Random number generators can also be used in a CALL routine. CALL routines give the user greater control over the seed stream and the random number stream than their function counterpart. Seed values must be initialized prior to the CALL statement.

Some researchers use the computer's current clock value as the seed value, however, this is not generally recommended. When conducting a simulation study, you will want to select beginning seed values so that you could reproduce your results, using that seed value, at a later date.

RANNOR(seed) – generates a random variable from a standard normal distribution.

Example: y = RANNOR(2816) ;

CALL RANNOR(seed, x) – returns a standard normal random variable named x.

Objective 7 – The following demonstrates the control one can exercise over the seed values used in a program. Note all seed values start out the same and progress the same until i=6. Used as a function, the seed values do not change when the value of the seed is specified outside the interval. (Note: Seed values typically do not all have to start at the same value. This is done here to illustrate the differences between functions and CALL routines using seed values declared outside of the DO loop and within the function.)

```
DATA a ;
seed1 = 2120;
seed2 = 2120;
seed3 = 2120;
DO i=1 TO 10;
        CALL RANNOR(seed1, x1);
        CALL RANNOR(seed2, x2);
        y1 = RANNOR(seed3) ;
        y2 = RANNOR(2120) ;
        IF i=6 THEN DO;
                 seed2=17;
                 seed3=17;
                    END;
        OUTPUT;
END;

PROC PRINT DATA=a;

RUN;
QUIT;
```

Binomial Distribution
x = RANBIN(seed, n, p);

CALL RANBIN(seed, n, p, x);

- seed is an integer-valued numeric variable such that $0 < seed < 2^{31} - 1$
- n is an integer number of independent trials
- p is the probability of success on a single trial, $0 < p < 1$.
- x is the SAS variable

Exponential Distribution
x = RANEXP(seed);

CALL RANEXP(seed, x) ;

- seed is an integer-valued numeric variable such that $0 < seed < 2^{31} - 1$
- x is a numeric variable with a random value from an exponential distribution with parameter 1.

Normal Distribution
x = RANNOR(seed) ;

CALL RANNOR(seed, x) ;

- seed is an integer-valued numeric variable such that $0 < seed < 2^{31} - 1$
- x is a numeric variable from a normal distribution with mean 0 and variance 1.

Tabled Probability Distribution
x = RANTBL(seed, p_1, p_2, . . . , p_n)

CALL RANTBL(seed, p_1, p_2, . . . , p_n, x)

- seed is an integer-valued numeric variable such that $0 < seed < 2^{31} - 1$
- x is a variable that has the value randomly chosen from the discrete distribution specified by p_1, p_2, . . . , p_n.

Uniform Distribution
x = RANUNI(seed) ;

CALL RANUNI(seed, x) ;

- seed is an integer-valued numeric variable such that $0 < seed < 2^{31} - 1$
- x is a variable that has the value chosen from the uniform distribution on the interval (0,1).