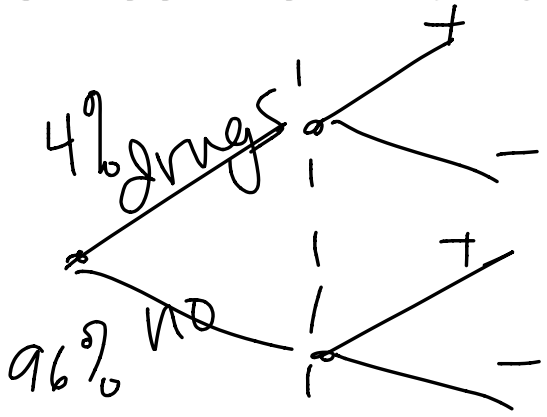
Alternate Example: False Positives and Drug Testing

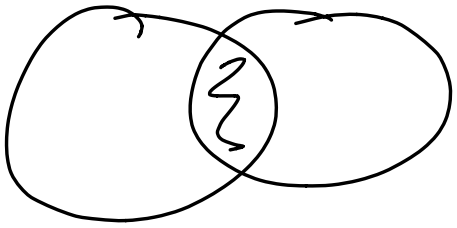
Many employers require prospective employees to take a drug test. A positive result on this test indicates that the prospective employee uses illegal drugs. However, not all people who test positive actually use drugs. Suppose that 4% of prospective employees use drugs, the false positive rate is 5% and the false negative rate is 10%.
(http://www.cbsnews.com/stories/2010/06/01/health/webmd/main6537635.shtml)

Problem: What percent of people who test positive actually use illegal drugs?



52 cards

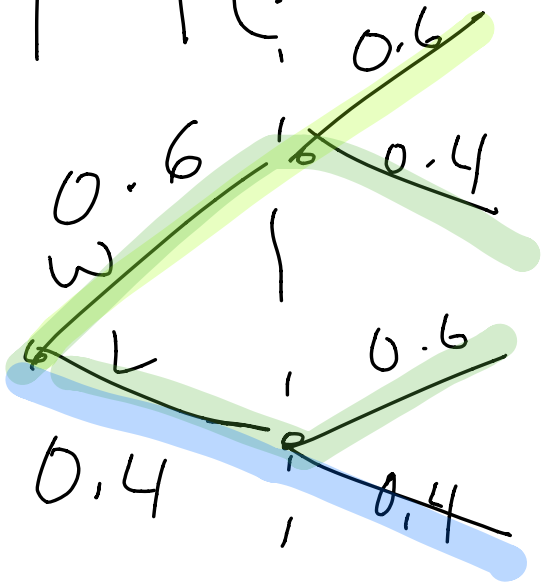
26 red 4 aces



$\frac{2}{52}$ $\frac{8}{}$

P(at least one of 2)

$= 1 - P(\text{lose both}) = 0.36$



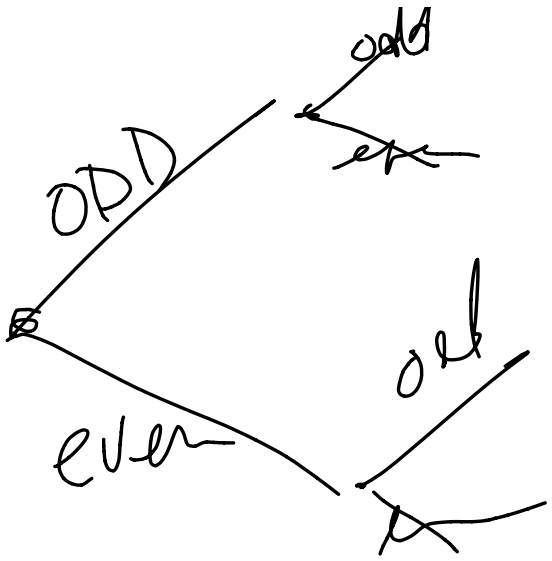
$= 0.24$

$= 0.24$

0.84

$\rightarrow P(\text{lose both}) = 0.4^2$

$1 - 0.4^2 = 84\%$

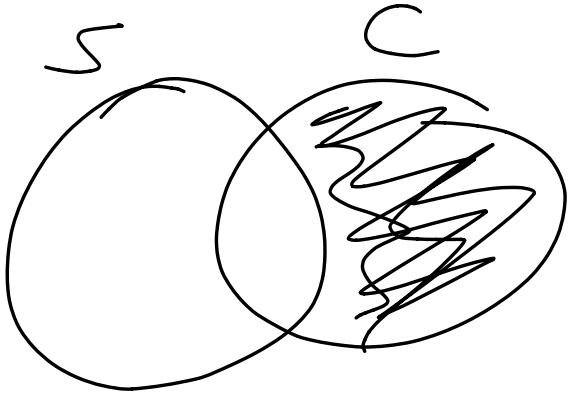


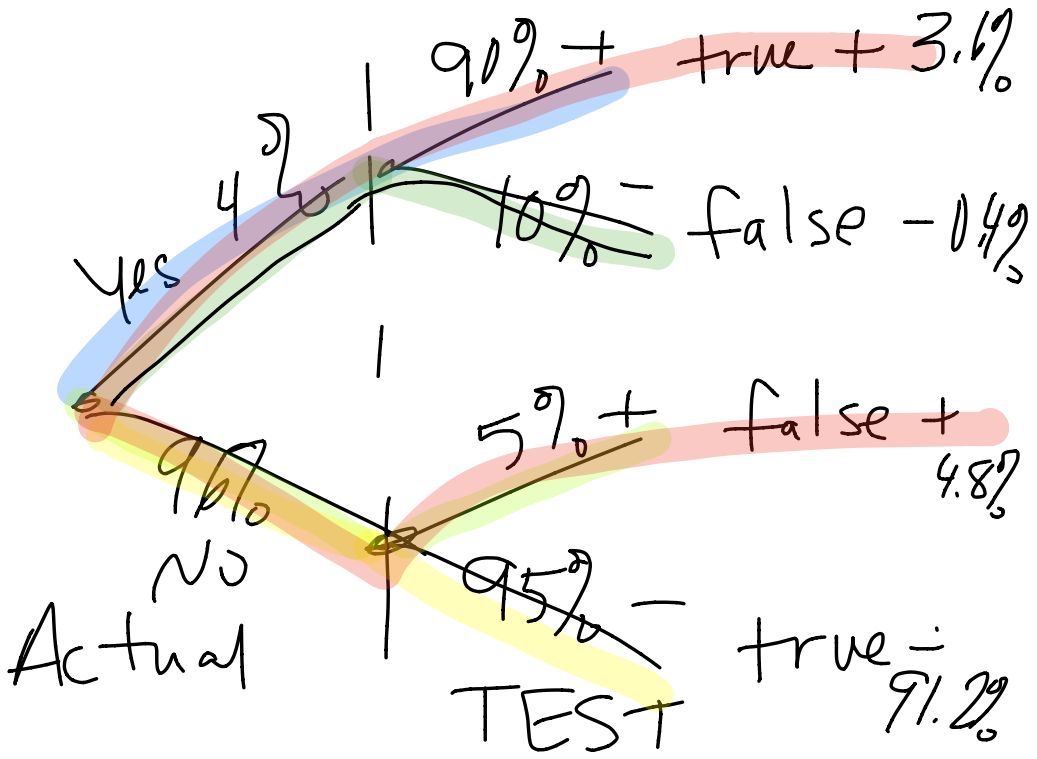
$\frac{2}{3} \cdot \frac{2}{3}$

$P(\text{both even}) = \frac{4}{9}$

$1 - \frac{4}{9} = \frac{5}{9}$

$\frac{4}{52} \cdot 1000$





$$\frac{90\% \cdot 4\%}{90\% \cdot 4\% + 96\% \cdot 5\%} = \frac{3.6}{8.4}$$

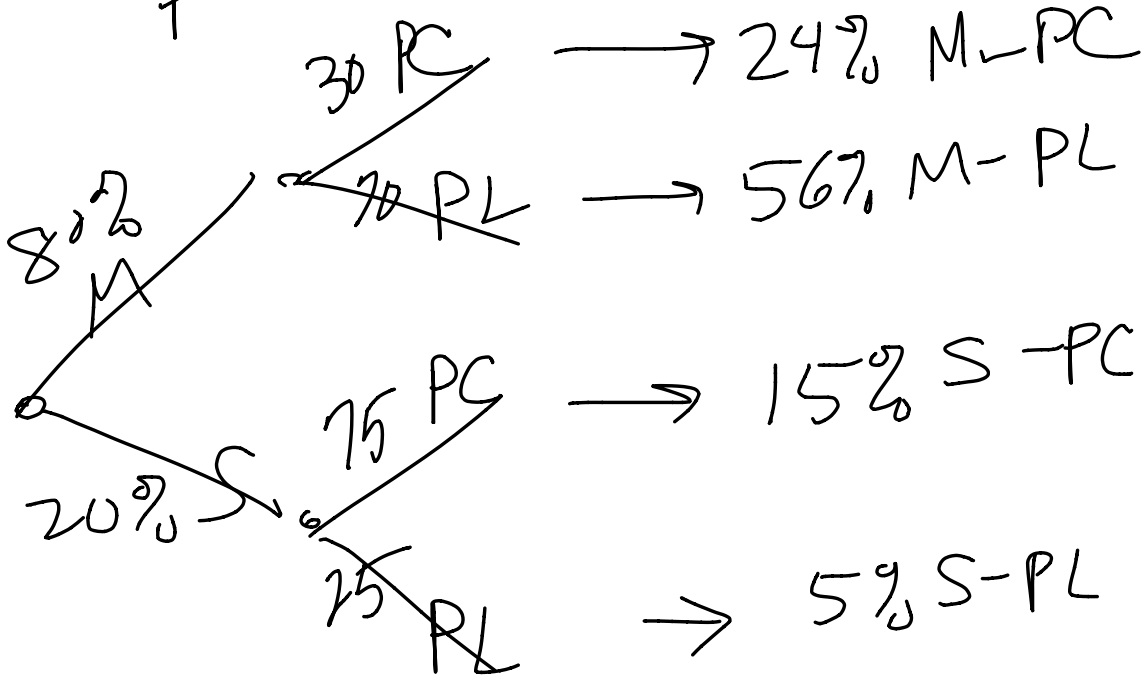
3.6 4.8

$\approx 43\%$

P. 335

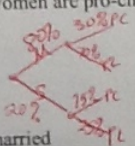
Review 5.7

p. 332: 99, 100



e) Is choosing a red bulb and choosing a defective bulb independent? Explain.

4. A woman's club has 80% of its members married. 30% of the married women are pro-choice and 75% of the single women are pro-choice. If a woman is chosen at random, find the probabilities. Make a chart.



24% M-PC
56% M-PL
15% S-PC
50% S-PL

a) she is married 80%

b) she is single 20%

c) she is pro-choice 24+15=39%

d) she is pro-life 56+5=61%

e) she is married and pro-choice 24%

f) she is single and pro-choice 15%

g) Given that she is married, she is pro-choice 30%

h) Given she is married, she is pro-life 70%

i) Given she is single, she is pro-choice 75%

j) Given she is single, she is pro-life 25%

k) Given she is pro-choice, she is married $\frac{24}{39} = 61.5\%$

l) Given she is pro-life, she is single $\frac{5}{61}$

m) Are being married and being pro-choice independent? Explain.

Let A = married
B = Pro-choice

No

$P(A) = 80\%$

$P(A|B) = \frac{24}{39} = 61.5\%$