Teaching resources on Use of Shiny Apps

1. Preliminary knowledge

Video:

➢ https://youtu.be/8IQz7U4w3ks (Theorem)

The number of possible outcomes of $x = 3$ successes occurred in $n = 5$ trials.

$$\binom{5}{3} = \frac{5!}{3!\,2!} = \frac{5\times4\times3\times2\times1}{(3\times2\times1)\times(2\times1)} = 10.$$
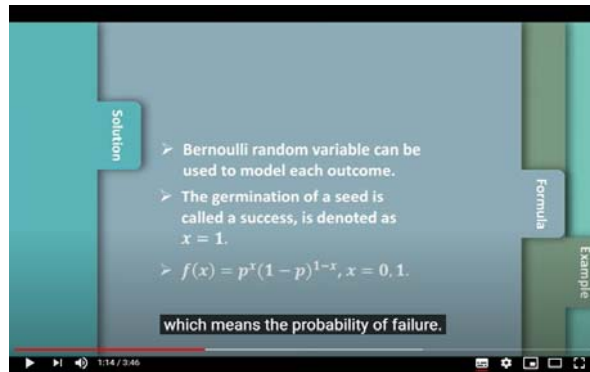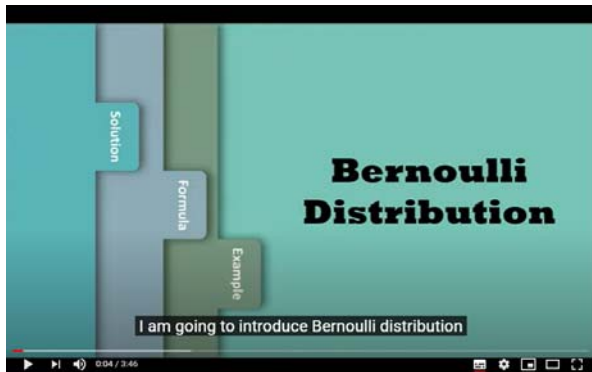
are shown below in the tables.

Teaching resources developed from TDG project: Development of e-Learning Package to Enhance Learning and Teaching Probability and Statistics (T0214)

2. Bernoulli distributions

Video:

> ➢ https://youtu.be/zzxTBgJdems (Theorem)

Exercises:

> ➢ Suppose that five seeds are planted in a row and the probability of germination of a seed is p=0.8. Assuming independence, find the probability of the first, third, and fifth seeds getting germinated and the other two not getting germinated (Shown in video).
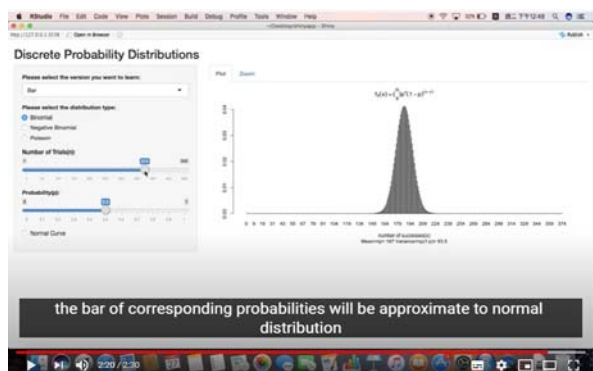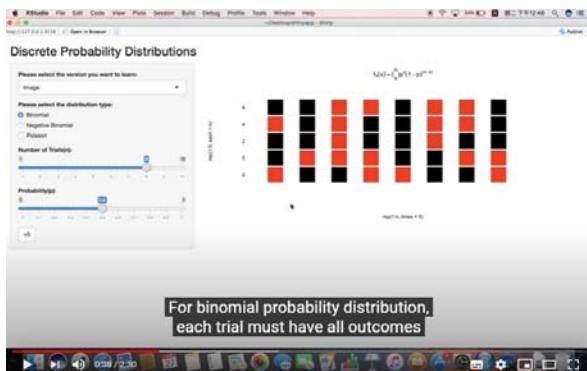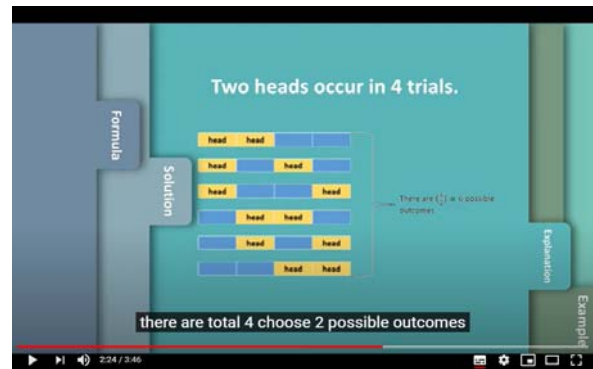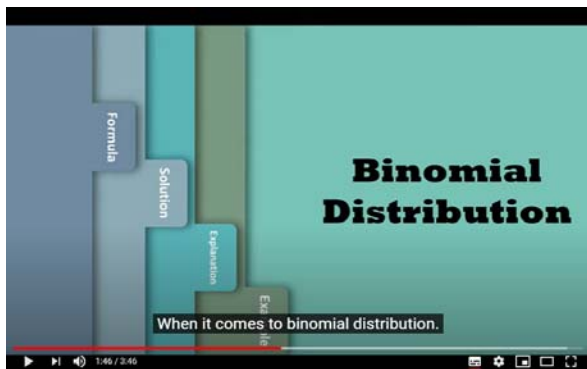
3. Binomial distributions

Video:

- https://youtu.be/zzxTBgJdems (Theorem)

- https://youtu.be/PTYajQbYf9A (ShinyApp)
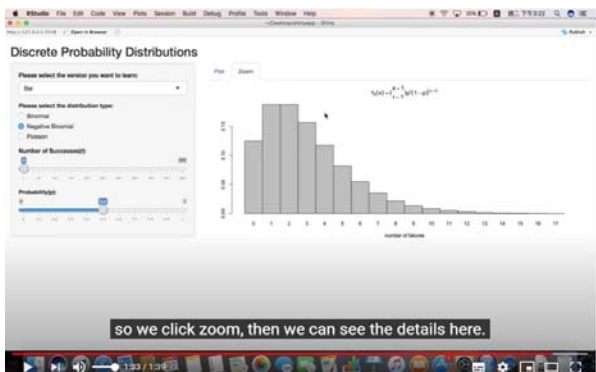
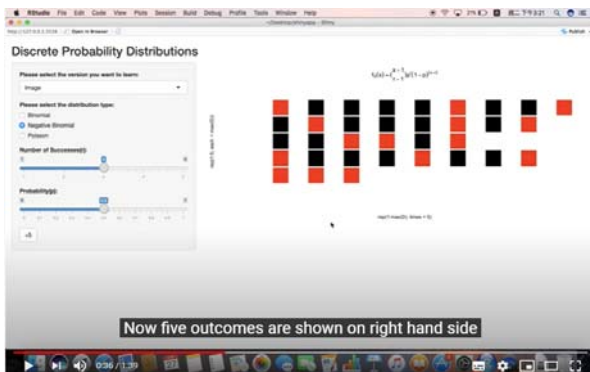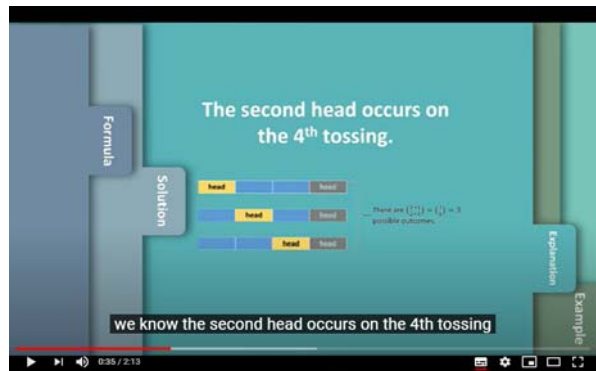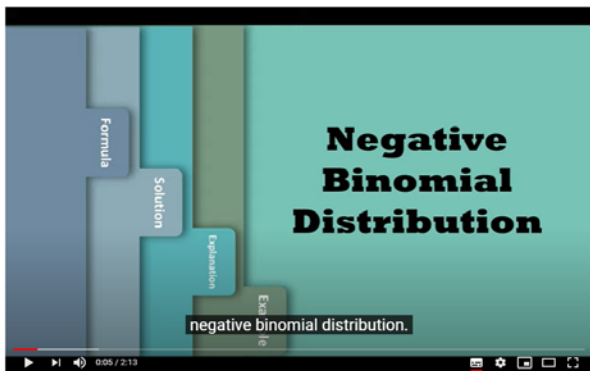## Teaching resources on Use of Shiny Apps

Exercises:

1. A coin is tossed 4 times. Assuming independence, find the probability of getting exactly 2 heads (Shown in video).

2. Explain which of the following three events is more likely that a person get (i) at least one "Six" when 6 dice are rolled, (ii) at least two "Sixes" when 12 dice are rolled, (iii) at least three "Sixes" when 18 dice are rolled.

3. Leghorn chickens are raised for laying eggs. Let p=0.5 be the probability that a newly hatched chick is a female. Assuming independence, let X equal the number of female chicks out of 10 newly hatched chicks selected at random. Find the probability that at least 6 chicks are females.

4. Suppose that observation over a long period of time has disclosed that, on average, 1 out of 10 items produced by a process is defective. If five items are independently selected from the production line and test them, find the probability of observing at most one defective item.

5. It is claimed that 15% of ducks in a particular region have patent schistosome infection. Suppose that seven ducks are selected at random. Let X equal the number of ducks that are infected. Find (i) $P(X \geq 2)$, (ii) $P(X \leq 3)$.

6. In an experiment involving inorganic syntheses of molecular precursors to organometallic ceramics, the final step of a five-step reaction involves the formation of a metal-tetal bond. The probability of such a bond forming is p=0.20. Let X equal the number of successful reactions out of n=25 such experiments. Find the probability that X is at most 4.

7. A random variable X has a binomial distribution with mean 6 and variance 3.6. Find $P(X \leq 4)$.

Teaching resources on Use of Shiny Apps

4. Negative Binomial distributions

Video:

➢ https://youtu.be/f4bvr3PGon8 (Theorem)

➢ https://youtu.be/vhBHpuVQOP8 (ShinyApp)

Teaching resources on Use of Shiny Apps
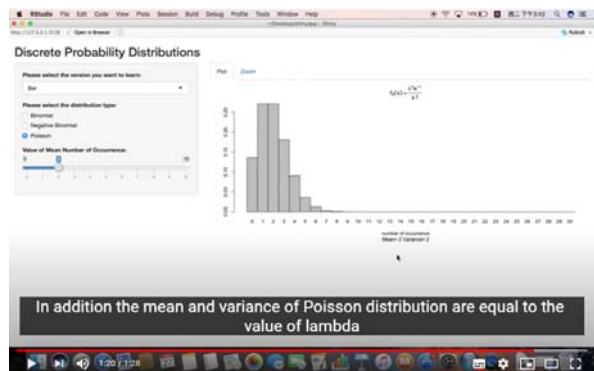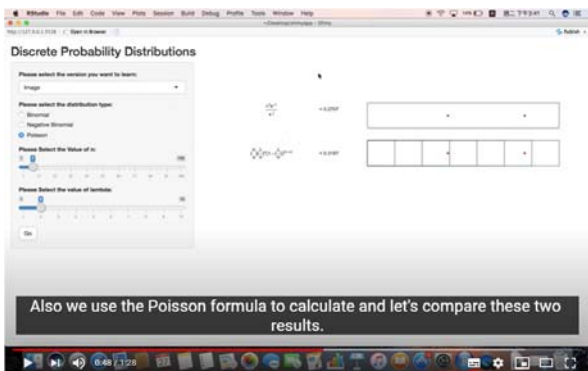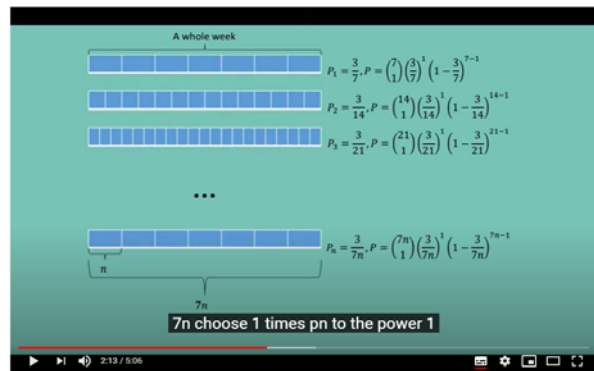
Exercises:

- A coin is tossed until getting 2 heads. Assuming independence, find the probability that the second head occurs on the 4th tossing (Shown in video).

- Suppose that during practice a basketball player can make a free throw 80% of the time. Assuming independence, let X equal the number of missed shots before making the 10th shot. Find P(X=2).

- Find the probability that the fifth head is observed on the tenth independent flip of a fair coin.

- An excellent free-throw shooter attempts several free throws until she misses. If p=0.9 is her probability of making a free throw, what is the probability of having the first miss on the 13th attempt.

- Raghu is making cold sales calls. The probability of a sale on each call is 0.4. Assuming independence, find the probability that he has exactly five failed calls before his second successful sales call.

- A company takes out an insurance policy to cover accidents that occur at its manufacturing plant. The probability that one or more accidents will occur during any given month is 3/5. The number of accidents that occur in any given month is independent of the number of accidents that occur in all other months. Find the probability that there will be four months without accidents before the month has at least one accident.

Teaching resources on Use of Shiny Apps

5. Poisson distributions

Video:

> ➢ https://youtu.be/elYEPRgeS8I (Theorem)

> ➢ https://youtu.be/KBbMJG0PT7k (ShinyApp)

Teaching resources on Use of Shiny Apps

Exercises:

- A life insurance salesman sells, on average, 3 life insurance policies per week. Find the probability that in a given week he will sell one policy (Shown in video).

- Vehicles pass through a junction on a busy road at an average rate of 300 per hour. Find the probability that none passes in a given minute.

- In a large city, a call center receives, on average, two calls in every 3 minutes. Find the probability of five or more calls arriving in a 9-minute period.

- Customers arrive at a travel agency at a mean rate of 11 per hour. Find the probability that more than 10 customers arrive in a given hour.

- Flaws in a certain type of drapery material appear on average of one in 150 square feet. Find the probability of at most one flaw appearing in 225 square feet.

- Births in a hospital occur randomly at an average rate of 1.8 births per hour. What is the probability of observing at least 2 births in a given hour at the hospital.
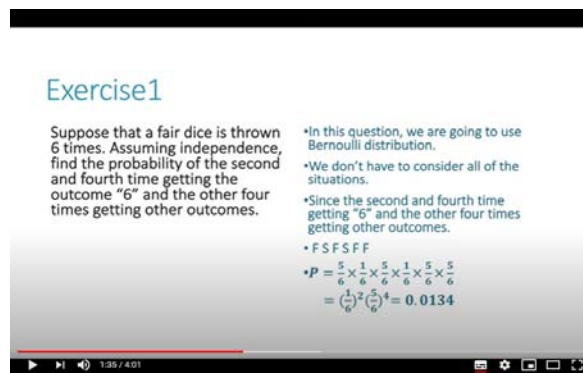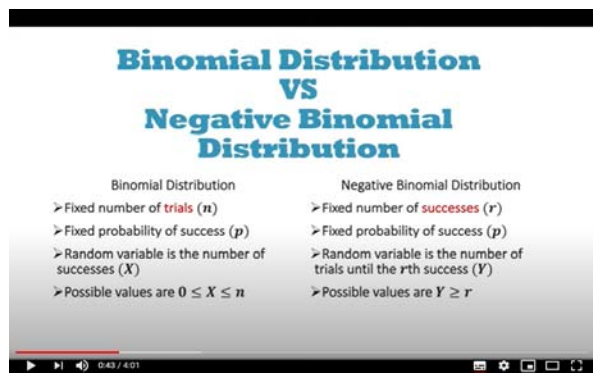
6. Review

Video:

 ➢ https://youtu.be/SQ_N1oOCwcI (Exercises)

Exercises:

 ➢ Suppose that a fair dice is thrown 6 times. Assuming independence, find the probability of the second and fourth time getting the outcome "6" and the other four times gettting other outcomes (Shown in video).

 ➢ 80% of people who purchase pet insurance are women. If 9 pet insurance owners are randomly selected, find the probability that exactly 6 are women (Shown in video).

 ➢ A recent geological study reported that an exploratory oil well have a 20% chance of striking oil. Find the probability that the first strike comes on the third well drilled (Shown in video).

 ➢ Vehicles pass through a junction on a busy road at an average rate of 300 per hour. Find the probabilitiy that none passes in a given minute (Shown in video).