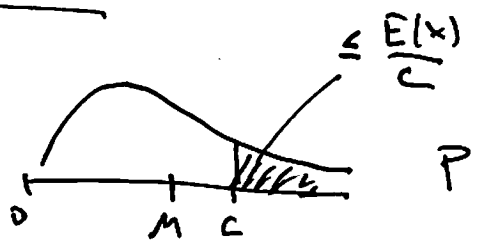
Stat 134 lec 16

Midterm Review

Markov and Chebychev's Ineq

Markov Ineq $X \geq 0$ w/ $\mu = E(X)$



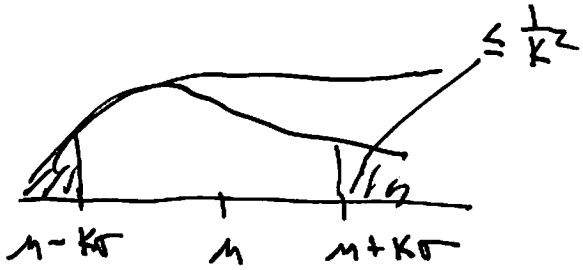
$$P(X \geq c) \leq \frac{E(X)}{c}$$

Chebyshev Ineq

any X

$\mu = E(X)$

$\sigma = SD(X)$



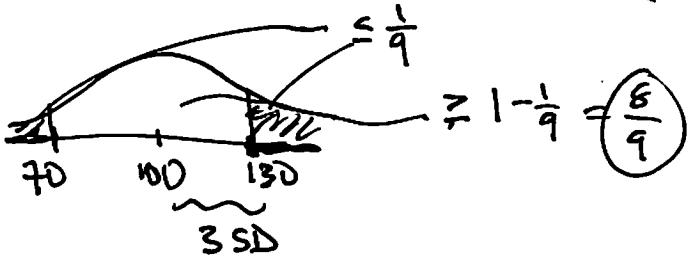
$$P(|X - \mu| \geq k\sigma) \leq \frac{1}{k^2}$$

ex Let X be a RV s.t. $E(X) = 100 = \text{Var}(X)$.

a) Can you find $E(X^2)$ exactly? If not, is there anything you can tell me about it that is more informative than "non-negative". $\text{Var}(X) = E(X^2) - E(X)^2$

$E(X^2) = \text{Var}(X) + E(X)^2 =$ **100 + 10000**

b) Can you find $P(70 < X < 130)$ exactly? If not is there anything you can tell me more informative then between 0 and 1.



ex X is RV w/ $E(X) = 3$ and $SD(X) = 2$.

T or F (justify) $P(X^2 \geq 40) \leq 1/3$.

$X^2 \geq 0$

$E(X^2) = \text{Var}(X) + E(X)^2 = 4 + 9 = 13$

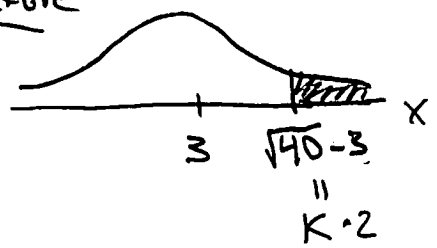
$P(X^2 \geq 40) \leq \frac{13}{40} < \frac{13}{39} = \frac{1}{3}$. (Markov)

True

You may also try this with Chebyshev:

$$P(X^2 \geq 40) = P(X \geq \sqrt{40}) = P(X-3 \geq \underbrace{\sqrt{40}-3}_{K\cdot\sigma})$$

Picture



$$\sqrt{40} - 3 = K \cdot 2$$

$$\Rightarrow K = \frac{\sqrt{40}-3}{2} = 1.66$$

Chebyshev gives

$$P(X-3 \geq 1.66(2)) \leq \left(\frac{1}{1.66}\right)^2 = \frac{1}{2.75}$$

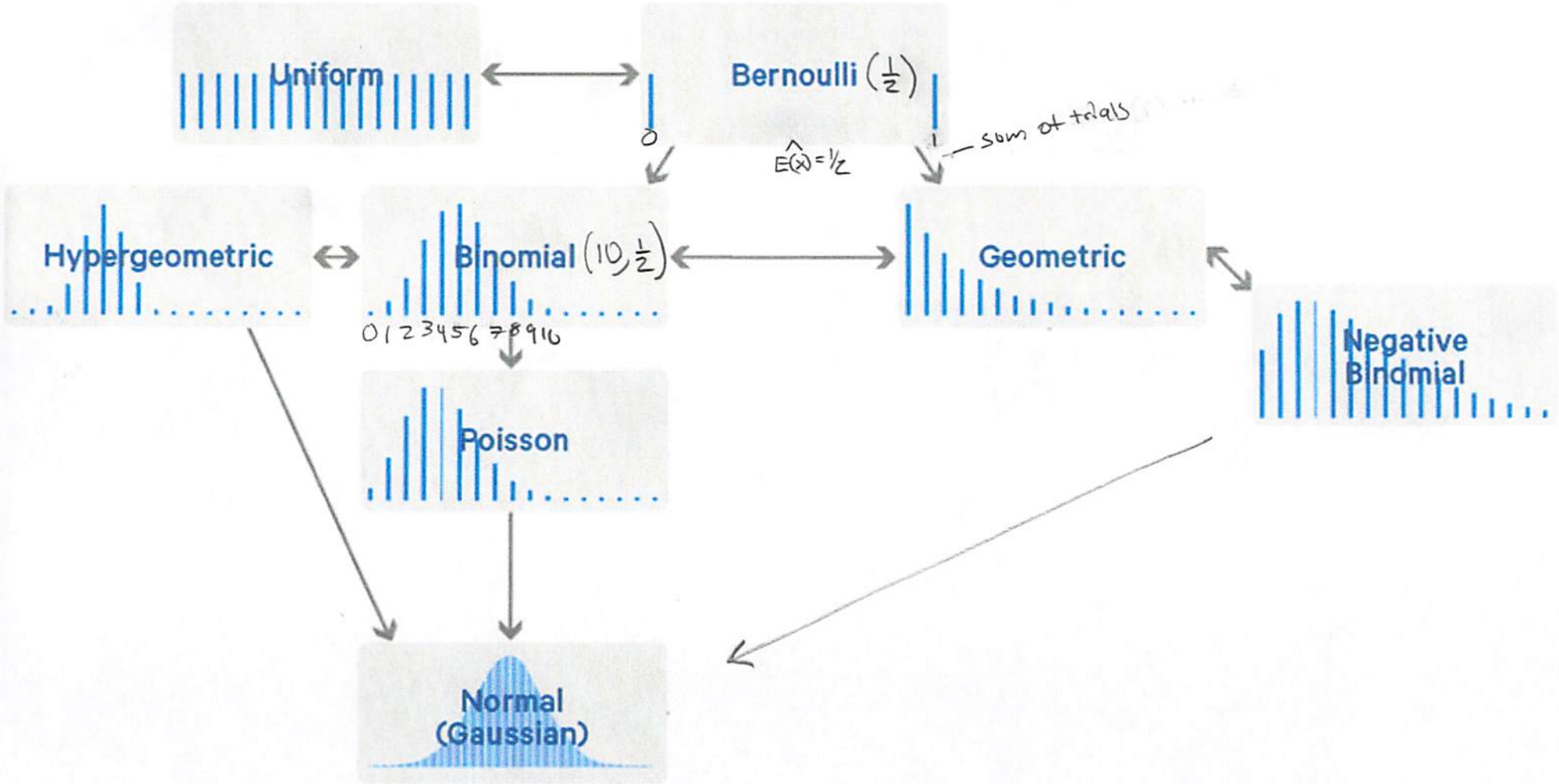
So Chebyshev doesn't show it is less than $\frac{1}{5}$ bus Markov does.

Distribution Summary

Instructions

Next to each distribution:
1) write parameter to match histogram
2) Describe a RV, X, with that histogram
3) Give values of X
4) indicate E(x) and its value in histogram
5) briefly explain relationship given by arrow

0, 1
X = # heads in one coin toss of fair coin



Possible solution?