Random Circles Activity – Why do we need a random sample?

When a population is sampled to study a certain variable, a random sample needs to be used to ensure that our conclusions about this variable can be inferred to the population. This activity will be used to show how our "eye" may not always see things as they actually are.

1. Turn on your ***n*spire** and open a new document from the (on) screen (If a message box appears either choose Yes to save or NO to not save). Arrow over to "Click to Add and Application", click on it, and select "Add a Lists & Spreadsheet".

2. Your teacher will give you a sheet of circles that have a number inside the circle. Keep this sheet face down. When you are told, you will flip the sheet over and pick 5 circles that you think best represents the average area of all of the circles on the page. Write these numbers down and use them to find the circles' area.

3. Put these areas in a column named **myarea**.

4. In a cell in a different column type = *mean (**myarea**)*. Press (enter) and the average area of your circles should be calculated.

5. Go to the teacher's computer and add your average to the Spreadsheet in the column labeled **avgarea**. When you are finished, connect your handheld to the link cord and the teacher will send you the file **Random Sampling Activity<class>.**

6. Open the file **Random Sampling Activity<class>** → Press (on), select *My documents*, and select the file **Random Sampling Activity<class>.**

7. Using One-Variable Statistics, calculate the mean of **avgarea**.

8. Make a histogram of **avgarea** on a Data & Statistics page.

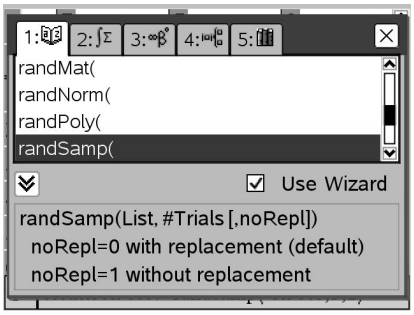
Record your mean and draw a rough sketch of your histogram.

9. Go back to the Lists & Spreadsheet Page. In the next column, we need to put the 100 numbers representing the 100 different circles. Name this column **circle**, and in the formula bar press (enter) and type **seq(x,x,1,100).** Press (enter) and your column should now fill with the numbers from 1 to 100.

We are now going to use a random number function on the nspire; however we do not want everyone starting at the same place, i.e. using the same line on the random number table. To ensure that a different "line" is used, we will *seed* the nspire.

10. Insert a *Calculator* page. Type *randSeed*(<last four digits of your telephone #>).

11. On the next line in the Calculator page, press (enter) and then (📖). Press [R] and scroll through the list to find *randSamp*. This function will randomly select *n* items from a List with(0) OR without(1) replacement. We want without replacement, since we are not using the same circle twice. The formula should look like: **randSamp(circle, 5, 1)**.



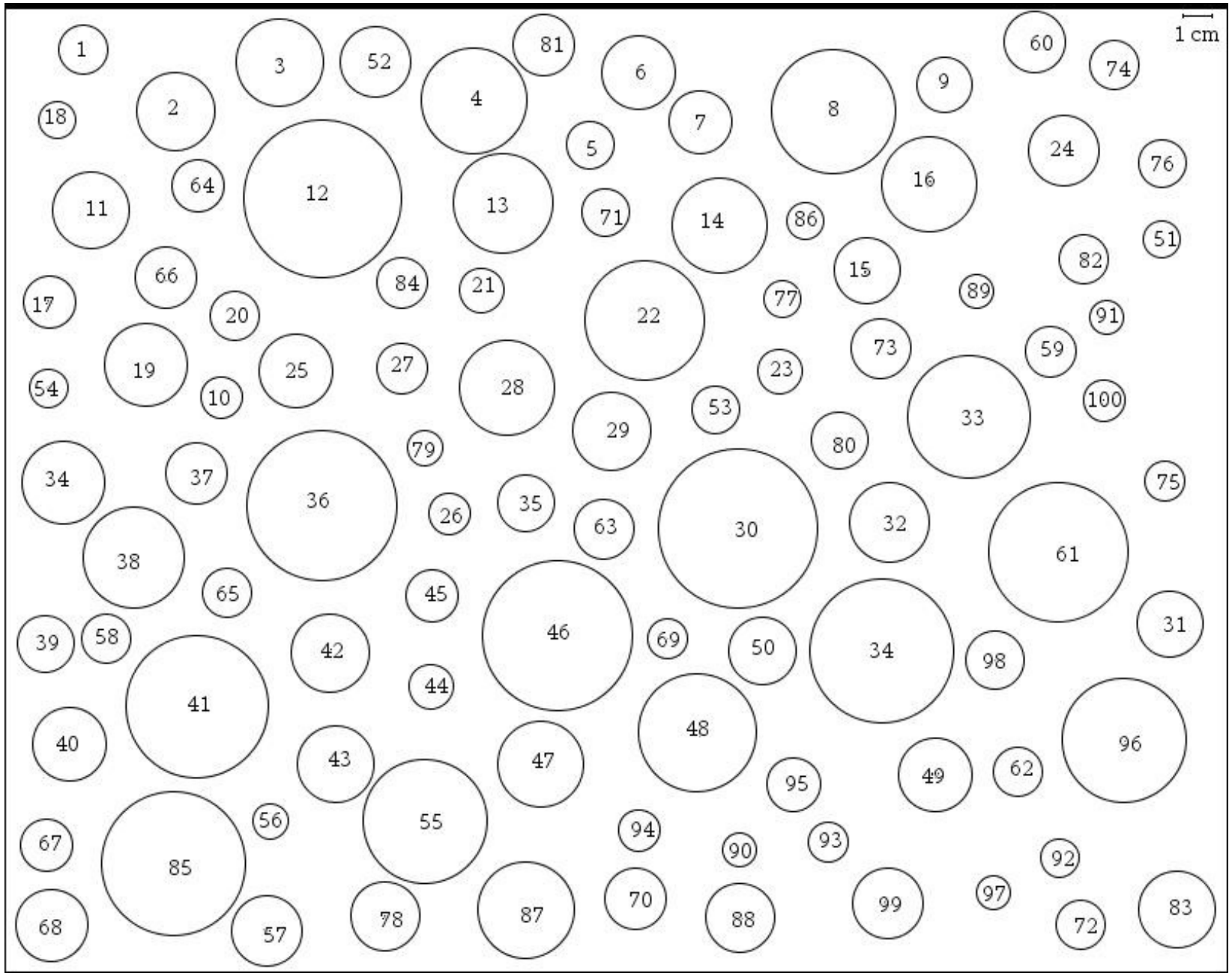
12. Find the corresponding areas and average them. Place these averages on the board and once everyone in the class has written their average, type these averages in a new column with the heading **rndarea.**

How do these averages from the random sample compare with the averages in *avgarea* from the judgment sample?

Create a histogram for <u>rndarea</u>. Draw a rough sketch here and describe this histogram. Compare this histogram with the one from <u>avgarea</u>.

Find the mean of rndarea and compare this with the mean from avgarea. How different are these means?

Get the true mean of the areas of the 100 circles from the teacher. Which mean is closer to the true mean? Why? What does this tell you about random sampling?


1 cm
1
2
3
52
4
81
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7
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74
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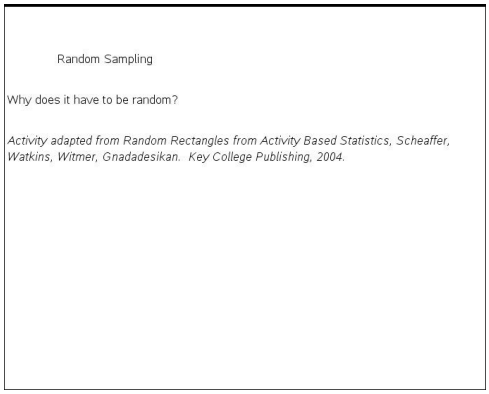
67
85
70
88
99
97
83
68
57
78
87
72

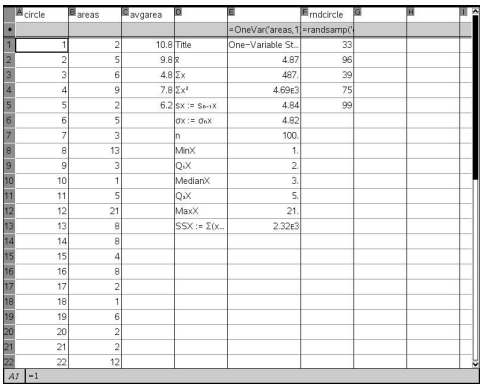
The following table contains the area (rounded to the nearest cm^2) of each circle. The table will need to be covered while the student picks the five representative circles.

Circle	Area	Circle	Area	Circle	Area	Circle	Area	Circle	Area
1	2	21	2	41	17	61	16	81	3
2	5	22	12	42	5	62	2	82	2
3	6	23	2	43	5	63	3	83	5
4	9	24	4	44	2	64	2	84	2
5	2	25	5	45	2	65	2	85	17
6	5	26	1	46	19	66	3	86	1
7	3	27	2	47	6	67	2	87	8
8	13	28	8	48	12	68	4	88	4
9	3	29	5	49	5	69	1	89	1
10	1	30	21	50	4	70	3	90	1
11	5	31	4	51	1	71	2	91	1
12	21	32	5	52	4	72	2	92	1
13	8	33	13	53	2	73	3	93	1
14	8	34	6	54	1	74	2	94	1
15	4	35	3	55	13	75	1	95	2
16	8	36	19	56	1	76	2	96	13
17	2	37	3	57	4	77	1	97	1
18	1	38	9	58	2	78	4	98	3
19	6	39	3	59	2	79	1	99	4
20	2	40	5	60	3	80	3	100	1

TEACHER NOTES:

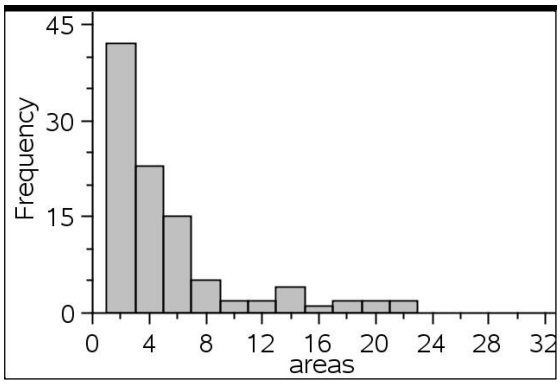
Here are the nspire screens for the teacher. The Spreadsheet page includes all 100 areas of the circles. Of course the students could possibly enter the 100 data values into their calculator to find the true mean instead of asking the teacher; however, there is no need for the students to take the time to do this (the true mean is $4.87cm^2$). The pages of circles should not be given to the students until the teacher is ready.

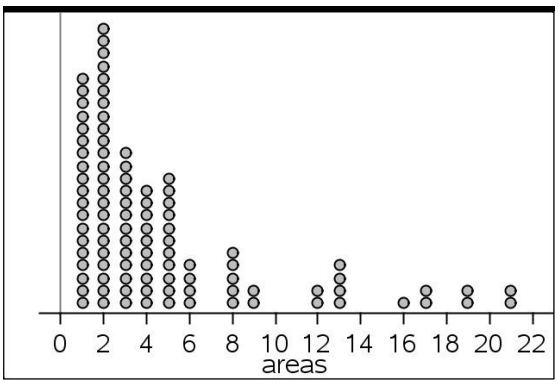




	circle	areas	avgarea			rndcircle
•					=OneVar("areas,1	=randsamp("
1	1	2	10.8	Title	One-Variable St...	33
2	2	5	9.8	$\bar{x}$	4.87	96
3	3	6	4.8	Σx	487.	39
4	4	9	7.8	Σx^2	4.69E3	75
5	5	2	6.2	$sx := s_{n-1}x$	4.84	99
6	6	5		$\sigma x := \sigma_n x$	4.82	
7	7	3		n	100.	
8	8	13		MinX	1.	
9	9	3		Q_1X	2.	
10	10	1		MedianX	3.	
11	11	5		Q_3X	5.	
12	12	21		MaxX	21.	
13	13	8		$SSX := \Sigma(x...$	2.32E3	
14	14	8				
15	15	4				
16	16	8				
17	17	2				
18	18	1				
19	19	6				
20	20	2				
21	21	2				
22	22	12				

A1 =1





→ For smaller classes (less than 15), you may want the students to repeat steps 11 & 12 one or two more times to get a larger number of sample means.