

1) Let A and B be independent events with $P(A) = .3$ and $P(B) = .6$. Find

(a) $P(A \cap B)$

(b) $P(A \cup B)$

(c) $P(A' \cup B')$

(d) $P(A|B')$

- 2) A diagnostic test for a disease that occurs in 0.04% of the population is used. The test will detect a person with the disease 98% of the time. It will say that a person without the disease has the disease about 4% of the time. A person is selected at random from the population, and the test indicates that the person has the disease. What is the probability that
- (a) the person has the disease?
 - (b) the person does not have the disease?

- 3) Suppose the pmf of X is given by $f(0) = .2, f(1) = .5, f(2.2) = .3$. Find
- (a) $E(X)$
 - (b) $V(X)$
 - (c) the moment generation function of X .

- 4) A hospital receives 30% of its flu vaccine from Company A and the remainder from Company B. Each shipment contains a large number of vials of vaccine. From Company A, 4% of the vials are ineffective; from Company B, 3% are ineffective. A hospital tests 30 randomly selected vials from one shipment and finds that 3 are ineffective. What is the conditional probability that this shipment came from Company A?

5) Suppose the moment generating function of X is given by

$$M(t) = \frac{e^t}{3-2e^t}, \text{ for } |t| < .1.$$

(a) Identify the distribution of X .

(b) Find the mean of X .

(c) Find the variance of X .

- 6) Suppose there are four defective items in a lot of 45 items. A sample of size 7 is taken at random from the lot without replacement. Let X be the number of defective items in the sample.
- (a) Find the probability that the sample contains at least one defective item.
 - (b) Find the moment generating function of X .
 - (c) Find the probability that the sample contains at least one defective item if the sample were taken with replacement. Which answer for (a) or (c) is larger? Explain intuitively why.