The George Washington University
Department of Statistics

Stat 4197/6197 – Fall 2019

Week 13 – November 22, 2019

Lecture Topics: Miscellaneous

1) Simulating Data with SAS
2) Calling R in a SAS/IML Session
3) Review of Selected Topics of Macro Facility

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Simulations

Simulations provide a way to answer questions and explore properties of statistical estimators and procedures (Kleinman and Horton, 2014).

In statistics, data are commonly simulated to

- generate random samples from a statistical distribution (discrete or continuous) with known properties
- estimate the sampling distributions of basic measures such as means, median, Pearson correlations
- evaluate statistical techniques
- ascertain statistical power of hypothesis tests

(Source: Simulating Data with SAS® by Rick Wicklin, 2013)

Some common functions used in simulation

- PDF Function
- CDF Function
- Quantile Function
- RAND Function

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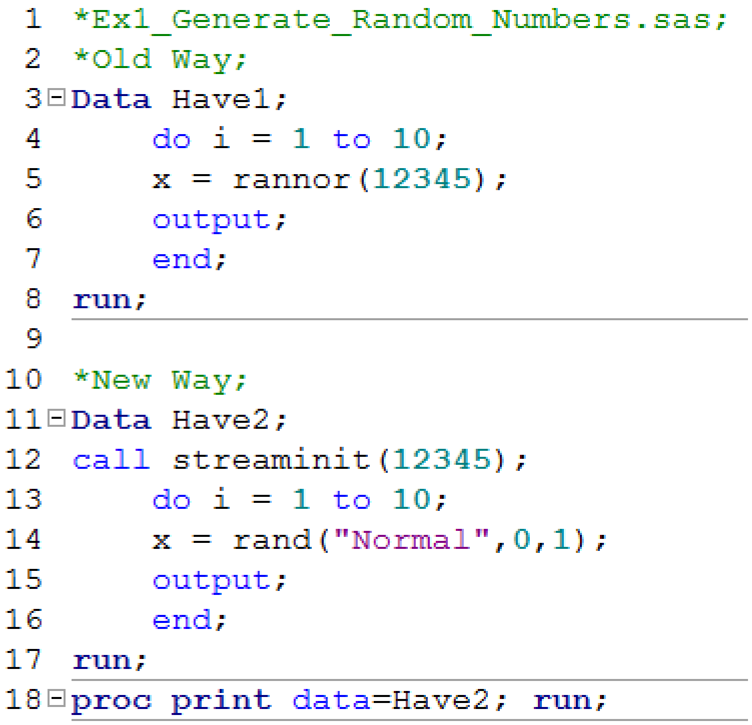
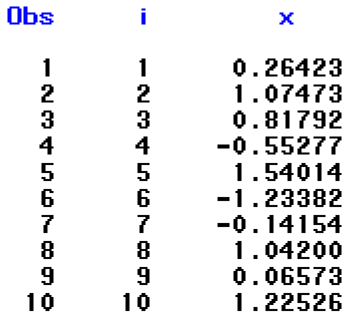
Generating Data



```
1  *Ex1_Generate_Random_Numbers.sas;
2  *Old Way;
3  Data Have1;
4        do i = 1 to 10;
5        x = rannor(12345);
6        output;
7        end;
8  run;
9
10 *New Way;
11 Data Have2;
12 call streaminit(12345);
13       do i = 1 to 10;
14       x = rand("Normal",0,1);
15       output;
16       end;
17 run;
18 proc print data=Have2; run;
```

Line 12: The routine is used to set the seed for the random number stream.



```
Obs     i          x

  1     1     0.26423
  2     2     1.07473
  3     3     0.81792
  4     4    -0.55277
  5     5     1.54014
  6     6    -1.23382
  7     7    -0.14154
  8     8     1.04200
  9     9     0.06573
 10    10     1.22526
```

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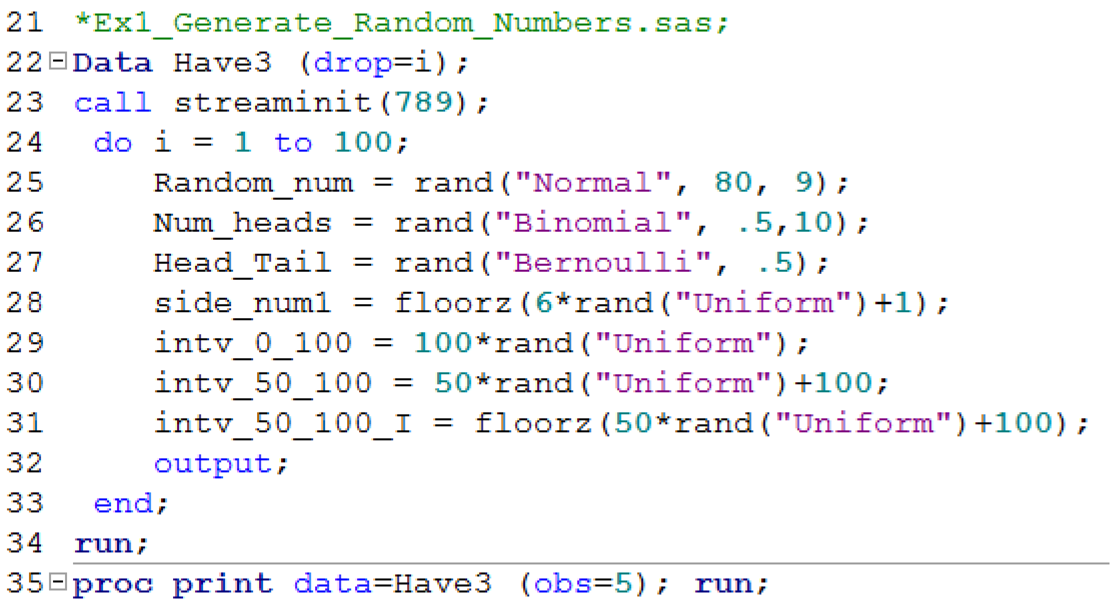
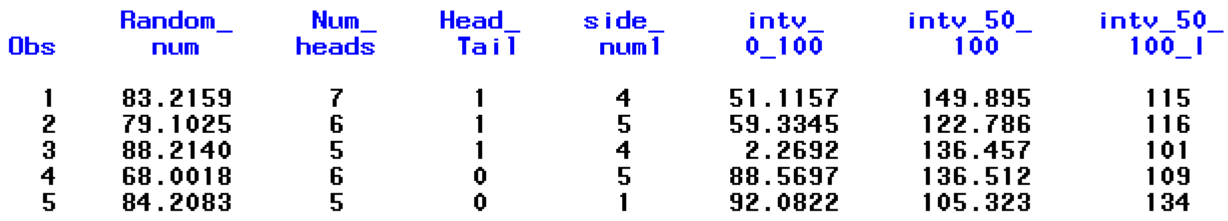
The following DATA step simulates 100 independent values from various distributions. The subsequent PROC PRINT step displays the first five observations.



```
21 *Ex1_Generate_Random_Numbers.sas;
22 Data Have3 (drop=i);
23 call streaminit(789);
24  do i = 1 to 100;
25     Random_num = rand("Normal", 80, 9);
26     Num_heads = rand("Binomial", .5,10);
27     Head_Tail = rand("Bernoulli", .5);
28     side_num1 = floorz(6*rand("Uniform")+1);
29     intv_0_100 = 100*rand("Uniform");
30     intv_50_100 = 50*rand("Uniform")+100;
31     intv_50_100_I = floorz(50*rand("Uniform")+100);
32     output;
33  end;
34 run;
35 proc print data=Have3 (obs=5); run;
```

Line 23: This routine sets the seed value.
Line 24: The DO loop iterates 100 times.
Line 25: Normal distribution with mean = 80 and standard deviation = 9.
Line 26: Binomial distribution with p (a numeric probability of success) = .5 and n (an integer parameter that counts the number of independent Bernoulli trials) = 10.
Line 27: Bernoulli distribution with p = .5.
Line 28: The Floorz converts the result to integers.



```
         Random_     Num_    Head_    side_     intv_      intv_50_    intv_50_
  Obs      num       heads    Tail     num1     0_100        100        100_I

    1    83.2159       7        1        4     51.1157     149.895       115
    2    79.1025       6        1        5     59.3345     122.786       116
    3    88.2140       5        1        4      2.2692     136.457       101
    4    68.0018       6        0        5     88.5697     136.512       109
    5    84.2083       5        0        1     92.0822     105.323       134
```

Some Other Distributions: Geometric, Poisson, and Exponential.

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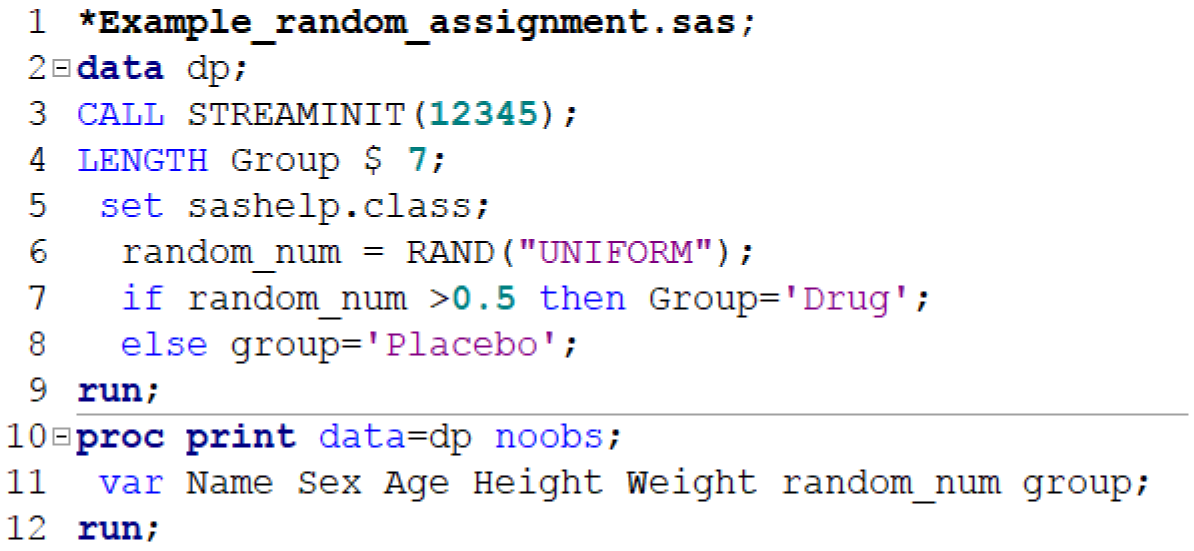
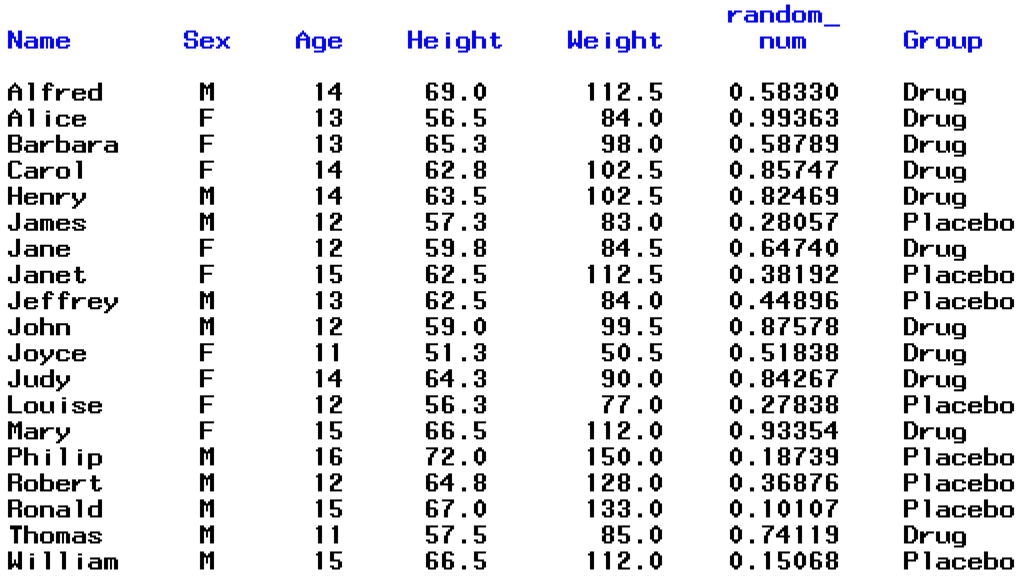
Assigning 19 Subjects in the data set SASHELP.CLASS to the Drug or Placebo Randomly



```
*Example_random_assignment.sas;
data dp;
CALL STREAMINIT(12345);
LENGTH Group $ 7;
 set sashelp.class;
  random_num = RAND("UNIFORM");
  if random_num >0.5 then Group='Drug';
  else group='Placebo';
run;
proc print data=dp noobs;
 var Name Sex Age Height Weight random_num group;
run;
```



```
                                                       random_
Name         Sex     Age     Height      Weight        num       Group

Alfred        M       14      69.0        112.5      0.58330     Drug
Alice         F       13      56.5         84.0      0.99363     Drug
Barbara       F       13      65.3         98.0      0.58789     Drug
Carol         F       14      62.8        102.5      0.85747     Drug
Henry         M       14      63.5        102.5      0.82469     Drug
James         M       12      57.3         83.0      0.28057     Placebo
Jane          F       12      59.8         84.5      0.64740     Drug
Janet         F       15      62.5        112.5      0.38192     Placebo
Jeffrey       M       13      62.5         84.0      0.44896     Placebo
John          M       12      59.0         99.5      0.87578     Drug
Joyce         F       11      51.3         50.5      0.51838     Drug
Judy          F       14      64.3         90.0      0.84267     Drug
Louise        F       12      56.3         77.0      0.27838     Placebo
Mary          F       15      66.5        112.0      0.93354     Drug
Philip        M       16      72.0        150.0      0.18739     Placebo
Robert        M       12      64.8        128.0      0.36876     Placebo
Ronald        M       15      67.0        133.0      0.10107     Placebo
Thomas        M       11      57.5         85.0      0.74119     Drug
William       M       15      66.5        112.0      0.15068     Placebo
```

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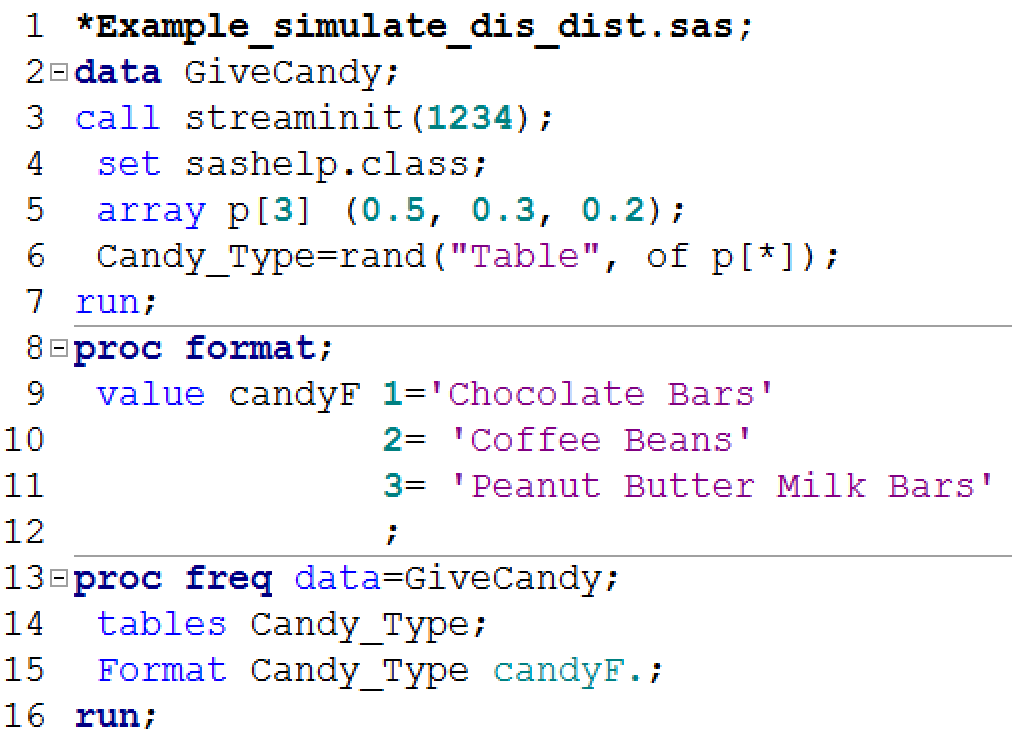
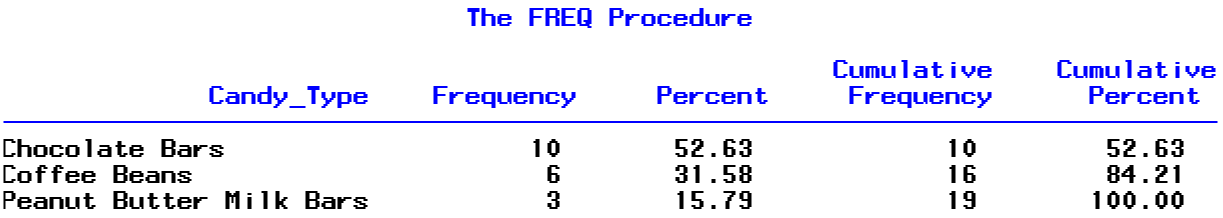
Simulating Data from a Discrete Distribution (See Wicklin, 2015)



```
 1  *Example_simulate_dis_dist.sas;
 2 data GiveCandy;
 3  call streaminit(1234);
 4   set sashelp.class;
 5   array p[3] (0.5, 0.3, 0.2);
 6   Candy_Type=rand("Table", of p[*]);
 7  run;
 8 proc format;
 9   value candyF 1='Chocolate Bars'
10                2= 'Coffee Beans'
11                3= 'Peanut Butter Milk Bars'
12                ;
13 proc freq data=GiveCandy;
14   tables Candy_Type;
15   Format Candy_Type candyF.;
16  run;
```

Line 6: The RAND function uses a "Table" distribution to specify a table of probabilities for each outcome.



```
                          The FREQ Procedure

                                                      Cumulative    Cumulative
             Candy_Type    Frequency     Percent       Frequency       Percent
------------------------------------------------------------------------------
Chocolate Bars                    10       52.63              10         52.63
Coffee Beans                       6       31.58              16         84.21
Peanut Butter Milk Bars            3       15.79              19        100.00
```

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Calling R in a SAS Session with PROC IML

Requirements:

- Both R and SAS software packages must be installed
- The RLANG system option in SAS must also be enabled.

Run the following code in SAS to check whether the permission to use R within SAS is enabled.

```
PROC OPTIONS OPTION=RLANG; RUN;
```

If the permission to use R within SAS is not enabled, you must modify the sasv9.cfg file, which is typically found in "C:\Program Files\SASHome\SASFoundation\9.3\nls\en\”, in order to reset this option by adding a –RLANG line to the config file.

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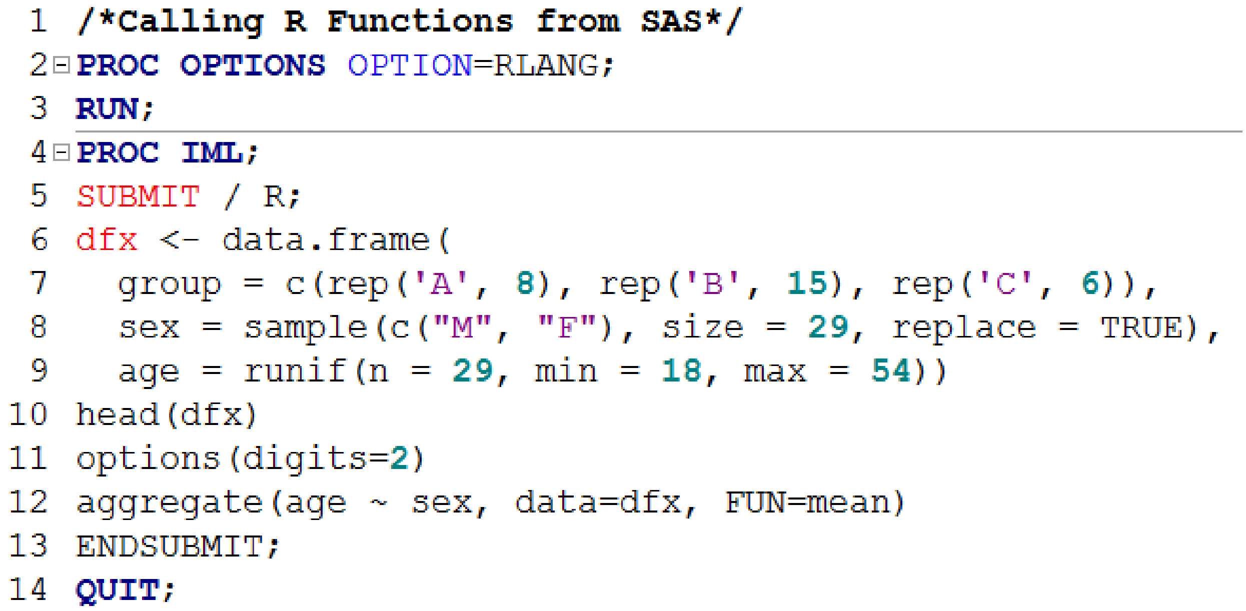
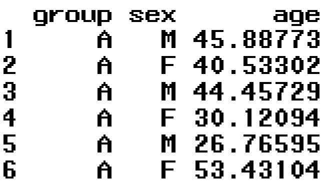


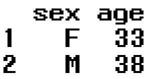
```
 1 /*Calling R Functions from SAS*/
 2 PROC OPTIONS OPTION=RLANG;
 3 RUN;
 4 PROC IML;
 5 SUBMIT / R;
 6 dfx <- data.frame(
 7   group = c(rep('A', 8), rep('B', 15), rep('C', 6)),
 8   sex = sample(c("M", "F"), size = 29, replace = TRUE),
 9   age = runif(n = 29, min = 18, max = 54))
10 head(dfx)
11 options(digits=2)
12 aggregate(age ~ sex, data=dfx, FUN=mean)
13 ENDSUBMIT;
14 QUIT;
```

Output from line 11 (Listing of 6 observations)



```
  group sex      age
1     A   M 45.88773
2     A   F 40.53302
3     A   M 44.45729
4     A   F 30.12094
5     A   M 26.76595
6     A   F 53.43104
```

Output from Lines 11-12



```
  sex age
1   F  33
2   M  38
```

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```
 [1] "./Ex1_Generate_Random_Numbers.sas"
 [2] "./Ex10_simulate.sas"
 [3] "./Ex11_simulate.sas"
 [4] "./Ex12_simulate.sas"
 [5] "./Ex13_simulate.sas"
 [6] "./Ex14_data_driven_simu.sas"
 [7] "./Ex15_calling_R_from_SAS.sas"
 [8] "./Ex16_calling_R_from_SAS.sas"
 [9] "./Ex17_calling_R_from_SAS.sas"
[10] "./Ex18_collapse_multiple_cols.sas"
[11] "./Ex19_count_repeated_rows.sas"
[12] "./Ex2_DoLoop_Mod_Func.sas"
[13] "./Ex20_macro_case_study.sas"
[14] "./Ex21_Load.sas"
[15] "./Ex22_R_List_of_Files.sas"
[16] "./Ex3_call_symputx_dates.sas"
[17] "./Ex4_generate_dates_sashelp_class.sas"
[18] "./Ex5_generate_SSN_dates_other_vars.sas"
[19] "./Ex6_random_assignment.sas"
[20] "./Ex7_simualte_randomID.sas"
[21] "./Ex8_simulate.sas"
[22] "./Ex9_simulate.sas"
```

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