

Inequalities and Geometric random variables

Say X is Geometric(p). Then $P(X > 7) = P(\text{first 7 trials fail})$
 $= q^7$ where $q = 1-p$.

In general $P(X > j) = P(\text{first } j \text{ trials fail})$
 $= q^j$

What about $P(X \geq 7) = P(X > 6) = P(\text{first 6 trials fail})$

In general $P(X \geq j) = q^{j-1} = q^6$

$$P(X \leq 7) = 1 - P(X > 7) = 1 - q^7$$

In general,

$$P(X \leq j) = 1 - P(X > j) = 1 - q^j$$

$$P(X < 7) = 1 - P(X \geq 7) = 1 - q^6$$

More generally,

$$P(X < j) = 1 - P(X \geq j) = 1 - q^{j-1}$$