

**PROBLEM SET #2**  
**DUE AT THE NEXT CLASS**

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I). You are given the following voting statistics (in millions) for the national election of 1988 based on persons of voting age.

	Voting Age Population	Registered to Vote	Actually Voted
Male	84.5	65.2	56.4
Female	93.6	67.8	58.3
	178.1	133	114.7

Let R- registered to vote, NR = not registered to vote Let V = actually voted VN = did not vote  
M = Male and F = Female

A) Determine the following probabilities (Note that only people who are registered can vote)

- i)  $P(R|F)$
- ii)  $P(R|M)$
- iii)  $P(V|F)$
- iv)  $P(V|M)$
- v)  $P(F|V)$
- vi)  $P(V|(R \cap F))$
- vii)  $P(V|(R \cap M))$

B) Use the numbers above to determine whether gender is independent of registering to vote.

## II. Can We Predict Color blindness from Gender?

25 women out of 10,000 are colorblind, while 5 men out of 100 are colorblind. What is the probability that a person is male if you learn that he is colorblind? (Assume that there are the same number of women and men in the general population).

## III. Medical Applications of Probability

The U.S. government and some private companies require certain employees to undergo mandatory, random drug testing. The standard urinalysis tests have a false positive rate of about 5 percent and a false negative rate of about 3 percent.

- A) About 4 percent of adults over the age of 25 are current users of illegal drugs (including marijuana). If a randomly-chosen adult tests positive, what is the probability that he or she is a drug-user?
- B) If a randomly chosen adult tests negative, what is the probability that he or she is not a drug user?
- C) Assuming the tests are independent, what is the probability that a non-drug-user would have two consecutive false positives?

#### **IV. Missile Defense**

The United States is developing a defense against ballistic missiles. The defensive system uses radars to identify and track incoming warheads and interceptors to destroy the warheads. The radars correctly identify and track 95% of all incoming warheads. If a warhead is properly identified and tracked, an interceptor has a 80% chance of destroying it.

- A). A warhead is launched against the United States. What is the probability that the warhead would be destroyed if only one interceptor is used?
- B). Now suppose that up to three interceptors can be used. What is the probability that the warhead would penetrate the defense?
- C). Suppose that five warheads are launched against the United States, and that the United States can use up to three interceptors against each warhead. What is the probability that at least one warhead will penetrate the defense?