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Demonstration and Assessment of the Statistics Online Computational Resource (SOCR)

Joint work with:

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Department of Mathematics and Statistics
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Outline

- What is SOCR?
- SOCR capabilities
- Research
- Future growth

What is SOCR? (not SOCCER!)

- **Statistics Online Computational Resource (SOCR): It is a collection of interactive applets and computational / graphing tools (2001 - Present).**
- **People: Ivo Dinov (Director and Faculty), Juana Sancez (Faculty), graduate students (Annie Che), programmers (Jenny Cui), and many others.**
- **Goal: To provide educators, students, and developers a set of interactive tools in the teaching and research of probability and statistics at all levels.**
- **Funding: NSF grant (since 2005), OID (UCLA)**
- **Access SOCR: It is available online at**

  `http://socr.stat.ucla.edu`

  and its code can be downloaded at

  `http://socr.stat.ucla.edu/htmls/SOCR_Download.html`

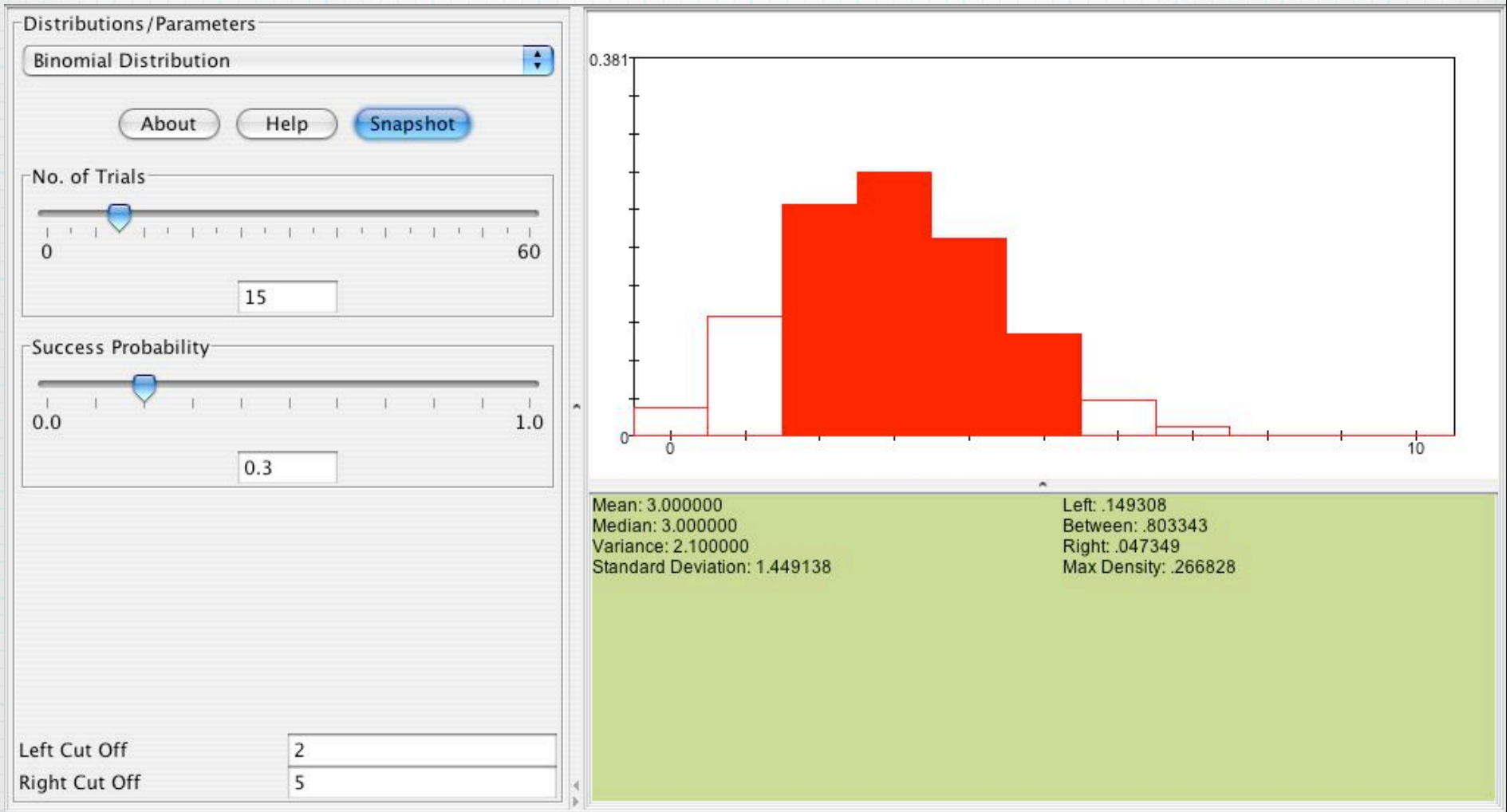
Capabilities of SOCR

- There are 6 major components of SOCR:
  - Distributions
  - Experiments
  - Analyses
  - Games
  - Modeler
  - Charts

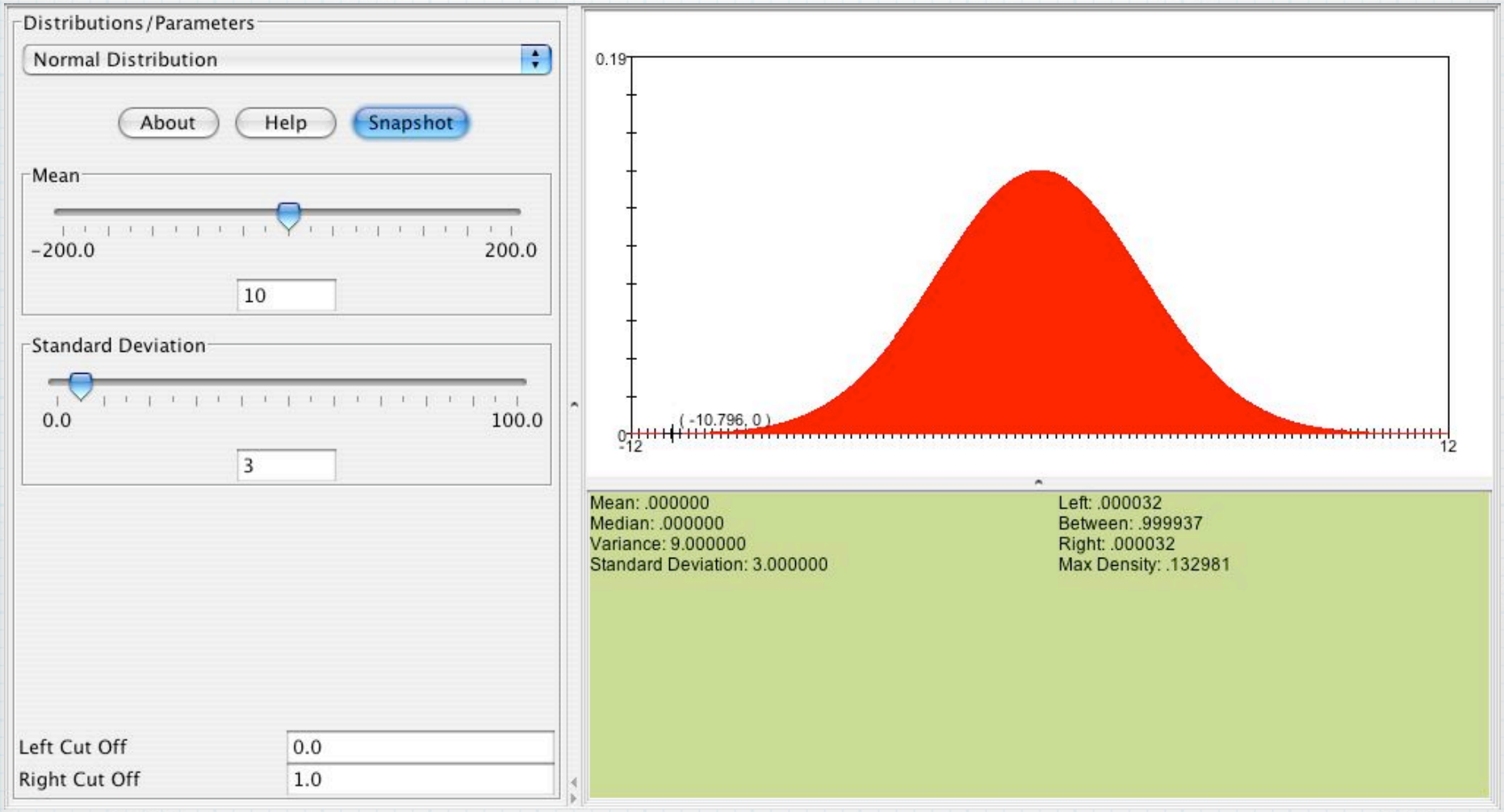
Distributions

- Binomial distribution
- Normal distribution
- Normal Approximation to binomial
- χ^2 distribution

$X \sim \text{Binomial}(15, 0.3)$

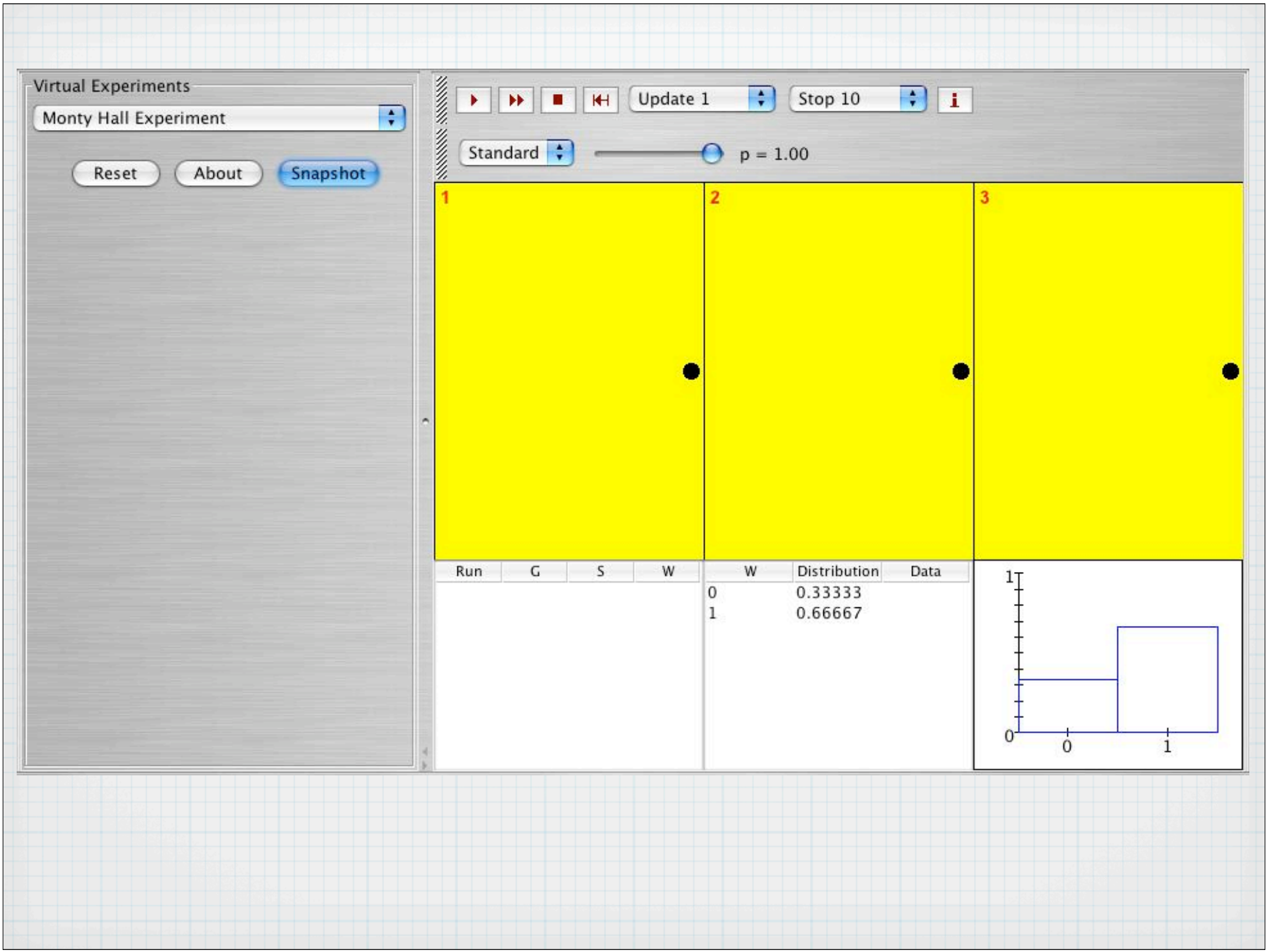


$X \sim N(10, 3)$


Distributions/Parameters
Normal Distribution
About
Help
Snapshot
Mean
-200.0
200.0
10
Standard Deviation
0.0
100.0
3
Left Cut Off
0.0
Right Cut Off
1.0
0.19
0
-12
(-10.796, 0)
12
Mean: .000000
Median: .000000
Variance: 9.000000
Standard Deviation: 3.000000
Left: .000032
Between: .999937
Right: .000032
Max Density: .132981

Experiments

- Birthday experiment
- Let's make a deal (Monty Hall) experiment
- Die coin experiment
- Confidence interval experiment


Virtual Experiments
Monty Hall Experiment
Reset
About
Snapshot
Update 1
Stop 10
Standard
p = 1.00
1
2
3
Run
G
S
W
W
Distribution
Data
0
0.33333
1
0.66667
1
0
0
1

Die Coin Experiment

A die is rolled and the number observed X is recorded. Then a coin is tossed number of times equal to the value of X. For example if $X = 2$ then the coin is tossed twice, etc. Let Y be the number of heads observed. Note: Assume that the die and the coin are fair.

a. **Construct the joint probability distribution of X and Y.**

b. **Find the conditional expected value of Y given $X = 5$.**

c. **Find the conditional variance of Y given $X = 5$.**

d. **Find the expected value of Y.**

e. **Find the standard deviation of Y.**

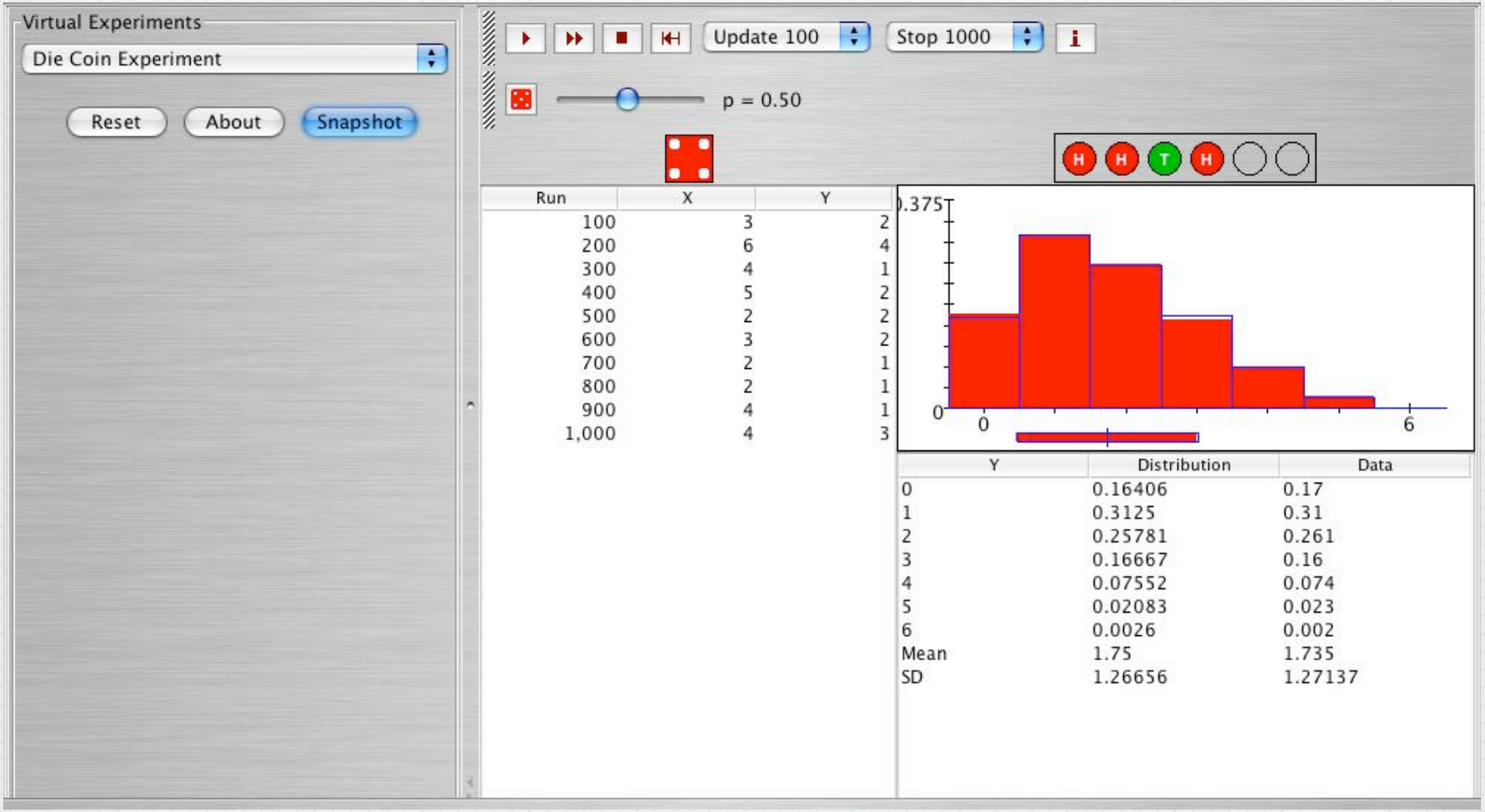
f. **Graph the probability distribution of Y.**

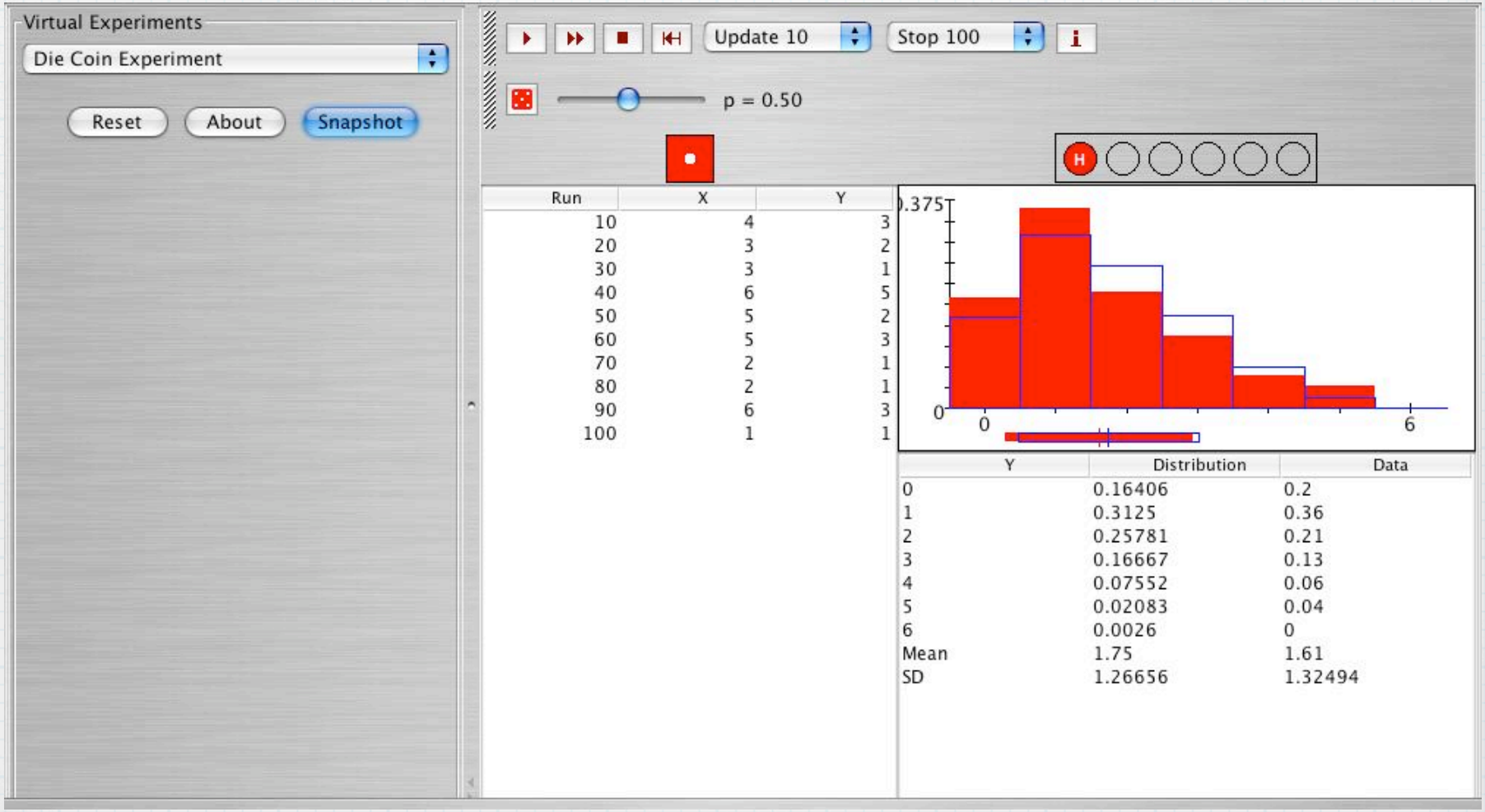
g. **Use $SOCR$ to graph and print the empirical distribution of Y when the experiment is performed**

   i. **n=1000 times.**

   ii. **n=10000 times.**

h. **Compare the theoretical mean and standard deviation of Y (parts (d) and (e)) with the empirical**


Virtual Experiments
Die Coin Experiment
Reset
About
Snapshot
Update 100
Stop 1000
p = 0.50
H H T H
Run X Y
100 3 2
200 6 4
300 4 1
400 5 2
500 2 2
600 3 2
700 2 1
800 2 1
900 4 1
1,000 4 3
.375
0
0
6
Y Distribution Data
0 0.16406 0.17
1 0.3125 0.31
2 0.25781 0.261
3 0.16667 0.16
4 0.07552 0.074
5 0.02083 0.023
6 0.0026 0.002
Mean 1.75 1.735
SD 1.26656 1.27137


Virtual Experiments
Die Coin Experiment
Reset
About
Snapshot
Update 10
Stop 100
p = 0.50
H
Run X Y
10 4 3
20 3 2
30 3 1
40 6 5
50 5 2
60 5 3
70 2 1
80 2 1
90 6 3
100 1 1
.375
0
0
6
Y Distribution Data
0 0.16406 0.2
1 0.3125 0.36
2 0.25781 0.21
3 0.16667 0.13
4 0.07552 0.06
5 0.02083 0.04
6 0.0026 0
Mean 1.75 1.61
SD 1.26656 1.32494

Analyses

- One sample t test
- Two sample t test
- Simple regression
- Multiple regression

Modeler

- Exponential fit
- Normal fit
- Poisson fit
- Mixture fit

Research

- Preliminary assessment of SOCR:
  - SOCR was tested on 3 undergraduate courses at UCLA Department of Statistics (Dinov, Sanchez, Christou).
  - Results:
    * Students exposed to SOCR generally performed better compared to those not.
    * Exit surveys (end of the courses) indicated high satisfaction and interest in SOCR.
    * More testing should be performed to validate the effectiveness of SOCR tools.
  - Next 3 tables show some quantitative results of students performance using SOCR (control vs. treatment).

Table 1: Quantitative Results measuring student learning in the two groups of Dinov's Stat 13 courses

	Group	High	Low	Median	Mean	Standard Deviation	Statistics
Midterm	**Control**	100	53	84.33	83.9	10	$t_o = 1.37$ t(169) p=0.089
	Treatment	100	58	88	86	10	
Final	**Control**	100	42	83	81.2	13	$t_o = 1.34$ t(169) p=0.093
	Treatment	99	35	87	83.8	12	
Overall Performance	**Control**	96.89	53.6	**86.82**	**84.57**	9.1	$t_o = 1.448$ t(169) p=0.075
	Treatment	98.05	42.32	**88.26**	**86.68**	9.9	

Table 2: Quantitative Results measuring student learning in the two groups of Sanchez's Stat 100A courses

	Group	High	Low	Median	Mean	Standard Deviation	Statistics
Midterm	**Control**	34	17.5	26.5	26.19	4.65	$t_o = 0.63$ t(38) p>0.2
	Treatment	33	17.5	28.5	27.08	4.25	
Homework	**Control**	19.74	4.69	16.92	15.76	4.44	$t_o = 0.64$ t(16) p>0.2
	Treatment	19.07	13.39	16.41	16.41	1.73	
Final	**Control**	37.2	18.4	29.4	28.48	5.31	t_o=0.49 t(38) p>0.2
	Treatment	36.9	22.5	29.40	29.23	4.30	
Overall Performance	**Control**	90.55	43.19	**71.22**	**70.45**	12.24	t_o=0.71 t(38) p>0.2
	Treatment	84.89	58.42	**72.44**	**72.73**	8.08	

Table 3: Quantitative Results measuring student learning in the two groups of Christou's Stat 100A course

	Group	High	Low	Median	Mean	Standard Deviation	Statistics
Quiz1	**Control**	96	41	70	72.61	16.84	t_o = 2.644 t(42) p=0.0058
	Treatment	100	58	93	87.67	14.72	
Quiz2	**Control**	100	32	73	72.61	16.78	t_o = 2.063 t(42) p<0.0227
	Treatment	100	58	89	84.11	13.25	
Exam1	**Control**	100	40	89	85.74	13.64	t_o=0.7617 t(42) p=0.225
	Treatment	100	47	96	89.56	16.62	
Exam2	**Control**	100	36	80	80.23	15.98	t_o=1.342 t(42) p= 0.0935
	Treatment	100	68	88	87.22	11.09	
Exam3	**Control**	100	46	82	82.45	14.13	t_o=0.2725 t(42) p=0.3933
	Treatment	100	60	88	83.78	13.66	
Overall Performance	**Control**	94.31	44.93	**80.09**	**80.23**	11.87	t_o=1.606 t(42) p=0.058
	Treatment	96.26	60.65	**90.59**	**86.76**	11.06	

Future growth

- Possibility of future research on the incorporation of SOCR in the teaching of statistics (high school and college) and the effect of a combination of SOCR as an enhancement tool to traditional teaching.
- Internationalization of SOCR:
  - Currently information about SOCR can vaguely translated into other languages using web-based resource.
  - The possibility of expanding SOCR into other languages (e.g. Greek), including Java applets.
- Software enhancement based on user-feedbacks and further developments.

Multilingual Support

- English (default)
- German
- Spanish
- French
- Italian
- Portuguese
- Japanese
- Korean
- Chinese
- Traditional Chinese
- Russian
- Dutch
- French
- Greek

Κατανομές/Παράμετροι

Διωνυμική Κατανομή

Σχετικά | Βοήθεια | Αποθήκευση Αποτελέσματος

Αριθμός Δοκιμών

0 60

15

Πιθανότητα Επιτυχίας

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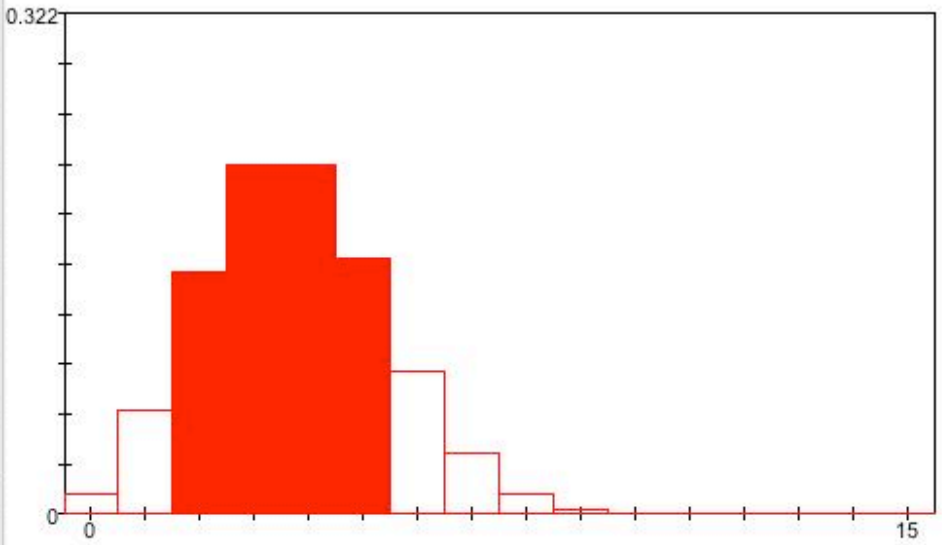
Κάτω Όριο 2

Άνω Όριο 5



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Μεταξύ: .771451
Τουλάχιστον: .148368
Μέγιστη Πυκνότητα: .225199

Κατανομές/Παράμετροι

Κανονική Κατανομή

Σχετικά | Βοήθεια | Αποθήκευση Αποτελέσματος

Μέση Τιμή

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Τυπική Απόκλιση

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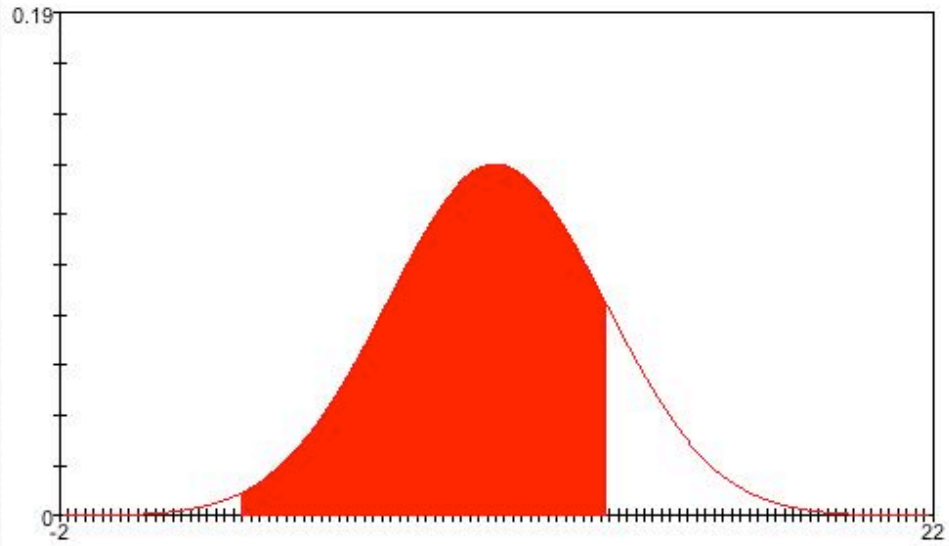
3

Κάτω Όριο 3

Άνω Όριο 13



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Μεταξύ: .831529
Τουλάχιστον: .158655
Μέγιστη Πυκνότητα: .132981

Acknowledgments

This is joint work with

Ivo Dinov (Director)

Annie Che

Jenny Cui

Juana Sanchez

Thank you!