

# MATH 451/URI

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**Exam #1**

3/20/2002

**1.**

- (a) If  $A \subset B$  with  $P(B) > 0$ , what is the value of  $P(A|B)$  ?
- (b) If  $A$  and  $B$  are exclusive (disjoint) events ( $A \cap B = \emptyset$ ) with  $P(B) > 0$ , what is the value of  $P(A|B)$  ?
- (b) In which case two exclusive events  $A$  and  $B$  are independent ?

**2.** In a certain population of voters, 70% of Democrats, 40% of the Republicans, and 60% of the independents say the mayor is doing a good job. The voters are 55% Democrat, 25% Republican, and 20% independent.

- (a) A randomly chosen voter thinks the mayor is doing a good job. What is the probability that the voter is a Republican ?
- (b) A randomly chosen voter thinks the president is not doing a good job. What is the probability that the voter is not a Democrat ?

**3.** Suppose that a random variable  $X$  has a binomial distribution for which the parameters are  $n = 100$  and  $p = P(S) = 0.4$ .

- (a) What is the probability of seven successes ?
- (b) What is the probability of at least three successes ?
- (c) What is the probability of seventy successes ? Use the exact formula and the exponential approximation.
- (d) What is the expectation and the variance ?

**4.** Suppose that a continuous random variable  $X$  has a probability distribution function (PDF) given with:

$$f(x) = \begin{cases} c(1 - x^3) & \text{for } 0 < x < 1, \\ 0 & \text{otherwise.} \end{cases}$$

- (a) Find  $c$  and CDF.
- (b) Find  $P(0 < X \leq 0.8)$ .
- (c) Find  $P(X = 0.7)$ .
- (d) Find  $E(X)$  and  $V(X)$ .

5. A device that continuously measures and records seismic activity is placed in a remote region. The time,  $T$ , to failure of this device is exponentially distributed with mean 4 years. Since the device will not be monitored during its first 3 years of service, the time to discovery of its failure is  $X = \max(T, 3)$ .

(a) Find PDF of  $X$ .

(b) Find  $E(X)$ .



*Extra Credit :*

6. A study is being conducted in which the health of two independent groups of ten policyholders is being monitored over a one-year period of time. Individual participants in the study drop out before the end of the study with probability 0.3. (independently of other participants).

What is the probability that at least 8 participants complete the study in one of the two groups, but not in both groups ?