

A	B	C	D	E	F	G	H	I	
Assume Households (#) have a Log-Normal Distribution by Income.									
<b>Households Log-Normal Distribution</b>					<b>Households Normal Distribution</b>				
Income	Median	50				mu	3.912	=LN(C4)	
	Mean	80				mu+S^2/2	4.382	=LN(C5)	
	Mode	19.5	=EXP(H4-H6)			Sigma^2	0.940	=2*(H5-H4)	
	PDF# (Mode)	1.32E-02	=LOGNORM.DIST(C7,H4,H7,0)			Sigma	0.970	=SQRT(H6)	
	Std.Dev	99.9	=SQRT((EXP(H6)-1)*EXP(2*H4+H6))						
	%HH by HH\$ < Ave\$	0.686	=NORM.S.DIST(SQRT(LN(C5/C4)/2), 1)						
	Gini Coefficient	0.507	=2*NORM.S.DIST(H7/SQRT(2),1)-1						

A	B	C	D	E	F	G	H	I	
Since households have a Log-Normal distribution by Income with mu# and sigma#, it follows that total Income has a Log-Normal Distribution by HH Income [Aitchinson & Brown (1963)] with parameters mu\$ = (mu# + sigma#^2) and sigma\$ = sigma#									
<b>Total Income Log-Normal Distribution</b>					<b>Total Income Normal Distribution</b>				
	Median\$	128	=EXP(H17)			mu\$	4.852	=H4+H6	
	Mean\$	205	=EXP(H20)			Sigma\$	0.970	=H7	
	Mode	50.0	=EXP(H17-H19)			Sigma\$^2	0.940	=H18^2	
	PDF (Mode)	5.14E-03	=LOGNORM.DIST(C20,H17,H18,0)			mu\$+S\$^2/2	5.322	=H17+H19/2	
	StdDev=Mean*CV	255.8	=C18*SQRT(((C18/C17)^2)-1)						
	%Tot\$ by HH\$ > Ave\$	0.686	=1-NORM.DIST(LN(C5),H17,H18,1)						

A	B	C	D	E	F	G	H	I	
<b>CELL</b>	<b>FormulaText()</b>				<b>CELL</b>	<b>FormulaText()</b>			
Add, B33.	C33: Manual entry (Already entered)				F33	=1-C33			
B34	=LOGNORM.INV(A34,H\$4,H\$7)				G33	=F33/E33			
C34	=LOGNORM.DIST(B34,H\$17,H\$18,1)				H33	=C\$5*F33/E33			
E33	=1-A33				I34	=H34/B34			

A	B	C	D	E	F	G	H	I	
-----BOTTOM-UP----- <b>Table 1</b> ---TOP_DOWN--- Times=Share Above AboveAve\$									
Pct#	#Cutoff\$	%\$cdf		%#down	%%\$down	%%\$/%#	Ave\$		AboveAve\$ /Cutoff\$
0%	0.0	0.00%		100%	100.0%	1.0	80		
10%	14.4	1.22%		90%	98.8%	1.1	88		6.1
20%	22.1	3.51%		80%	96.5%	1.2	96		4.4
30%	30.1	6.76%		70%	93.2%	1.3	107		3.5
40%	39.1	11.07%		60%	88.9%	1.5	119		3.0
50%	50.0	16.61%		50%	83.4%	1.7	133		2.7
60%	63.9	23.69%		40%	76.3%	1.9	153		2.4
70%	83.1	32.81%		30%	67.2%	2.2	179		2.2
75%	96.2	38.40%		25%	61.6%	2.5	197		2.1
80%	113.1	44.91%		20%	55.1%	2.8	220		1.9
85%	136.6	52.67%		15%	47.3%	3.2	252		1.8
90%	173.2	62.25%		10%	37.8%	3.8	302		1.7
95%	246.4	75.03%		5%	25.0%	5.0	400		1.6
98%	366.2	86.09%		2%	13.9%	7.0	557		1.5
99%	477.0	91.26%		1%	8.7%	8.7	699		1.5
99.5%	607.5	94.59%		0.5%	5.4%	10.8	866		1.4
99.9%	1000.4	98.30%		0.1%	1.7%	17.0	1,358		1.4
99.95%	1214.8	98.99%		0.05%	1.0%	20.3	1,623		1.3
99.99%	1840.4	99.70%		0.01%	0.3%	29.8	2,388		1.3

<http://www.statlit.org/Excel/2014-Schield-Explore-LogNormal-Incomes-Excel2013.xlsx>

<b>CELL</b>	<b>FormulaText()</b>	<b>CELL</b>	<b>FormulaText()</b>	
A62	Manual entries (Already enetered)	F62	=LOGNORM.DIST(A62,H\$17,H\$18,0)	53
B62	=LOGNORM.DIST(A62,\$H\$4,\$H\$7,0)	G62	=F62/C\$21	54
C62	=B62/C\$8	H62	=F62/C\$8	55
D62	=LOGNORM.DIST(A62,H\$4,H\$7,1)	I62	=LOGNORM.DIST(A62,H\$17,H\$18,1)	56

To make reading Table 2 easier, hide columns B-C and F-H. Unhide to read Table 1

A	B	C	D	E	F	G	H	I	59
---	---	---	---	---	---	---	---	---	----

<b>Table 2</b>	<b>Distribution of Subjects by Income</b>				<b>Distribution of Total Income by Amount</b>				60
----------------	-------------------------------------------	--	--	--	-----------------------------------------------	--	--	--	----

Income	PDF#	% of mode	CDF#
1	1.20E-04	0.91%	0.00%
2	8.31E-04	6.31%	0.05%
3	2.04E-03	15.46%	0.19%
4	3.46E-03	26.25%	0.46%
5	4.90E-03	37.25%	0.88%
7	7.52E-03	57.12%	2.13%
8	8.62E-03	65.46%	2.94%
9	9.57E-03	72.67%	3.85%
10	1.04E-02	78.79%	4.85%
12	1.16E-02	88.14%	7.05%
14	1.24E-02	94.27%	9.46%
16	1.29E-02	97.91%	12.00%
18	1.31E-02	99.65%	14.60%
20	1.32E-02	99.97%	17.23%
22	1.31E-02	99.25%	19.86%
24	1.29E-02	97.77%	22.45%
26	1.26E-02	95.74%	25.00%
28	1.23E-02	93.33%	27.49%
30	1.19E-02	90.67%	29.91%
33	1.14E-02	86.39%	33.41%
36	1.08E-02	81.96%	36.74%
40	1.00E-02	76.08%	40.90%
43	9.45E-03	71.80%	43.82%
46	8.91E-03	67.68%	46.57%
50	8.23E-03	62.50%	50.00%
55	7.45E-03	56.54%	53.92%
60	6.74E-03	51.17%	57.46%
65	6.10E-03	46.35%	60.67%
70	5.53E-03	42.03%	63.57%
75	5.03E-03	38.18%	66.21%
80	4.57E-03	34.73%	68.61%
90	3.80E-03	28.89%	72.78%
100	3.19E-03	24.20%	76.27%
110	2.69E-03	20.41%	79.20%
120	2.28E-03	17.32%	81.67%
130	1.95E-03	14.79%	83.78%
140	1.67E-03	12.70%	85.59%
150	1.44E-03	10.96%	87.14%
160	1.25E-03	9.51%	88.49%
170	1.09E-03	8.29%	89.66%
180	9.55E-04	7.25%	90.68%
190	8.39E-04	6.37%	91.57%
200	7.40E-04	5.62%	92.36%

PDF\$	% of \$mode	%of#mode	CDF\$
1.50E-06	0.03%	0.01%	0.00%
2.08E-05	0.40%	0.16%	0.00%
7.63E-05	1.48%	0.58%	0.01%
1.73E-04	3.36%	1.31%	0.02%
3.07E-04	5.96%	2.33%	0.04%
6.58E-04	12.79%	5.00%	0.14%
8.62E-04	16.76%	6.55%	0.21%
1.08E-03	20.93%	8.17%	0.31%
1.30E-03	25.21%	9.85%	0.43%
1.74E-03	33.85%	13.22%	0.73%
2.17E-03	42.23%	16.50%	1.12%
2.58E-03	50.13%	19.58%	1.60%
2.95E-03	57.40%	22.42%	2.15%
3.29E-03	63.98%	24.99%	2.78%
3.59E-03	69.87%	27.29%	3.47%
3.86E-03	75.09%	29.33%	4.21%
4.10E-03	79.66%	31.12%	5.01%
4.30E-03	83.63%	32.67%	5.85%
4.48E-03	87.04%	34.00%	6.73%
4.69E-03	91.23%	35.63%	8.10%
4.86E-03	94.42%	36.88%	9.54%
5.01E-03	97.39%	38.04%	11.51%
5.08E-03	98.80%	38.59%	13.03%
5.12E-03	99.63%	38.92%	14.56%
5.14E-03	100.00%	39.06%	16.61%
5.12E-03	99.52%	38.87%	19.18%
5.05E-03	98.25%	38.38%	21.73%
4.96E-03	96.40%	37.66%	24.23%
4.84E-03	94.16%	36.78%	26.68%
4.71E-03	91.63%	35.79%	29.07%
4.57E-03	88.91%	<b>34.73%</b>	31.39%
4.28E-03	83.21%	32.50%	35.82%
3.98E-03	77.45%	30.25%	39.95%
3.70E-03	71.84%	28.06%	43.79%
3.42E-03	66.52%	25.98%	47.35%
3.16E-03	61.53%	24.04%	50.64%
2.93E-03	56.90%	22.23%	53.68%
2.71E-03	52.62%	20.56%	56.50%
2.50E-03	48.69%	19.02%	59.10%
2.32E-03	45.09%	17.61%	61.51%
2.15E-03	41.78%	16.32%	63.74%
1.99E-03	38.75%	15.14%	65.81%
1.85E-03	35.98%	14.05%	67.74%

**DEFINITIONS Study these closely before answering any questions.**

**Table 1 on Page 1: Sorted by Percentile: Percentage of subjects below stated income.**

Cell	ID	Definition
A33	Pct#	X: The percentile of subjects by income
B33	#Cutoff\$	The income needed for a subject to be at the Xth percentile by income
C33	;%cdf	The percentage of total income earned by subjects having an income <b>below</b> the cutoff
E33	;%#down	Y: The percentage of subjects having incomes <b>above</b> the cutoff.
F33	;%\$down	Percentage of total income earned by the <b>top</b> Y percentage of subjects by income
G33	;%\$/%#	TimesEqualShare: <b>Top-down</b> ratio of cumulative pctg of income to cumul. pctg. of subjects
H33	Ave\$	The average income of subjects in the <b>top</b> Y percentage of subjects by income
I34	/Cutoff\$	Tatio of average income above the Xth percentile to the cutoff income at the Xth percentile.

**Table 2 on Page 2: Sorted by Income**

A62	Income	X: The income (in \$1,000)
D62	CDF#	The percentage of <b>subjects</b> that have incomes <b>BELOW</b> X
I62	CDF\$	The percentage of <b>total income</b> that is earned by subjects having incomes <b>BELOW</b> X

**PRACTICE QUESTIONS:**

**Table 1 (Pg 1) is sorted by percentages (bottom up & top down); Table 2 (Pg 2) is sorted by Incomes**

- | Q | Answer             | Question:                                                                                                                                                                                        |
|---|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | 96.2K<br>Cell B41  | If Median = 50k and Mean = 80k, what is the minimum income (\$) needed to be in the top 25% of income earners (#)?<br>% of subjects =>Table 1. Top 25% = Bottom 75% => Row 41. Min Income Col B. |
| 2 | 16.6%<br>Cell C38  | what percentage of income (\$) is earned by the bottom 50% of income earners (#)?<br>% of subjects =>Table 1. Bottom 50% => Row 38. Pctg of total income =Col C.                                 |
| 3 | 25.0%<br>Cell F45. | what percentage of income (\$) is earned by the top 5% of income earners?<br>% of subjects =>Table 1. Top 5% => Top Down Row 45. Pctg of total income = Col F.                                   |
| 4 | 5.0<br>Cell G45    | The top 5% of subjects have ____ times their equal share of total income<br>% of subjects => Table 1. Top 5% => Top Down Row 45. Times their equal share=> Col G                                 |
| 5 | 68.6%<br>Cell D92  | what percentage of subjects (#) have income less than 80K<br>Less than \$ => Table 2. 80K => Row 92. Pctg of subjects below % => Col D.                                                          |
| 6 | 31.4%<br>Cell I92  | what percentage of income (\$) is earned by subjects (#) making <b>less</b> than 80k<br>Less than \$ => Table 2. 80K => Row 92. Pctg of Income below => Col I                                    |
| 7 | 68.6%              | what percentage of income (\$) is earned by subjects (#) making <b>more</b> than 80k<br>arithmetic 100% - 31.4%                                                                                  |