review q 4: \[ 3 \times 0.6 \times 0.6 \times 0.4 \]

5

\[ \frac{3!}{1!1!1!} = \frac{3!}{3!} = 1 \]

\[ \binom{6}{1} = 6 \]

\[ \binom{12}{2} = 66 \]

\[ \binom{12}{3} = 220 \]

\[ \binom{12}{4} = 495 \]

6

A = event that you picked 6-sided die
\[ p(A) = \frac{1}{2} \]

2 = event that you threw 2
\[ p(2|A) = \frac{1}{6} \]
\[ p(2|A') = \frac{1}{12} \]
\[ P(2 \text{ and } A) = p(2|A) p(A) = \frac{1}{12} \]
\[ p(2 \text{ and } A') = p(2|A') p(A') = \frac{1}{24} \]
\[ p(2) = \frac{1}{8} \]
\[ p(A|2) = \frac{p(A|2) p(2)}{p(2)} = p(2 \text{ and } A) \]
\[ p(A|2) = \frac{2}{3} \]

7 you think

8 even: 2 4 6 8 10 12 \[ p = \frac{1}{2} \]
mult of 3: 3 6 9 \[ p = \frac{1}{3} \]
both: 6 12 \[ p = \frac{1}{6} \]

indep? definition A, B indep iff \( p(A \text{ and } B) = p(A) p(B) \)
yes

What if \( S = \{1, 2, \ldots, 10\} \)

even: 2 4 6 8 10 \[ p = \frac{1}{2} \]
mult of 3: 3 6 9 \[ p = \frac{3}{10} \]
both: 6 \[ p = \frac{1}{10} \]

indep? no
p = .05 of a particular chip being bad

if I buy 8 chips p(all good)? .95^8
if I buy 9 chips p(exactly 8 good) = (9 choose 1) .95^8 .05
= .29
p(I had to buy 9 to get 8 good ones) = (8 choose 1) .95^8 .05
p(I had to buy 10 to get 8 good) = (9 choose 2) .95^8 .05^2
p(I had to buy n to get 8 good) = (n-1 choose 7) .95^8 .05^(n-8)
Iclicker 3. 1

$p(1 \text{ bad}) = 1 \times 10^{-10}$.

If all independent, approximate $p(\text{any 1 of 9}) = 9 \times 1 \times 10^{-10}$.

Next level of accuracy, use binomial.

$$9 \times 1 \times 10^{-10}^1 (1 - 1 \times 10^{-10})^8$$

to approximate $(1 - e)^n = 1 - ne$ if $n$ big and $e$ small and $ne$ small.

$$(1 - e)^n = 1 - ne + \binom{n}{2} e^2 - \binom{n}{3} e^3 \ldots$$

Here $e$ is any small number, not 2.718.

$.99^{10}$

$(1 - .01)^{10} = 1 - 10 \times .01 + 45 \times .0001 + \ldots$

$= 1 -.1 + .0045 - \ldots$
X is a r.v. uniform in [10, 20].

\[ f(x) = \begin{cases} 
0 & \text{if } x < 10 \\
0.1 & \text{if } 10 < x < 20 \\
0 & \text{if } x > 20 
\end{cases} \]

\[ P(a < x < b) = \int_{a}^{b} f(x) \, dx \]

\[ P(12 < x < 18) = \int_{12}^{18} f(x) \, dx \]

\[ = \int_{12}^{18} 0.1 \, dx \]

\[ = 0.1 \cdot (18 - 12) \]

\[ = 0.6 \]

\[ P(5 < x < 15) = \int_{5}^{15} f(x) \, dx \]

\[ = \int_{5}^{15} 0.1 \, dx \]

\[ = 0.1 \cdot (15 - 5) \]

\[ = 1 \]

\[ \text{Diagram:} \]

\[ \text{Y-axis:} \]

\[ \text{X-axis:} \]

\[ 0 \quad 10 \quad 20 \]

\[ 5 \quad 10 \quad 15 \]
Normal distribution

$$f(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$$

$$\mu = 0 \quad \sigma = 1$$