

VOG Create Sampling Distribution of a Single Die using COUNTIF in Excel 2013 1

Create Sampling Distributions from a Single Die in Excel 2013

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Slides at: www.StatLit.org/pdf/Excel2013-Sampling-1Die-Demo-Slides.pdf

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The Goal and Approach

Goal: to create the sampling distribution from a single die with various sample sizes using Excel 2013.

A preformatted data spreadsheet is at www.StatLit.org/xls/Excel2013-Sampling-1Die-Data.xlsx

This step-by-step demo is at www.StatLit.org/pdf/Excel2013-Sampling-1Die-Demo-Slides.pdf

A picture of the output is at www.StatLit.org/pdf/Excel2013-Sampling-1Die-Demo-Output.pdf

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Steps in Creating Sampling Distributions for a single die

Access Pre-formatted Data Worksheet:

1. Insert RandBetween(1, 6) to simulate throw of die.
2. Create row averages: samples of 4, 16, 25, 50, 200.
3. Calculate population statistics for a single die.
4. Calculate summary sample statistics by sample size.
5. Group row averages into frequency bins.
6. Create line-graph histograms by sample size.

Upload completed worksheet.

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1a: Insert RandBetween(1,6) Function in AA5

Randomly generated numbers will be random!

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1b: Drag over 200 columns to the right to HR5

Drag this first row of random numbers down 200 rows to Row 204

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2a: In S5, create row average with sample size four

Notice that the range is only four columns wide: AA5:AD5
 Averages of random numbers will be random!

2b: In T5, create row average with sample size of 16

`=AVERAGE($AA5:AP5)`

L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	IJ	JK	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LL	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS	TT	TU	TV	TW	TX	TY	TZ	UA	UB	UC	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE	XF	XG	XH	XI	XJ	XK	XL	XM	XN	XO	XP	XQ	XR	XS	XT	XU	XV	XW	XX	XY	XZ	YA	YB	YC	YD	YE	YF	YG	YH	YI	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	ZC	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW	ZX	ZY	ZZ	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	IJ	JK	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LL	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS	TT	TU	TV	TW	TX	TY	TZ	UA	UB	UC	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE	XF	XG	XH	XI	XJ	XK	XL	XM	XN	XO	XP	XQ	XR	XS	XT	XU	XV	XW	XX	XY	XZ	YA	YB	YC	YD	YE	YF	YG	YH	YI	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	ZC	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW	ZX	ZY	ZZ	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	IJ	JK	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LL	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS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4c: H11 Ratio of Std. Error to Population Std. Deviation

H11: $=H10/SB5$

A	B	C	D	E	F	G	H	
1	A	B	C	D	E	F	G	H
2	3	Population: Six sides of a Single Die						
3	1	2	3	4	5	6		
4	3.5	Mean			3.5	Median		
5	1.71	Std Dev Population			0.748	StdDev / Half-R		
6								
7	4	Sample Size		4	16	25	50	200
8		Mean of Means					3.47	
9		Median of Means					3.50	
10		Std Dev of Means					0.12	
11		SE: % of Pop SD					7%	
12		1/Sqrt(n)						

Insert $=1/\text{SQRT}(H7)$ into cell H12

4d: Drag H8:H12 column left-ward to fill out the table

D11: $=D10/SB5$

A	B	C	D	E	F	G	H	
1	A	B	C	D	E	F	G	H
2	3	Population: Six sides of a Single Die						
3	1	2	3	4	5	6		
4	3.5	Mean			3.5	Median		
5	1.71	Std Dev Population			0.748	StdDev / Half-R		
6								
7	4	Sample Size		4	16	25	50	200
8		Mean of Means		3.52	3.51	3.52	3.53	3.52
9		Median of Means		3.50	3.53	3.52	3.52	3.51
10		Std Dev of Means		0.85	0.41	0.34	0.24	0.12
11		SE: % of Pop SD		50%	24%	20%	14%	7%
12		1/Sqrt(n)		50%	25%	20%	14%	7%

5a: Insert COUNTIF function in H17

H17: $=\text{COUNTIF}(W\$5:W\$204, "<="&\$C17)$

A	B	C	D	E	F	G	H	I
13								
14	3	Rolling a Single Six-Sided Die						
15		----- Distribution of Averages by Sample size -----						
16		Midpoint	Max	4	16	25	50	200
17		2.10	2.00					0
18		2.10	2.20					0
19		2.30	2.40					0
20		2.50	2.60					0
21		2.70	2.80					0
22		2.90	3.00					0
23		3.10	3.20					0
24		3.30	3.40					0

Insert \$ sign in before Column in range; before Row in single cell!

5b: Insert "=CountIF() -Sum()" function in 2nd row: H18

H18: $=\text{COUNTIF}(W\$5:W\$204, "<="&\$C18) - \text{SUM}(H\$17:H17)$

C	D	E	F	G	H	I	J	
		Rolling a Single Six-Sided Die						
		----- Distribution of Averages by Sample size -----						
		Max	4	16	25	50	200	
		2.00					0	
		2.20					0	
		2.40					0	
		2.60					0	
		2.80					0	
		3.00					0	
		3.20					0	
		3.40					0	
		3.60					0	

H18: Equivalent to $=\text{COUNTIF}(W\$5:W\$204, "<="&\$C18) - \text{COUNTIF}(W\$5:W\$204, "<="&\$C17)$

Insert single \$ sign in Sum function before first row.

5c: Drag H18, =CountIF() -Sum(), formula down to bottom row

H18: $=\text{COUNTIF}(W\$5:W\$204, "<="&\$C18) - \text{SUM}(H\$17:H17)$

A	B	C	D	E	F	G	H	I	J
14	3	Rolling a Single Six-Sided Die							
15		----- Distribution of Averages by Sample size -----							
16		Midpoint	Max	4	16	25	50	200	
17		2.10	2.00					0	
18		2.10	2.20					0	
19		2.30	2.40					0	
20		2.50	2.60					0	
21		2.70	2.80					0	
22		2.90	3.00					0	
23		3.10	3.20					0	
24		3.30	3.40					0	
25		3.50	3.60					44	
26		3.70	3.80					117	
27		3.90	4.00					36	
28		4.10	4.20					0	
29		4.30	4.40					0	
30		4.50	4.60					0	
31		4.70	4.80					0	
32		4.90	5.00					0	
33		Total # of Samples		0	0	0	0	200	

Drag entire right column (H17:H32) left-ward to fill out frequency table.

Insert SUM at bottom of each column.

May be different from 200.

Do not include H17 when dragging H18 downward!!!

6a: Select Data (B17:H32) to use in Histogram

A	B	C	D	E	F	G	H	
14	3	Rolling a Single Six-Sided Die						
15		----- Distribution of Averages by Sample size -----						
16		Midpoint	Max	4	16	25	50	200
17		2.10	2.00	10	0	0	0	0
18		2.10	2.20	0	0	0	0	0
19		2.30	2.40	10	0	0	0	0
20		2.50	2.60	8	3	0	0	0
21		2.70	2.80	8	4	3	0	0
22		2.90	3.00	24	18	20	2	0
23		3.10	3.20	0	23	18	20	1
24		3.30	3.40	34	34	40	50	39
25		3.50	3.60	17	33	53	66	113
26		3.70	3.80	21	33	33	46	47
27		3.90	4.00	21	30	18	15	0
28		4.10	4.20	0	14	13	1	0
29		4.30	4.40	13	8	2	0	0
30		4.50	4.60	15	0	0	0	0
31		4.70	4.80	11	0	0	0	0
32		4.90	5.00	4	0	0	0	0
33		Total # of Samples		196	200	200	200	200

19

6b: Insert X-Y Scatter Plot

Midpoint	Max	4	16	25	50	200
2.10	2.00	15	0	0	0	0
2.10	2.20	0	0	0	0	0
2.30	2.40	5	0	0	0	0
2.50	2.60	7	2	0	0	0
2.70	2.80	6	12	9	0	0
2.90	3.00	20	21	14	0	0
3.10	3.20	0	20	23	20	5
3.30	3.40	22	26	35	47	43
3.50	3.60	23	49	38	65	118
3.70	3.80	29	26	47	39	35
3.90	4.00	20	30	21	18	1
4.10	4.20	0	14	11	3	0
4.30	4.40	16	6	3	0	0
4.50	4.60	18	1	1	0	0
4.70	4.80	9	1	0	0	0
4.90	5.00	7	1	0	0	0
Total # of Samples		197	200	200	200	200

20

6c: Format Horizontal Axis: Change Min and Max

Delete legend.

21

6d: Select/delete Series 5 (size 50), 3 (size 16) and 1 (Max).

22

6e: Insert Title and Horizontal Axis Text

23

6f: Insert legends in text boxes. Final Result

24

Summary

When sampling from a process, the population “size” is “infinite”. That doesn’t influence the standard deviation.

Notice as sample size increases, the standard error (the std. deviation of the sample means) quickly decreases – as a percentage of the population standard deviation.

A sample of size 4 is expected to have a standard error that is only a half of the population standard deviation: a sample of 25 has a fifth, a sample of 100 has a tenth and a sample of 10,000 has a hundredth.

Create Sampling Distributions from a Single Die in Excel 2013

Milo Schield

Member: International Statistical Institute

US Rep: International Statistical Literacy Project

Director, W. M. Keck Statistical Literacy Project

Slides at: www.StatLit.org/pdf/

Excel2013-Sampling-1Die-Demo-Slides.pdf

The Goal and Approach

Goal: to create the sampling distribution from a single die with various sample sizes using Excel 2013.

A preformatted data spreadsheet is at www.StatLit.org/xls/Excel2013-Sampling-1Die-Data.xlsx

This step-by-step demo is at www.StatLit.org/pdf/

- [Excel2013-Sampling-1Die-Demo-Slides.pdf](http://www.StatLit.org/pdf/Excel2013-Sampling-1Die-Demo-Slides.pdf)

A picture of the output is at www.StatLit.org/pdf/Excel2013-Sampling-1Die-Demo-Output.pdf

Steps in Creating Sampling Distributions for a single die

Access Pre-formatted Data Worksheet:

1. Insert `RandBetween(1, 6)` to simulate throw of die.
2. Create row averages: samples of 4, 16, 25, 50, 200.
3. Calculate population statistics for a single die.
4. Calculate summary sample statistics by sample size.
5. Group row averages into frequency bins.
6. Create line-graph histograms by sample size.



Upload completed worksheet.

1a: Insert RandBetween(1,6) Function in AA5

	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF
1	U	V	W	X	Y	z	aa	ab				
2					2							
3	Averages				3							
4	25	50	200		4	R1	R2	R3	R4	R5	R6	
5					5	1						
6					6							

Randomly generated numbers will be random!

1b: Drag over 200 columns to the right to HR5

HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT
														Row
														2
														3
188	189	190	191	192	193	194	195	196	197	198	199	200		4
6	6	5	5	1	2	5	4	1	2	5	6	6		5
														6
														7
														8
														9
														10

Drag this first row of random numbers down 200 rows to Row 204

2a: In S5, create row average with sample size four

	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AE	AC	AD
1	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	z	aa	ab		
2								AD	AP	AY	BX	HR		2	AA5	=RANDE			
3								②	Row Averages					3					
4								4	16	25	50	200		4	R1	R2	R3	R4	
5	S5	=AVERAGE(\$AA5:AD5)						3.75						5	4	6	1	4	
6	T5	=AVERAGE(\$AA5:AP5)												6	2	1	1	5	
7	U5	=AVERAGE(\$AA5:AY5)												7	1	6	4	5	
8	V5	=AVERAGE(\$AA5:BX5)												8	2	1	6	2	
9	W5	=AVERAGE(\$AA5:HR5)												9	1	6	2	4	
10													10	1	3	1	2		

Notice that the range is only four columns wide: AA5:AD5

Averages of random numbers will be random!

2b: In T5, create row average with sample size of 16

	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AE	AC	AD	AE
1	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	z	aa	ab			
2	Right-End of Range >>>							AD	AP	AY	BX	HR		2	AA5	=RANDBET				
3								②	Row Averages					3	-----					
4								4	16	25	50	200		4	R1	R2	R3	R4	R5	
5	S5	=AVERAGE(\$AA5:AD5)						3.25	3.69					5	3	3	2	5	4	
6	T5	=AVERAGE(\$AA5:AP5)												6	6	3	3	2	1	
7	U5	=AVERAGE(\$AA5:AY5)												7	2	2	2	1	4	
8	V5	=AVERAGE(\$AA5:BX5)												8	4	4	2	5	5	
9	W5	=AVERAGE(\$AA5:HR5)												9	1	5	2	5	4	
10													10	5	2	2	1	4		
11	Press F9 to get new data.												11	6	6	5	2	1		

In U5:W5, create row averages for sample sizes 25, 50 and 200

Right-end of ranges are shown in S2:W2

2d: Drag First Row Averages, S5:W5, down to Row 204.

S	T	U	V	W	X	Y	
S	T	U	V	W	X	Y	
AD	AP	AY	BX	HR		2	
②	Row Averages						3
4	16	25	50	200		4	
3.25	3.56	3.16	3.26	3.40		5	
						6	
2.25	3.13	3.52	3.66	3.38		200	
3.75	2.94	3.24	3.42	3.35		201	
2.25	3.63	3.56	3.54	3.30		202	
3.50	3.81	3.36	3.76	3.53		203	
3.75	3.50	3.60	3.48	3.42		204	

3a: Generate mean (average) [and median] for a six-sided die

	A	B	C	D	E	F	G
1	A	B	C	D	E	F	G
2	(3)	Population: Six sides of a Single Die					
3		1	2	3	4	5	6
4		3.5	Mean				Median
5			Std Dev Population				StdDev

In cell F4, insert `=Median(B3:G3)`

3b: Generate population std. deviation for a fair die

	A	B	C	D	E	F	G	H	I
1	A	B	C	D	E	F	G	H	I
2	③	Population. Six sides of a Single Die							
3		1	2	3	4	5	6		
4		3.5	Mean			3.5	Median		
5		1.71	Std Dev Population				StdDev / Half-Range		
6									
7	④	Sample Size	4	16	25	50	200		
8		Mean of Means							
9		Median of Means							

In cell F5, insert $=B5/((G3 - B3)/2)$

4a: Generate Mean [& Median] of Row Means for Sample Size 200

		✕		✓		fx	
		=AVERAGE(W\$5:W\$204)					
B	C	D	E	F	G	H	
B	C	D	E	F	G	H	
Population: Six sides of a Single Die							
1	2	3	4	5	6		
3.5	Mean			3.5	Median		
1.71	Std Dev Population			0.683	StdDev / Half-R		
Sample Size	4	16	25	50	200		
Mean of Means					3.50		
Median of Means							

In cell H9, insert =Median(W5:W204)

4b: Generate Sample Std.Dev of Row Means for Size 200

H10		✕ ✓ <i>f_x</i>		=STDEV.S(W5:W204)				
	A	B	C	D	E	F	G	H
1	A	B	C	D	E	F	G	H
2	③	Population: Six sides of a Single Die						
3		1	2	3	4	5	6	
4		3.5	Mean			3.5	Median	
5		1.71	Std Dev Population			0.748	StdDev / Half-R	
6								
7	④	Sample Size		4	16	25	50	200
8		Mean of Means						3.46
9		Median of Means						3.50
10		Std Dev of Means						0.12
11		SE: % of Pop SD						
12		1/Sqrt(n)						

4c: H1 1 Ratio of Std. Error to Population Std. Deviation




H11						=H10/\$B5		
	A	B	C	D	E	F	G	H
1	A	B	C	D	E	F	G	H
2	③	Population: Six sides of a Single Die						
3		1	2	3	4	5	6	
4		3.5	Mean			3.5	Median	
5		1.71	Std Dev Population			0.748	StdDev / Half-R	
6								
7	④	Sample Size		4	16	25	50	200
8		Mean of Means						3.47
9		Median of Means						3.50
10		Std Dev of Means						0.12
11		SE: % of Pop SD						7%
12		1/Sqrt(n)						

Insert $=1/\text{SQRT}(H7)$ into cell H12

4d: Drag H8:H12 column left-ward to fill out the table

D11		✕ ✓ <i>fx.</i>		=D10/\$B5				
	A	B	C	D	E	F	G	H
1	A	B	C	D	E	F	G	H
2	③	Population: Six sides of a Single Die						
3		1	2	3	4	5	6	
4		3.5	Mean			3.5	Median	
5		1.71	Std Dev Population			0.748	StdDev / Half-R	
6								
7	④	Sample Size		4	16	25	50	200
8		Mean of Means		3.52	3.51	3.52	3.53	3.52
9		Median of Means		3.50	3.53	3.52	3.52	3.51
10		Std Dev of Means		0.85	0.41	0.34	0.24	0.12
11		SE: % of Pop SD		50%	24%	20%	14%	7%
12		1/Sqrt(n)		50%	25%	20%	14%	7%

5a: Insert COUNTIF function in H17

H17 :    =COUNTIF(W\$5:W\$204, "<="&\$C17)

	A	B	C	D	E	F	G	H	I
13									
14	⑤			Rolling a Single Six-Sided Die					
15			----- Distribution of Averages by Sample size -----						
16		Midpoint	Max	4	16	25	50	200	
17		2.10	2.00					0	
18		2.10	2.20						
19		2.30	2.40						
20		2.50	2.60						
21		2.70	2.80						
22		2.90	3.00						
23		3.10	3.20						
24		3.30	3.40						

Insert \$ sign in before Column in range; before Row in single cell!

5b: Insert “=CountIF() -Sum()” function in 2nd row: H18

The screenshot shows an Excel spreadsheet with the following data:

	C	D	E	F	G	H	I	J
	Rolling a Single Six-Sided Die							
	----- Distribution of Averages by Sample size -----							
Max	4	16	25	50	200			
2.00						0		
2.20						0		
2.40								
2.60	H18: Equivalent to =COUNTIF(W\$5:W\$204, "<="&\$C18) - COUNTIF(W\$5:W\$204, "<="&\$C17)							
2.80								
3.00								
3.20	Insert single \$ sign in Sum function before first row.							
3.40								
3.60								

The formula bar shows: `=COUNTIF(W$5:W$204, "<="&$C18)-SUM(H$17:H17)`

5c: Drag H18, =COUNTIF()-SUM(), formula down to bottom row

H18 : *fx* =COUNTIF(W\$5:W\$204, "<="&\$C18)-SUM(H\$17:H17)

	A	B	C	D	E	F	G	H	I	J
14	Ⓢ		Rolling a Single Six-Sided Die							
15		----- Distribution of Averages by Sample size -----								
16		Midpoint	Max	4	16	25	50	200		
17		2.10	2.00					0		
18		2.10	2.20					0		
19		2.30	2.40					0		
20		2.50	2.60					0		
21		2.70	2.80					0		
22		2.90	3.00					0		
23		3.10	3.20					3		
24		3.30	3.40					44		
25		3.50	3.60					117		
26		3.70	3.80					36		
27		3.90	4.00					0		
28		4.10	4.20					0		
29		4.30	4.40					0		
30		4.50	4.60					0		
31		4.70	4.80					0		
32		4.90	5.00					0		
33		Total # of Samples		0	0	0	0	200		

Drag entire right column (H17:H32) left-ward to fill out frequency table.

Insert SUM at bottom of each column.

May be different from 200.

Do not include H17 when dragging H18 downward!!!

6a: Select Data (B17:H32) to use in Histogram

	A	B	C	D	E	F	G	H
14	⑤			Rolling a Single Six-Sided Die				
15			----- Distribution of Averages by Sample size -----					
16		Midpoint	Max	4	16	25	50	200
17		2.10	2.00	10	0	0	0	0
18		2.10	2.20	0	0	0	0	0
19		2.30	2.40	10	0	0	0	0
20		2.50	2.60	8	3	0	0	0
21		2.70	2.80	8	4	3	0	0
22		2.90	3.00	24	18	20	2	0
23		3.10	3.20	0	23	18	20	1
24		3.30	3.40	34	34	40	50	39
25		3.50	3.60	17	33	53	66	113
26		3.70	3.80	21	33	33	46	47
27		3.90	4.00	21	30	18	15	0
28		4.10	4.20	0	14	13	1	0
29		4.30	4.40	13	8	2	0	0
30		4.50	4.60	15	0	0	0	0
31		4.70	4.80	11	0	0	0	0
32		4.90	5.00	4	0	0	0	0
33		Total # of Samples		196	200	200	200	200

6b: Insert X-Y Scatter Plot

HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW PDF Architect

Recommended PivotTables Tables Illustrations Apps Recommended Charts Charts PivotChart Power View Line Column Win/Loss Sparklines

Rolling a Single Six-Sided Die

----- Distribution of Averages by Sample size -----

Midpoint	Max	4	16	25	50	200
2.10	2.00	15	0	0	0	0
2.10	2.20	0	0	0	0	0
2.30	2.40	5	0	0	0	0
2.50	2.60	7	2	0	0	0
2.70	2.80	6	12	9	0	0
2.90	3.00	20	21	14	8	0
3.10	3.20	0	20	23	20	5
3.30	3.40	22	26	35	47	43
3.50	3.60	23	40	36	65	116
3.70	3.80	29	26	47	39	35
3.90	4.00	20	30	21	18	1
4.10	4.20	0	14	11	3	0
4.30	4.40	16	6	3	0	0
4.50	4.60	18	1	1	0	0
4.70	4.80	9	1	0	0	0
4.90	5.00	7	1	0	0	0
Total # of Samples		197	200	200	200	200

Scatter

Scatter with Smooth Lines

Use this chart type to:

- Compare at least two sets of values or pairs of data.

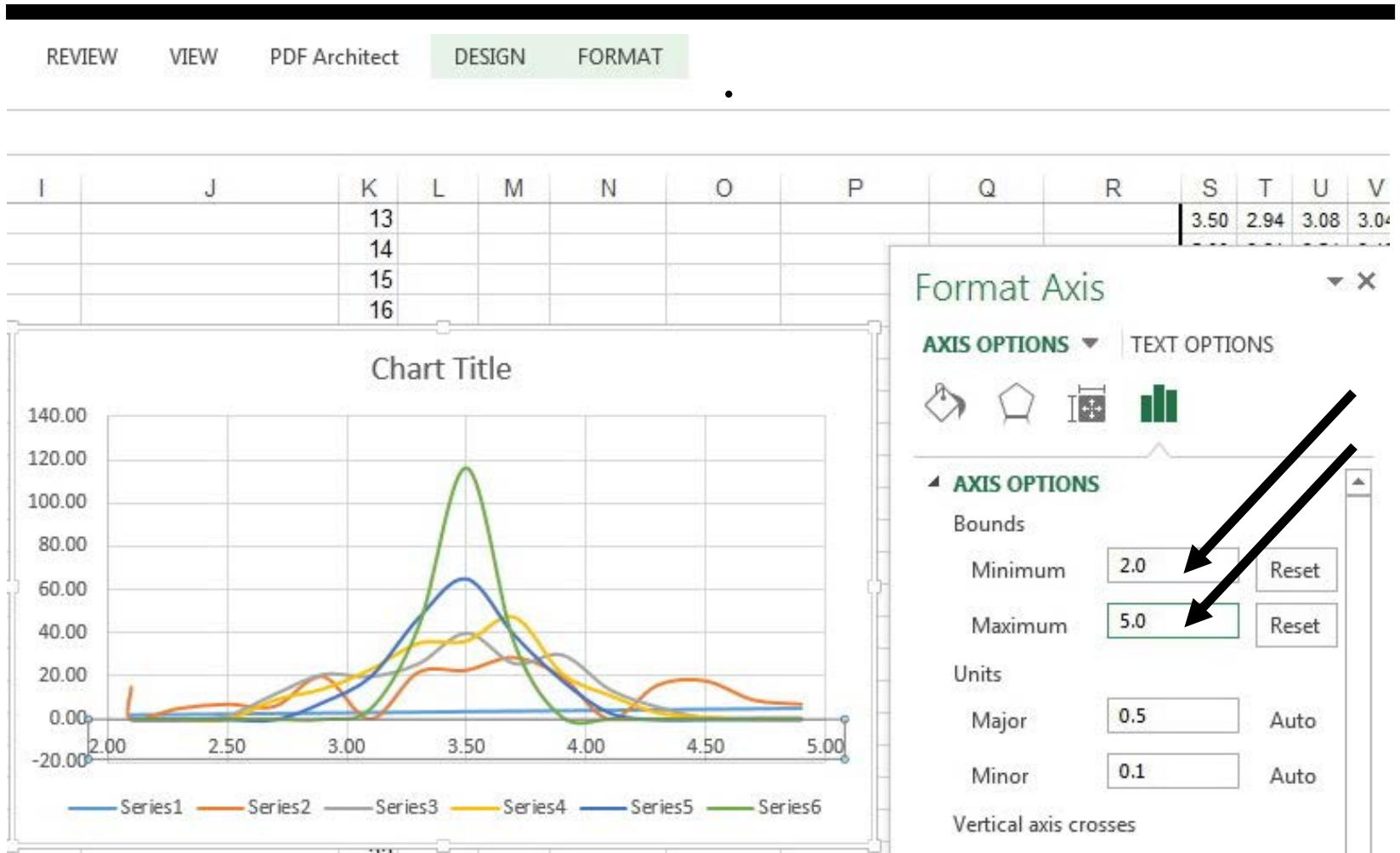
Bubble

Use it when:

- There are many data points
- The data represents a set of x,y pairs based on a formula.

More Scatter Chart

6c: Format Horizontal Axis: Change Min and Max



Delete legend.

6d: Select/delete Series 5 (size 50), 3 (size 16) and 1 (Max).

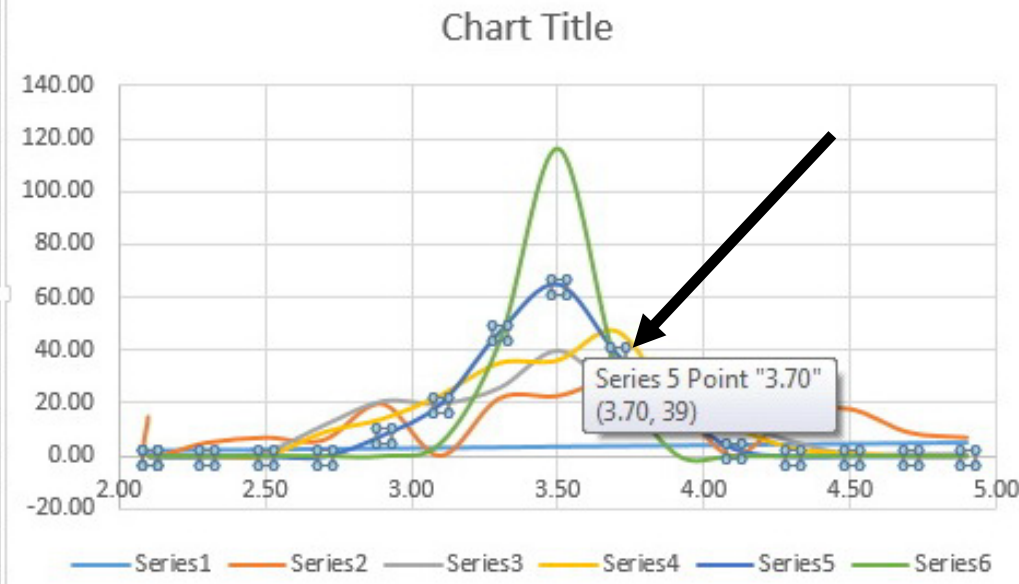
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=SERIES(,Data!\$B\$17:\$B\$32,Data!\$G\$17:\$G\$32,5)

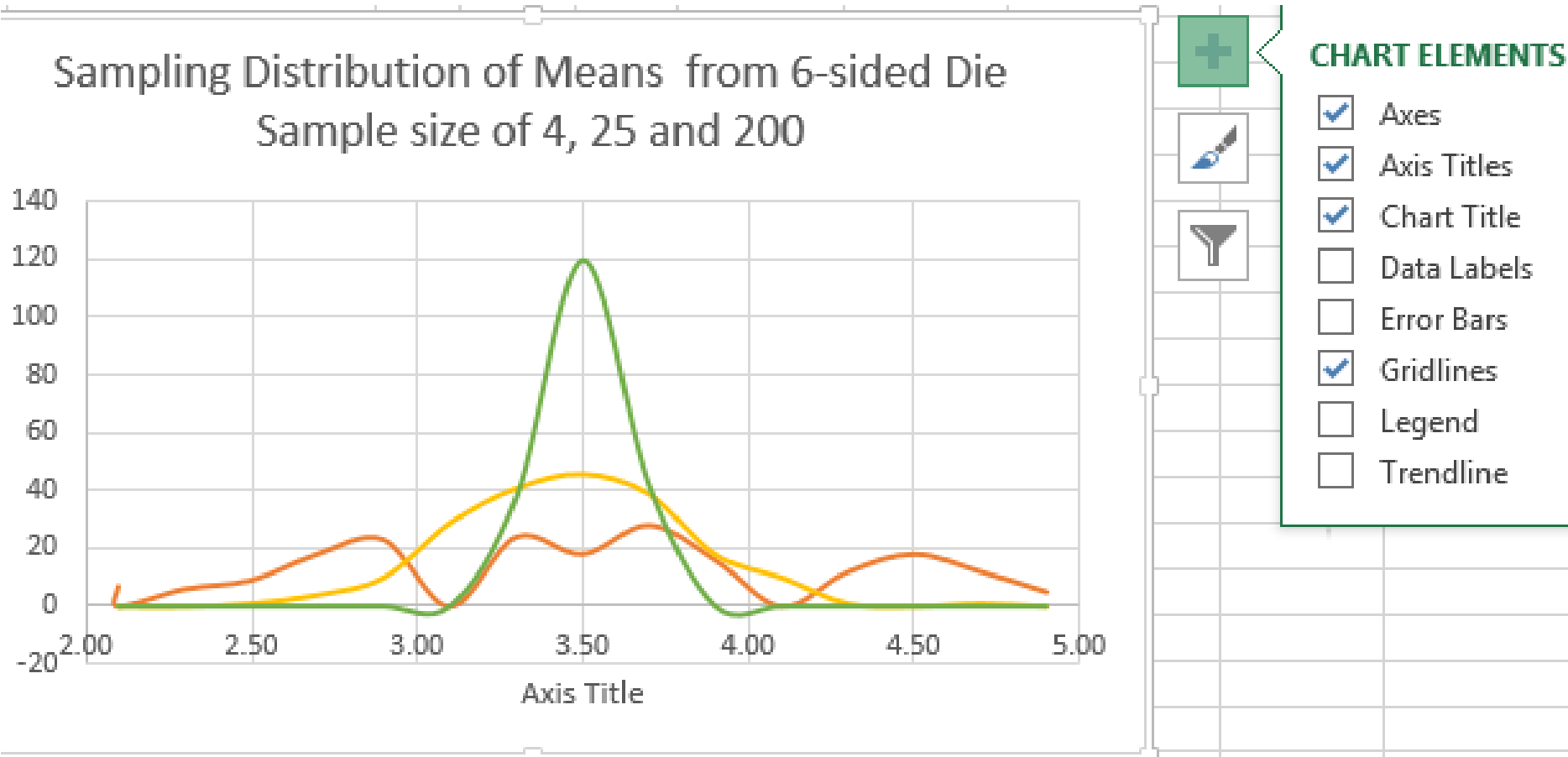
Rolling a Single Six-Sided Die

----- Distribution of Averages by Sample size -----

Midpoint	Max	4	16	25	50	200
2.10	2.00	15	0	0	0	0
2.10	2.20	0	0	0	0	0
2.30	2.40	5	0	0	0	0
2.50	2.60	7	2	0	0	0
2.70	2.80	6	12	9	0	0
2.90	3.00	20	21	14	8	0
3.10	3.20	0	20	23	20	5
3.30	3.40	22	26	35	47	43
3.50	3.60	23	40	36	65	116
3.70	3.80	29	26	47	39	35
3.90	4.00	20	30	21	18	1
4.10	4.20	0	14	11	3	0
4.30	4.40	16	6	3	0	0
4.50	4.60	18	1	1	0	0
4.70	4.80	9	1	0	0	0
4.90	5.00	7	1	0	0	0
Total # of Samples		197	200	200	200	200

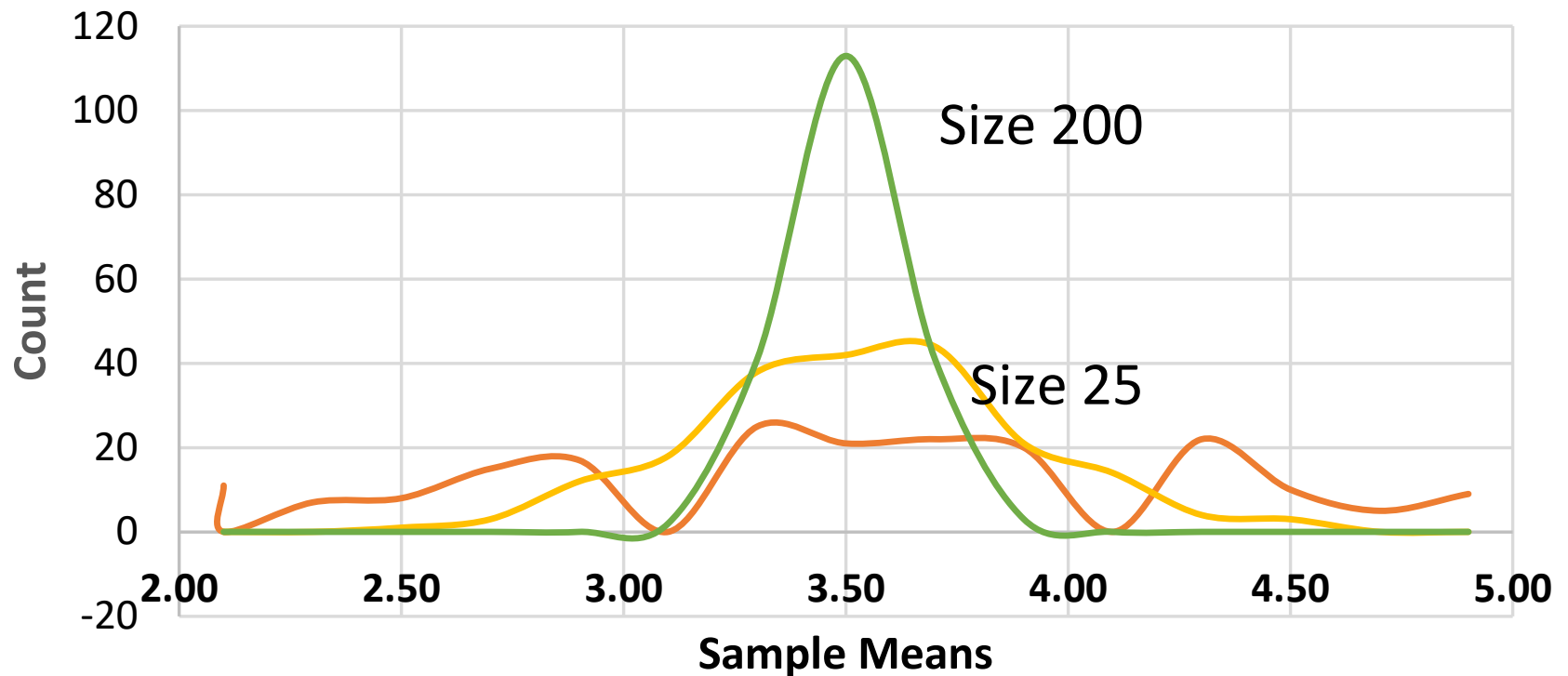


6e: Insert Title and Horizontal Axis Text



6f: Insert legends in text boxes. Final Result

**Sampling Distribution of Sample Means: 6-side Die
Sample sizes of 4, 25 and 200**



Summary

When sampling from a process, the population “size” is “infinite”. That doesn’t influence the standard deviation.

Notice as sample size increases, the standard error (the std. deviation of the sample means) quickly decreases – as a percentage of the population standard deviation.

A sample of size 4 is expected to have a standard error that is only a half of the population standard deviation: a sample of 25 has a fifth, a sample of 100 has a tenth and a sample of 10,000 has a hundredth.