My name . . .

Partners name . . . (if applicable)

average atomic mass simulation lab   honors chem   period x

introduction

1. A simulation mimics the behavior of a system. [“citation not needed since didn’t need to look it up”]

purpose

2. Phet: blah, since given free points

   AACT: blah

3. Based on the output of the Excel simulation

atomic mass simulation lab using beans to represent isotopes		
to simulate running multiple trails, press F9 key for each trail		
output in green high-lighted cells		
number of beans		
lima =	15	
pinto =	42	
navy =	59	
total mass of sample =	42.83	grams

use below average mass of a single bean in your calculations

	Bean 1 (Lentils)	Bean 2 (Navy)	Bean 3 (Pinto)	Bean 4 (Lima)
Mass of 100 beans plus cup (g)	18.16	28.65	52.55	113.15
Mass of 100 beans (g)	6.01	16.50	40.40	101.00
Average mass of one bean (g)	0.0601	0.165	0.404	1.01

to find the average bean mass, using equation 1,

$$average\ bean\ mass = \frac{\#\ g\ beans\ in\ sample}{\#\ beans\ in\ sample} = \frac{42.83\ g}{(15+42+59)beans} = 0.369\frac{g}{bean}$$

and using equation 2,

$$average\ bean\ mass = \sum m_i\ p_i$$

$$= m_{lima}\ p_{lima} + m_{pinto}\ p_{pinto} + m_{navy}\ p_{navy}$$

$$= 1.01\left(\frac{15}{15+42+59}\right) + 0.404\left(\frac{42}{15+42+59}\right) + 0.165\left(\frac{59}{15+42+59}\right)$$

= 0.229 g / bean

seems to have different values.

results

4. Running the Excel simulation, 8 more times, to find the average bean mass (in g / bean) produced the below results.

Use eqn 1	Use eqn 2
0.341	0.337
0.341	0.359
0.325	0.346
0.308	0.325
0.318	0.329
0.340	0.355
0.349	0.360

The results of using the independent sample t-test (http://vassarstats.net/), where column A was from eqn 1, while column is from eqn 2, is shown below.

Data Summary

	A	B	Total
n	8	8	16
ΣX	2.649	2.7629999	5.4119999
ΣX^2	0.8792070	0.9555609	1.834768
SS	0.0021	0.0013	0.0042
mean	0.3311	0.3454	0.3382

Results

$Mean_a - Mean_b$	t	df			
-0.0142	-1.84	14	P	one-tailed	0.043532
				two-tailed	0.087064

For independent samples, these results pertain to the "usual" t-test, which assumes that the two samples have equal variances.

F-Test for the Significance of the Difference between the Variances of the Two Samples

df_1	df_2	F	P
7	7	1.59	0.277767

[Applicable only to independent samples.]
P>.05 indicates no significant difference detected between the variances of the two samples.

as the 2-tail p-value > 0.05, the data is the same; i.e. eqn 1 and eqn 2 produce the same results.

discussion

4. Show that

$$\text{eqn1: } average\ bean\ mass = \frac{\#\ g\ beans\ in\ sample}{\#\ beans\ in\ sample}$$

$$eqn\ 2\text{: } average\ bean\ mass = m_{lima}\ p_{lima} + m_{pinto}\ p_{pinto} + m_{navy}\ p_{navy}$$

are the same. Equation 1 is

$$average\ bean\ mass$$

$$= \frac{\#\ g\ beans\ in\ sample}{\#\ beans\ in\ sample} = \frac{m_{lima} + m_{pinto} + m_{navy}}{n_{total}}$$

$$= \frac{m_{single\ lima}\ n_{lima} + m_{single\ pinto}\ n_{pinto} + m_{single\ navy}\ n_{navy}}{n_{total}}$$

$$= \frac{m_{single,lima}\ n_{lima}}{n_{total}} + \frac{m_{single,pinto}\ n_{pinto}}{n_{total}} + \frac{m_{single\ ,navy}\ n_{navy}}{n_{total}}$$

$$= m_{lima}\ p_{lima} + m_{pinto}\ p_{pinto} + m_{navy}\ p_{navy}$$

which is eqn 2; therefore, eqn 1 and eqn 2 are the same.