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Research Paper

Range of outputs precise of digits rounding in SPSS and MS Excel

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Abstract

The statistical operations done by many specialist programs, by them can do these operations fluently and precisely. There are many functions in such programs can calculate in SAS, STAT and the analytical program SPSS. There is Microsoft Excel program that is calculate like these functions. The level of some programs may be different than others within these functions they are calculating. From these functions are Sum, Average, Maximum and Minimum. Round function is also from these functions that can measure it's accuracy through this research. In this research i chose ten digits numbers and I also chose three criteria under, equal and more than 5. According to that the rounding operations are done based on if wanted decimal place is less, equal or higher than 5. Rounding applied on ten digits using SPSS and MS Excel programs. The outputs findings are the same except that Microsoft Excel is truncating the last zeroes of the digit after the decimal point. Wherever the decimal place specified in the digit is want it will truncate after the decimal point. The SPSS is more precise than MS Excel based on the decimal place in the digit number wanted statistically and analytically.

Keywords: *Decimal Place, Digit, Excel, Function, Round.*

1. Introduction

Functions in many statistical programs like MS Excel and SPSS programs are count many kinds of numbers like integers, natural, real and digits. The results of such as these functions are supposed to be same outputs in MS Excel and in SPSS programs. The digits numbers rounding are also supposed to be the same in many statistic programs like SPSS, SAS, STAT and MS Excel.

Ted French said in Spreadsheet.about.com: rounding a number means altering it to a specific size. Rounding integers (whole numbers) involves rounding them up or down to the nearest multiple of 10, while rounding decimals reduces them to a set number of decimal places [1].

According to Poes and Matthew Joseph,2011 [2] they used SPSS program to export some values to MS excel, by save it as Excel file, when they do this, it's truncating the values down to only one digit after the decimal place. It also is not rounding correctly, as some values which should be appropriately rounded up, are being rounded down. They said as example, a value of 6.547 becomes 6.5 instead of 6.6.

The digits numbers in both SPSS and MS Excel are supposed to round up into the same truncate numbers, whatever decimal place must convert.

In SPSS the decimals are valid for numeric variables only. It specifies the number of decimals to be kept for a variable. All the extra decimals will be rounded up and the rounded numbers will be used in all the analysis, so should be careful to specify the number of decimals to fit in the precision the researcher want.

Professor Matthew in his study name: Reporting Statistics in APA Style [3] using SPSS, about using rounding appropriately said round number to one or two decimal place he said, must keep in mind that fewer decimal places are easier to comprehend. He said must consider rescaling measurements required for more two decimal places.

A scientific fact stipulates that, when rounding numbers especially digits numbers, these numbers should be rounded up as far as rounded down. The rounding precisely must examine the first digit to be truncated. If the digits are 6, 7, 8, or 9, round the number will be up. When the digits are 1, 2, 3, or 4 the rounding will be down. Then if this digit is a 5, you should look to the remaining digits beyond the 5 to see if they are all zeroes.

If they are not all zeroes, then the number does not end in an exact 5 and should be rounded up. If all remaining digits to the right are zero or in other word there are no additional digits available to the right of the 5, then the number in its current precision is an exact 5. Then in this state, that the number should be rounded up as often as it is rounded down. This is a research done by choosing ten samples digits if they are less, equal and more 5 in the decimal place to check the round result through these three cases in SPSS and MS Excel.

2. Method

The concept of this research is calculates rounding and truncate in SPSS and round function in MS Excel for 10 random digits numbers and comparing the results in the two programs with the same digits numbers. Compare the rounding outputs in both programs in four decimal places. The research Methodology is by choosing 10 random digits numbers with four decimal places and do the rounding less than 5, equal 5 (after decimal place numbers) and bigger than 5. These rounding could do it in SPSS and MS Excel with the same ten random digits numbers in both. Then could compare the rounding and truncate results of the same digits numbers in the two programs.
The rounding is done according to 5 number position whether it in under, equal (after decimal place number to get rounding in the decimal place number) and higher than 5, if the number after the decimal place is bigger or less than 5. In the below tables can see the decimal place in bold color. In case of that it is equal 5; the position of the five numbers must be after the decimal place.
In MS Excel the rounding is done by ROUND function by inter the digit and then inter the decimal place. In SPSS must consider how many decimal places should inter when interring the variables.

3. SPSS rounding

3.1. Under 5

Table 1.3.1: The under 5 digits number and their decimal places

Digits Numbers		1	2	3	4	5	6	7	8	9	10
Decimal Places	1	26.**4**2	77.**3**2	12.**2**2	49.**1**4	66.**0**1	33.**3**4	70.**4**4	41.**1**3	75.**0**3	91.**1**1
	2	76.3**4**3	86.4**4**4	90.2**1**3	24.4**3**3	55.4**2**0	78.2**2**2	40.3**0**2	11.1**0**1	20.4**1**0	30.3**2**1
	3	67.34**2**1	74.32**1**4	46.23**1**3	90.10**2**0	45.23**3**3	76.20**0**3	31.23**0**4	87.21**1**3	50.44**4**4	10.34**2**3
	4	24.102**0**1	76.343**2**1	11.344**4**1	90.203**0**2	43.123**2**0	21.404**0**0	87.223**2**3	21.340**0**0	10.201**1**1	99.234**2**1

The SPSS outputs rounding if the decimal places numbers are less than 5 in the four decimal places like in table 2.3.1:

Table 2.3.1: SPSS under 5 digits number rounding results

The first decimal place rounding result

one	two	three	four	five	six	seven	eight	nine	ten
26.4	77.3	12.2	49.1	66.0	33.3	70.4	41.1	75.0	91.1

The second decimal place rounding result

one	two	three	four	five	six	seven	eight	nine	ten
76.34	86.44	90.21	24.43	55.42	78.22	40.30	11.10	20.41	30.32

The third decimal place rounding result

one	two	three	four	five	six	seven	eight	nine	ten
67.342	74.321	46.231	90.102	45.233	76.200	31.230	87.211	50.444	10.342

The fourth decimal place rounding result

one	two	three	four	five	six	seven	eight	nine	ten
24.1020	76.3432	11.3444	90.2030	43.1232	21.4040	87.2232	21.3400	10.2011	99.2342

3.2. Equal 5 after decimal place number

In this case the five numbers must be after the number of decimal place to get the rounding outputs:

Table 1.3.2: The Equal 5 digits and their decimal places

Digits Numbers		1	2	3	4	5	6	7	8	9	10
Decimal Places	1	26.**25**	77.**35**	12.**05**	49.**75**	66.**85**	33.**75**	70.**85**	41.**95**	75.**15**	91.**45**
	2	76.3**45**	86.4**65**	90.2**35**	24.4**95**	55.4**05**	78.2**95**	40.3**05**	11.1**15**	20.5**55**	30.5**95**
	3	67.34**85**	74.32**05**	46.23**65**	90.10**45**	45.23**55**	76.20**35**	31.23**95**	87.21**75**	50.44**95**	10.34**35**
	4	24.102**15**	76.343**15**	11.344**05**	90.203**55**	43.123**75**	21.404**45**	87.223**85**	21.340**25**	10.201**65**	99.234**45**

In the table 2.3.2 the SPSS outputs rounding if the decimal places are equal 5 and put it after decimal place number in the four decimal places are:

Table 2.3.2: SPSS equal 5 digits number rounding results

The first decimal place rounding result

one	two	three	four	five	six	seven	eight	nine	ten
26.3	77.4	12.1	49.8	66.9	33.8	70.9	42.0	75.2	91.5

The second decimal place rounding result

one	two	three	four	five	six	seven	eight	nine	ten
76.35	86.47	90.24	24.50	55.41	78.30	40.31	11.12	20.56	30.60

The third decimal place rounding result

one	two	three	four	five	six	seven	eight	nine	ten
67.349	74.321	46.237	90.105	45.236	76.204	31.240	87.218	50.450	10.344

The fourth decimal place rounding result

one	two	three	four	five	six	seven	eight	nine	ten
24.1022	76.3432	11.3441	90.2036	43.1238	21.4045	87.2239	21.3403	10.2017	99.2345

3.3 Higher than 5

Table 1.3.3: The higher than 5 digits number and their decimal places

Digits Numbers		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Decimal Places	**1**	26.67	77.76	12.99	49.87	66.98	33.77	70.88	41.69	75.97	91.86
	2	76.377	86.486	90.298	24.468	55.476	78.269	40.387	11.166	20.596	30.589
	3	67.3488	74.3279	46.2366	90.1097	45.2369	76.2076	31.2369	87.2179	50.4489	10.3496
	4	24.10268	76.34377	11.34496	90.20376	43.12397	21.40469	87.22378	21.34069	10.20186	99.23497

The SPSS outputs rounding if the decimal places numbers are higher than 5 in the four decimal places are in this table:

Table 2.3.3: SPSS Higher than 5 digits rounding results

The first decimal place rounding result

one	two	three	four	five	six	seven	eight	nine	ten
26.7	77.8	13.0	49.9	67.0	33.8	70.9	41.7	76.0	91.9

The second decimal place rounding result

one	two	three	four	five	six	seven	eight	nine	ten
76.38	86.49	90.30	24.47	55.48	78.27	40.39	11.17	20.60	30.59

The third decimal place rounding result

one	two	three	four	five	six	seven	eight	nine	ten
67.349	74.328	46.237	90.110	45.237	76.208	31.237	87.218	50.449	10.350

The fourth decimal place rounding result

one	two	three	four	five	six	seven	eight	nine	ten
24.1027	76.3438	11.3450	90.2038	43.1240	21.4047	87.2238	21.3407	10.2019	99.2350

4. MS excel rounding

4.1. Under 5

Table 1.4.1: Under 5 digits and their decimal places

Digits Numbers		1	2	3	4	5	6	7	8	9	10
Decimal Places	1	26.42	77.32	12.22	49.14	66.01	33.34	70.44	41.13	75.03	91.11
	2	76.343	86.444	90.213	24.433	55.420	78.222	40.302	11.101	20.410	30.321
	3	67.3421	74.3214	46.2313	90.1020	45.2333	76.2003	31.2304	87.2113	50.4444	10.3423
	4	24.10201	76.34321	11.34441	90.20302	43.12320	21.40400	87.22323	21.34000	10.20111	99.23421

The same method rounding in SPSS, in MS Excel outputs rounding after consideration that the decimal places are less than 5 in the four decimal places are:

Table 2.4.1: Excel under 5 digits rounding results

The first decimal place rounding result

1	2	3	4	5	6	7	8	9	10
91.1	75	41.1	70.4	33.3	66	49.1	12.2	77.3	26.4

The second decimal place rounding result

1	2	3	4	5	6	7	8	9	10
30.32	20.41	11.1	40.3	78.22	55.42	24.43	90.21	86.44	76.34

The third decimal place rounding result

1	2	3	4	5	6	7	8	9	10
10.342	50.444	87.211	31.23	76.2	45.233	90.102	46.231	74.321	67.342

The fourth decimal place rounding result

1	2	3	4	5	6	7	8	9	10
99.2342	10.2011	21.34	87.2232	21.404	43.1232	90.203	11.3444	76.3432	24.102

4.2. Equal 5 after decimal place number

The same in SPSS, this rounding in MS Excel is consider 5 number after the decimal place number

Table 1.4.2: Equal 5 digits and their decimal places

Digits Numbers		1	2	3	4	5	6	7	8	9	10
Decimal Places	1	26.25	77.35	12.05	49.75	66.85	33.75	70.85	41.95	75.15	91.45
	2	76.345	86.465	90.235	24.495	55.405	78.295	40.305	11.115	20.555	30.595
	3	67.3485	74.3205	46.2365	90.1045	45.2355	76.2035	31.2395	87.2175	50.4495	10.3435
	4	24.10215	76.34315	11.34405	90.20355	43.12375	21.40445	87.22385	21.34025	10.20165	99.23445

In MS Excel outputs rounding also can consider if the decimal places are equal 5 and put it after decimal place number in the four decimal places are the below table:

Table 2.4.2: Excel equal 5 digits rounding results

The first decimal place rounding result

1	2	3	4	5	6	7	8	9	10
91.5	75.2	42	70.9	33.8	66.9	49.8	12.1	77.4	26.3

The second decimal place rounding result

1	2	3	4	5	6	7	8	9	10
30.6	20.56	11.12	40.31	78.3	55.41	24.5	90.24	86.47	76.35

The third decimal place rounding result

1	2	3	4	5	6	7	8	9	10
10.344	50.45	87.218	31.24	76.204	45.236	90.105	46.237	74.321	67.349

The fourth decimal place rounding result

1	2	3	4	5	6	7	8	9	10
99.2345	10.2017	21.3403	87.2239	21.4045	43.1238	90.2036	11.3441	76.3432	24.1022

4.3. Higher than 5

Table 1.4.3: Higher than 5 digits and their decimal places

Digits Numbers		1	2	3	4	5	6	7	8	9	10
Decimal Places	1	26.67	77.76	12.99	49.87	66.98	33.77	70.88	41.69	75.97	91.86
	2	76.377	86.486	90.298	24.468	55.476	78.269	40.387	11.166	20.596	30.589
	3	67.3488	74.3279	46.2366	90.1097	45.2369	76.2076	31.2369	87.2179	50.4489	10.3496
	4	24.10268	76.34377	11.34496	90.20376	43.12397	21.40469	87.22378	21.34069	10.20186	99.23497

MS Excel outputs rounding if the decimal places numbers are higher than 5 in the four decimal places are in the table 2.4.3:

Table 2.4.3: Excel higher than 5 rounding results

The first decimal place rounding result									
1	2	3	4	5	6	7	8	9	10
91.9	76	41.7	70.9	33.8	67	49.9	13	77.8	26.7
The second decimal place rounding result									
1	2	3	4	5	6	7	8	9	10
30.59	20.6	11.17	40.39	78.27	55.48	24.47	90.3	86.49	76.38
The third decimal place rounding result									
1	2	3	4	5	6	7	8	9	10
10.35	50.449	87.218	31.237	76.208	45.237	90.11	46.237	74.328	67.349
The fourth decimal place rounding result									
1	2	3	4	5	6	7	8	9	10
99.235	10.2019	21.3407	87.2238	21.4047	43.124	90.2038	11.345	76.3438	24.1027

5. Discussion

The outputs of the rounding less, equal and after decimal place and higher than 5 are all the same results in SPSS and MS Excel, except that MS Excel truncate the zeros by default after the decimal point number if there zeroes after it and in the last one or two or even three numbers.

From the tabulation results can be seen that in the first output of the rounding under 5, which is less than 5 in the second decimal point, can be found the digit 11.10 in SPSS is truncated in MS Excel to 11.1 which is rounding to two decimal places. Also less than 5 outputs can see the digit: 76.200 in SPSS rounded to three decimal places while in MS Excel rounded to 76.2. Another example indicates that MS Excel truncate the digit number if there are zeroes after the decimal point, if there aren't any number only (0000), like 21.3400 when rounded to four decimal places rounded to 21.34 in Microsoft Excel program where in the SPSS statistical program is 21.3400.

In other outputs from the tabulation outputs indicate that MS Excel program is rounding the digits without zeroes after decimal point numbers in the equal and after decimal place is 30.60 in the second decimal place rounding. This digit rounded to 30.6 in Microsoft Excel and in SPSS result got the same digit (30.60). Also 13.240 in the third decimal place rounding can be seen that it is rounded to 13.24 in MS Excel. It could be seen from the first time to the reader that it is rounded to second decimal place, but MS Excel rounding it as third decimal place. 67.0 is a digit rounded to the first decimal place. In SPSS is the same 67.0, in contrast in MS Excel it is rounded to 67. In this rounding for the reader it is an integer while it is rounded to first decimal place.

SPSS is more precise than MS Excel in the last results calculation in considering the digits numbers after the decimal point.

Last instances when rounding to fourth decimal place in this digit: 11.2450, it is rounded to four decimal places while in MS excel rounded to 11.245 with truncate of the zero after 5.

When doing a function in SPSS and MS Excel, example for that is Sum function for digits numbers: 56.60000 +34.70000 will equal 91.30000.

In SPSS statistic program will equal 91.30000. In contrast in MS Excel it equal 91.3 which is rounded to that digit in MS Excel. This function result is rounded without zeroes after decimal point and after first number 3.

Average function can be calculated for 4.3000, 4.4000 and 4.5000 the output of SPSS is 4.4000 and the result in MS Excel is 4.4.

In such Statistical programs, the SPSS program is more precise than MS Excel especially in counting the decimal places after the decimal point.

This digit: 2.3000000 is indicates how many precise after decimal point is want, example for that, if want two decimal points the result will be 2.30 while the in the MS Excel in 2.3. If wanted is four decimal places the result will be 2.3000 and also in the MS Excel the result is 2.3.
In MS Excel there is no significant zeros are displayed correctly when rounding a number to a certain number of significant digits.
Ted French, 2014 [4] in his article entitled: Excel Round Function, he said that Excel normally rounding the number to the right of the rounding digit determines whether the rounding digit will be rounded up or down.
Ted French also said that MS Excel follows some rules like SPSS program rules when doing the rounding: the first is if the value of the number to the right of the rounding digit is less than five, the rounding digit is left unchanged. The second is if the value of the number to the right of the rounding digit is five or higher, the rounding digit is raised by one.
According to Tim Birkett on Online Excel Tutorial, 2006 [5]: in MS Excel, Round function takes two arguments first the number to be rounded while the second is the number of decimal places to round to. He said also to prevent the format to do not displaying three zeros based on this research outputs, it is suggested to put comma like this: #,###,;

6. Conclusion

From the statistic programs are SPSS, SAS and STAT as well as Microsoft Excel programs that can by it done many statistical operations and many functions. These functions are common between such as these statistical programs and the same rules are followed. Round function in SPSS and MS Excel is shared.
The ten samples digits numbers which are less than 5, more than 5 and equal 5, are all the same outputs got when applying rounding in both SPSS and MS Excel. The same round is gotten with the same results. A SPSS statistical program is more precise than MS Excel when it truncates any zero after decimal point in the digit number. Wherever decimal place is wanted after specific decimal point in the digit will be truncated in Microsoft Excel. Example for that in this research is: 21.34000 rounded to 21.34, while it wanted the fourth decimal place to round.
In case of calculate some other functions like sum and average also the same results will get after done the function with truncate the zeroes after decimal point whatever number of zeros are there. Based on SPSS that it is more precise and more support in précised results in the calculations. According to what the researcher wants that could assign the decimal place to round the digit number statistically within the range of precision that the researcher wants.

7. Acknowledgment

Thank to everyone help me and was helpful to finish this research. I hope that this research is very useful for who looking something about applying functions in SPSS and MS Excel and to go through such as like this scientific researching in IT. I hope to do more researches in IT and CS scope in the future.

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