Connections to Discrete Random Variables

Dec 5/2018

Recall: Binomial Distribution

The probability of x successes in n identical independent trials is:

$$P(x) = {}_nC_x p^x q^{n-x}$$

n is the number of trials
x is the number of successes
p is the probability of success in a single trial
q is the probability of failure in a single trial

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As the number of trials increases, the binomial distribution takes on the characteristics of the normal distribution.

You can approximate binomial distribution results using normal distribution values if:

$np > 5$ and $nq > 5$

Under these conditions,

$$\bar{x} = np \qquad \sigma = \sqrt{npq}$$

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Recall: Hypergeometric Distribution

For dependent trials, where the outcome of the first trial will impact the outcome of the second trial.

$$P(x) = \frac{({}_aC_x)({}_{n-a}C_{r-x})}{{}_nC_r}$$

where,

n is the population
a is the number of successes available in population
x is the number of successes observed
r is the number of trials

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If the sample size (r) is small compared to the population size (n), the hypergeometric distribution can be approximated by a normal distribution.

$$r < \frac{1}{10}n$$

Under these conditions,

$$\bar{x} = rp \qquad \sigma = \sqrt{rpq\left(\frac{n-r}{n-1}\right)}$$

p = probability of success

q = probability of failure

p + q = 1

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A continuity correction must be applied when approximating a discrete distribution using a normal (continuous) distribution.

For example,

(1) Flipping exactly 4 heads: $P(3.5 \le X \le 4.5)$

(2) Flipping at least 4 heads: $P(X \ge 3.5)$

(3) Flipping more than 4 heads: $P(X \ge 4.5)$

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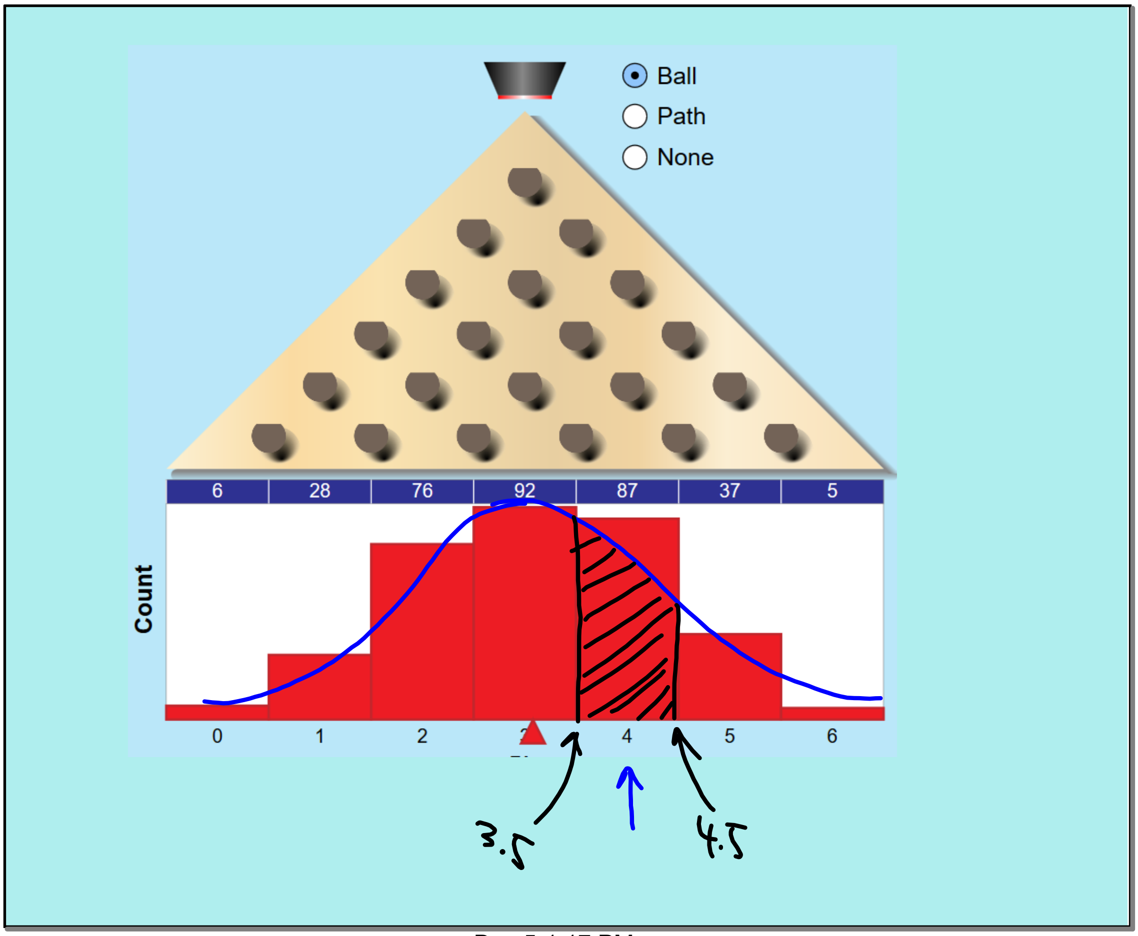

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Assigned Work:

p. 370 # 1 - 3, 5, 8, 10

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3. Two dice are rolled. A double is considered a win, and anything else is a loss. What is the minimum number of rolls that should be made to model this situation using a normal distribution?

① binomial (independent) or hyper? (dependent)

$p = \frac{6}{36}$ $q = \frac{30}{36}$

$np > 5$ $nq > 5$

$n\left(\frac{1}{6}\right) > 5$ $n\left(\frac{5}{6}\right) > 5$

$n\left(\frac{1}{6}\right) = 5$ $n\left(\frac{5}{6}\right) = 5$

$n = 30$ $n = 6$

$n > 30$ $n > 6$

∴ we need more than 30 rolls.

∴ min number is 31.

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Unit Review:

p.372 # 2, 3ac, 4, 6-12

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