RANDOMIZATION EXERCISE 1

The goal is to try out different randomization techniques. See how easy each is to perform; and see how your assignments of objects to analysis order may vary with each method.

Premise: Your lab is to conduct elemental analysis (using several non-destructive surface testing methods) and non-destructive optical microscopy coupled with image analysis and cathodoluminescence on small marble specimens that come from three sources (A, B, and C). You have three samples of each.

A is a marble source on the Island of Forgers Paradise. This source is known to have been in use in 500 B.C., but was depleted before the 20th century. You were able to obtain specimens collected in the 18th century by a geologist who then donated them to the Museum of Ancient Stuff, where you have a good friend who is head of the lab, and who gave you three samples for testing.

B is a marble source on the same Island, located near the ancient one, but not exploited until the 20th century. This source is still accessible for quarrying. A foundation funded your expedition to the Island to collect these samples yourself.

C is a marble sculpture that your museum recently purchased for $4,000,000, after the museum curators concluded it was ancient. Now a leading art historian from a rival institution has announced to the New York Times that your museum was fooled: he believes the work to be recently carved, and has heard that the marble, instead of coming from the Island's ancient quarry, was purchased from the Island of Forgers Paradise Home Depot, which obtains its marble from the new quarry on the Island.

Your analysis, which includes three replicates of each marble type, will ultimately be used to compare the sculpture marble with the old and new source marbles. To avoid unintentional bias, you will code the marble specimens with a letter and a number on the back, then do your analyses "blind" as to which block comes from which source. You also want to spread out any instrumental drift or analytical errors by randomizing the order of measurement (so you don't do all of A, then all of B, then all of C).

Try performing several different randomization methods:

1. Cut and label 9 pieces of papers to represent your experimental units (the marble specimens A-C).Randomly assign each slot in the analysis order by drawing the pieces of paper from a cup. List how the numbered specimens were assigned. Note that here you start with analysis order known and randomly assign the specimens to each slot in the analysis order. Caution: in order to assure random drawing, the papers must be very well mixed within the cup and you should not be able to read any papers in the cup.

(e.g.,)	1	2	3	4	6	7	8	9
	C2	A3	C1	B1	B3	A2	A1	C3

2. Now do the randomization by rolling dice for each slot in the analysis order (1-9). Use the dice to assign an analytical order to each specimen. When you encounter a throw of the dice that is a higher number than you need (such as 11), or is a number you have already assigned to a specimen, ignore it and roll again. Again, list how the specimens ended up being ordered. Note that here you start with specimen known and randomly assign the order.

(e.g.,) A: 3 B: 4 C: 5
A: 2 B: 1 C: 6
A: 7 B: 9 C: 8

3. Now use a random number table to make your assignments, starting with either analysis order or specimen known with the other assigned using the random number table. List the results again. Notice how each piece of specimen may have ended up in a very different slot in the analysis order each time.

Method 1: Specimens selected first, order assigned

[fill A first with the first three randomly selected numbers within 1-9; then fill B; and C]

A B C

Method 2: Analysis order selected first, specimens assigned to a slot

[Code A-C by assigning them numbers in advance in some manner, such as A=1, B=2, C=3]

1 3 4 5 6 7 8 9