AN INTERACTIVE SHINY APP FOR ENHANCING LEARNING PROBABILITY DISTRIBUTIONS

TDG PROJECT

SUPPORTED BY FACULTY-LEVEL TEACHING DEVELOPMENT GRANTS, THE EDUCATION UNIVERSITY OF HONG KONG, (PROJECT NO.: T0214)

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PROJECT TEAM MEMBERS

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OBJECTIVES

Students often find it difficult to understand various discrete probability distributions, namely *Bernoulli distributions, binomial distributions, geometric distributions, negative binomial distributions, and Poisson distributions*.

This project intends to revisit those fundamental yet important probability distributions from a different perspective with the use of simulation in R.

OBJECTIVES

Some interactive learning objects with a powerful statistical tool, R, were developed in this project, to facilitate teaching and learning probability distributions.

1. An Shiny app
2. Videos
3. Short exercises

This learning package may meet the needs of students with diverse academic backgrounds.

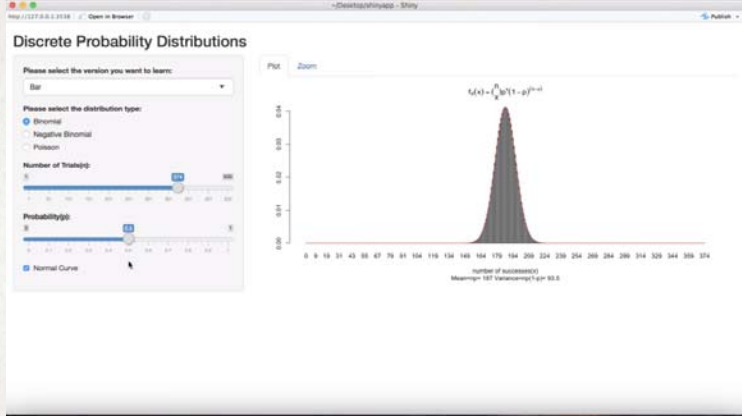Students are expected to have a better understanding of various important discrete probability distributions.

OBJECTIVES

	Number of Videos	Number of Exercises
Preliminary knowledge	• https://youtu.be/8IQz7U4w3ks (Combination formula)	
Bernoulli and Binomial Distributions	• https://youtu.be/zzxTBgJdems (Theorem) • https://youtu.be/PTYajQbYf9A (ShinyApp)	10
Negative Binomial Distributions	• https://youtu.be/f4bvr3PGon8 (Theorem) • https://youtu.be/vhBHpuVQOP8 (ShinyApp)	7
Poisson Distributions	• https://youtu.be/elYEPRgeS8I (Theorem) • https://youtu.be/KBbMJG0PT7k (ShinyApp)	7
Review	• https://youtu.be/SQ_N1oOCwcI	
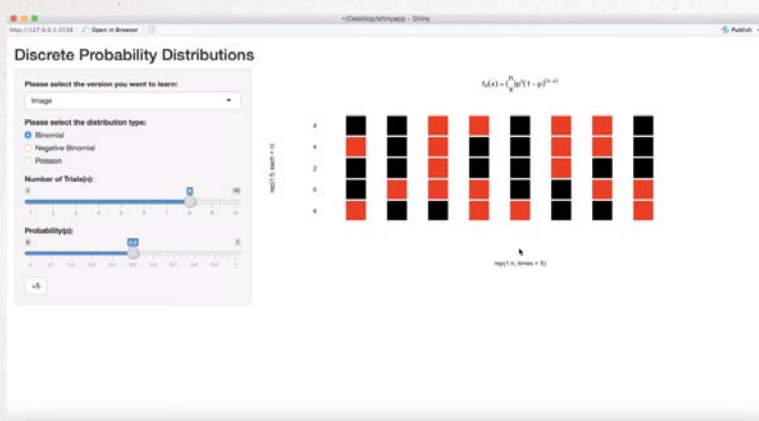
BINOMIAL DISTRIBUTIONS

Using red squares and black squares to represent different possible situations.

Please click the photo to see the videos.

BINOMIAL DISTRIBUTIONS

Simulating the possible outcomes of binomial distributions.

NEGATIVE BINOMIAL DISTRIBUTIONS

Using red squares and black squares to represent different possible situations.

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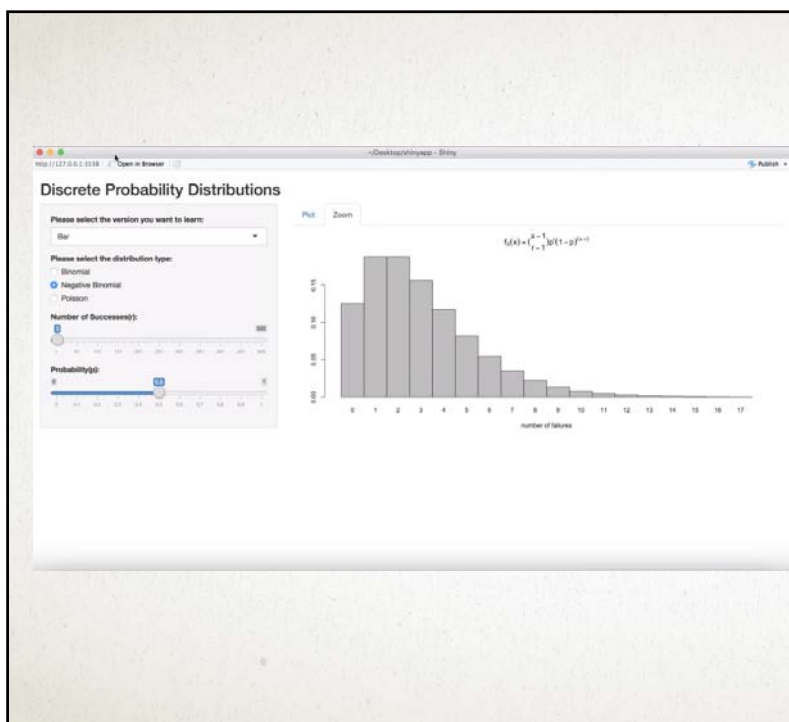
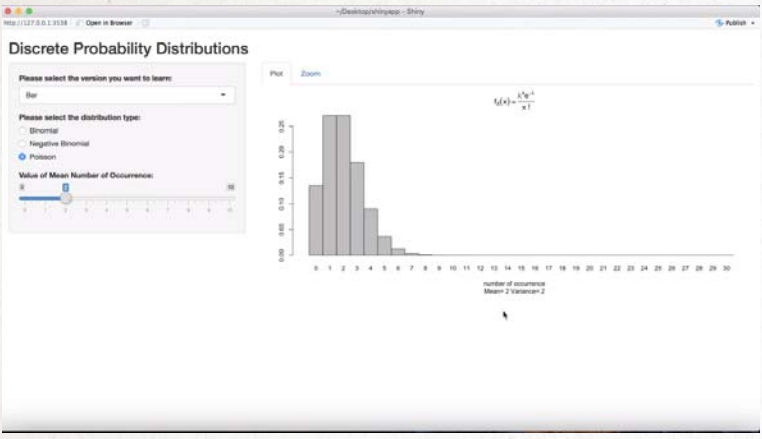## NEGATIVE BINOMIAL DISTRIBUTIONS

Simulating the possible outcomes of negative binomial distributions.
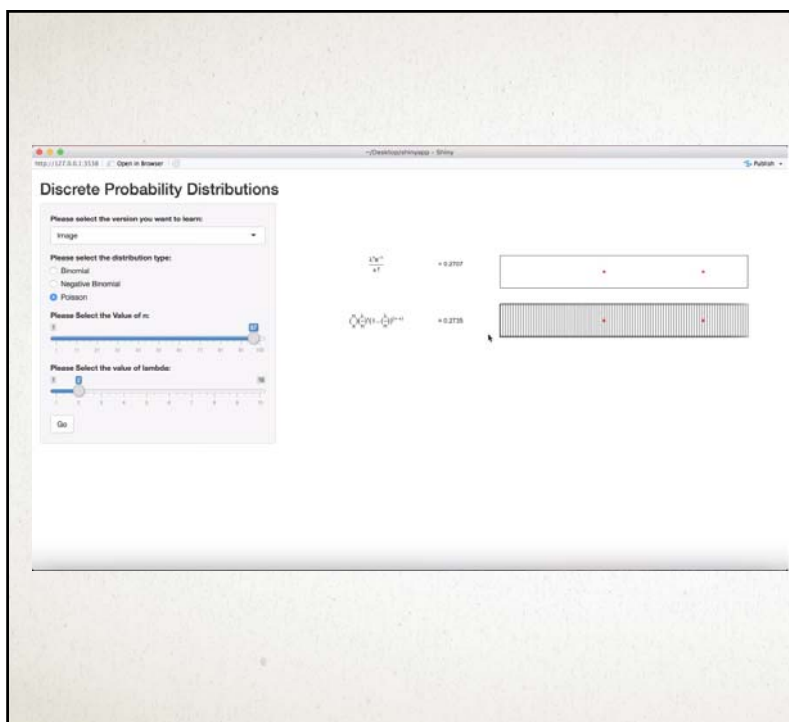
POISSON DISTRIBUTIONS

Simulating and connecting Poisson distributions to Binomial distributions.

POISSON DISTRIBUTIONS

Simulating the possible outcomes of Poisson distributions.

INTRODUCTORY VIDEOS

Please click the photo to see the videos.

PILOT STUDY

Those teaching objects have been uploaded on the EdUHK Moodle for e-learning / blended learning in introductory courses of probability and statistics.

Students can access the developed objects through their own devices and to learn probability distributions on their own paces.

RESULTS OF PILOT STUDY(PAIRED T-TESTS)

BEd Program	Pre-test	Post-test	Difference
Sample size	6	6	6
Mean	3.3333	8.3333	5
Standard deviation	1.6330	2.3381	1.6733
T value			7.3193
P value			0.0004
MA Program	Pre-test	Post-test	Difference
Sample size	8	8	8
Mean	2.5	5	2.5
Standard deviation	2.5635	4	2.3299
T value			3.0349
P value			0.0095

*Remark: Target students ①Finished and completed both pre-test and post-test.
②Pre-test score <= 6.

RESULTS OF PILOT STUDY(QUESTIONNAIRES)

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The app is <u>useful</u> for my study in the probability distributions.	15.38%	53.85%	19.23%	11.54%	0%
Using the app to learn the probability distributions <u>is a good idea.</u>	20.00%	60.00%	17.14%	2.86%	0%
The app makes study <u>more interesting.</u>	20.59%	50.00%	20.59%	8.82%	0%
I will recommend this app to my friends to learn the probability distributions.	15.38%	46.15%	26.92%	11.54%	0%

RESULTS OF PILOT STUDY(QUESTIONNAIRES)

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The videos help me better learn <u>Binomial distributions</u>.	28.57%	48.57%	17.14%	5.71%	0%
The exercises help me better learn <u>Binomial distributions</u>.	31.43%	45.71%	17.14%	5.71%	0%

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The videos help me better learn <u>Negative Binomial distributions</u>.	28.57%	48.57%	17.14%	5.71%	0%
The exercises help me better learn <u>Negative Binomial distributions</u>.	31.43%	45.71%	17.14%	5.71%	0%

RESULTS OF PILOT STUDY(QUESTIONNAIRES)

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The videos help me better learn Poisson distributions.	26.47%	44.12%	23.53%	5.88%	0%
The exercises help me better learn Poisson distributions.	25.71%	54.29%	14.29%	5.71%	0%

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I am confident in choosing an appropriate model for data analysis.	14.71%	50%	26.47%	5.88%	2.94%

RESULTS OF PILOT STUDY(FOCUS GROUP)

- Demonstrating the distributions with images in the app is good, the app resolves some limitations in textbooks.
- The app is simple to use and is helpful.
- The videos with the app make it easier to understand the theorem.
- Various scenarios and the bar charts let them understand better.
- They are willing to use the app for flipped classrooms when they are teaching.

RESULTS OF PILOT STUDY(FOCUS GROUP)

- 5 situations shown on the right panel are not enough.
- The videos are short for students without any probability knowledge.
- More instructions and descriptions are needed in the app.

Thank you for your attention!