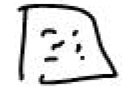
HW Roll 3 dice

$X$ = number of 

| $x$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| $P(x)$ | $\frac{125}{216}$ | $\frac{75}{216}$ | $\frac{15}{216}$ | $\frac{1}{216}$ |

$$E(x) = \frac{125}{216}(0) + \frac{75}{216}(1) + \frac{15}{216}(2) + \frac{3}{216}$$

$$\mu = E(x) = \frac{108}{216} = \frac{1}{2}$$

$$\boxed{\begin{aligned}\mu &= np \\ &= 3 \cdot \frac{1}{6} = \frac{1}{2}\end{aligned}}$$

$$E(X^2) = \frac{125}{216}(0^2) + \frac{75}{216}(1^2) + \frac{15}{216}(2^2) + \frac{1}{216}(3^2)$$

$$E(X^2) = \frac{144}{216} = \frac{2}{3}$$

$$\boxed{\sigma^2 = npq}$$

$$= 3 \cdot \frac{1}{6} \cdot \frac{5}{6}$$

$$= \frac{5}{12}$$

$$\sigma^2 = E(X^2) - \left[E(X)\right]^2$$

$$\frac{2}{3} - \left[\frac{1}{2}\right]^2 = \frac{5}{12}$$

For a binomial distribution,

$$B(n, p),$$

$$\mu = E(x) = np$$

$$\sigma^2 = np(1-p) = npq$$

Ex.

| X | 1 | 2 | 3 |
|---|---|---|---|
| P(x) | $\frac{1}{16}$ | $\frac{1}{8}$ | $\frac{13}{16}$ |

Find $E(x) = \frac{1}{16}(1) + \frac{1}{8}(2) + \frac{13}{16}(3)$

$$= \frac{11}{4}$$

Ex (calculator).

Toss 25 coins. $X$ = number of H

(a) $P(X = 12) = 0.155$

binomialpdf(25, 1/2, 12)

(b) $P(X > 12) = 1 - P(X \le 12) = 0.500$

1 − binomialcdf(25, 1/2, 12)

(c) $P(X \ge 12) = 1 - P(X \le 11) = 0.655$

$np = 25 \cdot \frac{1}{2}$

(d) $E(X) = 12.5$

(e) $\sigma^2 = \underset{n}{25} \cdot \underset{p}{\frac{1}{2}} \cdot \underset{q}{\frac{1}{2}} = 6.25$

# The Poisson Distribution

(Another discrete distribution)

- Events that occur in a small region or small time interval.
- Average number of occurances is constant over any time (or space) interval

EX. A manuscript averages 4 errors per page.

$X$ = number of errors on a page.

$X \sim P_o(4)$

The one par is $\mu$

(a) Find $P(X=0) = 0.018$

(b) Find $P(X=4) = 0.195$

(c) Find $P(X=40) = 2.71 \times 10^{-26}$

(d) $P(X \le 4) = 0.629$

poissoncdf(4,4)

(e) $P(X > 6) = 1 - P(X \le 6)$

$= 0.111$

---

The Poisson pdf is

$$\boxed{P(X=x) = \frac{e^{-m}\, m^{x}}{x!}, \quad \text{for } P_o(m)}$$

---

EX. On average, 9 customers use the self check line each hour at a store.

$X$ = number of customers in a 1-hour period. $X \sim P_o(9)$

(no calculator): $P(X=1) = \dfrac{e^{-9} \cdot 9^{1}}{1!}$

$= \dfrac{9}{e^{9}} \approx 0$

(calculators)

$$P(X > 12) = 1 - P(X \leq 12)$$

$$= 0.124$$

---

$\ast$ $\boxed{\begin{aligned} \mu &= m \\ \sigma^2 &= m \end{aligned}}$

$P_\circ(2)$

| $X$ | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| $P(X)$ | | | | | | |

$E(X^2) \approx 5.92 \leftarrow$ first 8 outcomes

$\sigma^2 \approx 5.92 - (2^2) = \underline{1.92} < \sigma^2$

$$\boxed{\sigma^2 = 2}$$

HW

10G #1-4

10H #2

Poisson

10E #1, 4 Binomial