

1. (a) pmf: $P_X(i) = P(X = i) = \frac{1}{6}(\frac{5}{6})^{i-1}$
 (b) cdf: $F(X) = P(X \leq x) = \sum_{j \leq x} \frac{1}{6}(\frac{5}{6})^{j-1}$
 (c) $E(X) = \sum_{k=0}^{\infty} k \frac{1}{6}(\frac{5}{6})^{k-1} = 6$
2. $P(X=j) = \binom{4}{j}$, $P(Y=k) = \binom{13}{k}$
3. $P(k \text{ heads in } N \text{ tosses}) =$
4. $P(\text{testPos}|\text{haveHep}) = 0.99 = \frac{P(\text{testPos} \cap \text{haveHep})}{P(\text{haveHep})} = \frac{X}{0.0001} \Rightarrow P(\text{testPos} \cap \text{haveHep}) = 0.000099$
 $P(\text{testPos}) = (0.99 * 1 + 0.05 * 9999)/10000 = 0.050094$

$P(\text{haveHep}|\text{testPos}) = \frac{P(\text{haveHep} \cap \text{testPos})}{P(\text{testPos})} = \frac{0.000099}{0.050094} = 0.001976$
5. (a) $P(\text{allH}|\text{firstH}) = \frac{P(\text{allH} \cap \text{firstH})}{P(\text{firstH})} = \frac{P(\{HH\})}{P(\{HH, HT\})} = \frac{1/4}{1/2} = 0.5$
 (b) $P(\text{allH}|\text{oneH}) = \frac{P(\text{allH} \cap \text{oneH})}{P(\text{oneH})} = \frac{P(\{HH\})}{P(\{HH, HT, TH\})} = \frac{1/4}{3/4} = \frac{1}{3}$
6. cond pmf: $P_{T|N}(t|n) = \frac{P(T=t, N=n)}{P(N=n)} = \frac{e^{-\lambda} \lambda^t / t!}{1/n}$
 $E(T|N) =$
 $E(E(T|N)) = E(T) = N\lambda$