4.47 b $\{1, 2, 3, 4, 5, 6, 7, 8\}$

$A = \{2, 5, 7\}$

$B = \{2, 4, 8\}$ ←

a) No, not mutually exclusive

b. Independent?

$P(A) \stackrel{?}{=} P(A \mid B)$

$\frac{3}{8} = \frac{1}{3}$ $\therefore$ not independent

Complementary events –

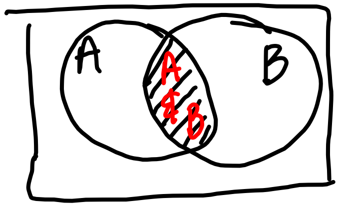
Roll a die

$P(1) = \frac{1}{6}$

$P(2, 3, 4, 5, 6) = \frac{5}{6}$

$\boxed{4.8}$ Intersection of Events –

$A \cap B$ = common to both A & B



A or B
union

Joint Probability

P(A and B)

$P(A \cap B) = P(A) \cdot P(B|A)$

$P(AB)$

OR $P(B) \cdot P(A|B)$

is found by multiplying the probability of one times the conditional probability of the other

(24) Boys & Girls

	Yes	No	Total
Boys	201	129	330
Girls	178	152	330
Total	379	281	660

Choose one child a random

what is the $P(G \& N) = P(G) \cdot P(N|G)$

$$= \frac{\cancel{330}^{1}}{660} \cdot \frac{152}{\cancel{330}_{1}}$$

$$= \frac{152}{660}$$

$$P(G \cap N) \approx .2303$$

$P(A \mid B)$ $P(B \mid A)$

$$\frac{P(A \,\&\, B)}{P(A)} = \frac{\cancel{P(A)} \cdot P(B \mid A)}{\cancel{P(A)}}$$

$$\frac{\cancel{2}x}{\cancel{2}}$$

$$P(B \mid A) = \frac{P(A \,\&\, B)}{P(A)}$$

$$\frac{P(A \,\&\, B)}{P(B)} = \frac{\cancel{P(B)} \cdot P(A \mid B)}{\cancel{P(B)}}$$

$$\frac{P(A \,\&\, B)}{P(B)} = P(A \mid B)$$

ex Given that $P(A) = .30$
$P(A \,\&\, B) = .24$

Find the $P(B \mid A)$

$$\frac{P(A \,\&\, B)}{P(A)} = \frac{P(\cancel{A}) \cdot P(B \mid A)}{P(\cancel{A})}$$

$$\frac{.24}{.30} = P(B \mid A)$$

$$.80 = P(B \mid A)$$

$$A = C \cdot B$$

(4) 4.78 Given $P(A|B) = .40$
and $P(A \& B) = .36$
find $P(B)$

solve for this

$$\frac{P(A \& B)}{P(A|B)} = \frac{P(B) \cdot \cancel{P(A|B)}}{\cancel{P(A|B)}}$$

$$\frac{.36}{.40} = P(B)$$

$$.90 = P(B)$$

ex Given $P(A \mid B) = .30$

and $P(A \& B) = .24$

Find $P(B)$

$$\frac{P(A \& B)}{P(A \mid B)} = \frac{P(B) \cdot \cancel{P(A \mid B)}}{\cancel{P(A \mid B)}}$$

$$\frac{P(A \& B)}{P(A \mid B)} = P(B)$$

$$\frac{.24}{.30} = P(B)$$

$$.80 = P(B)$$

.8

.84

.79

.80

Multiplication Rule for independent events

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

$$P(B) = P(B|A)$$

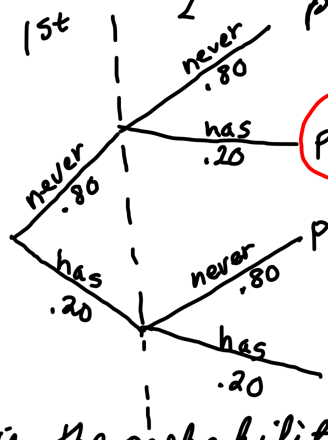
$$P(A \,\&\, B) = P(B) \cdot P(A)$$

for independent events because

$$P(A) = P(A|B)$$

4.90
pg 167

P(Never) = .80



$P(N,N) = .80(.80) = .64$

$P(N,H) = .80(.20) = .16$

$P(H,N) = .20(.80) = .16$

$P(H,H) = .20(.20) = .04$

What is the probability that 3 students are interviewed and none have gone to Florida?

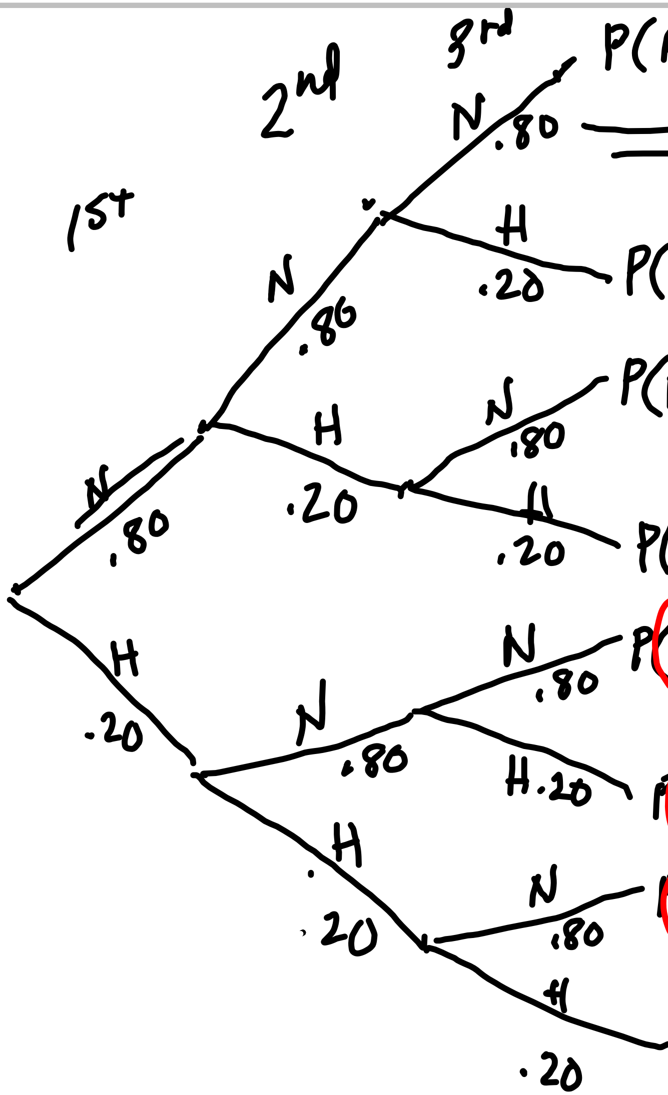
$P(N,N,N) = .80(.80)(.80)$
$= .51$

What is the probability that at least one has gone to Florida?

$P(N,N,N) = .80(.80)(.80)$

$P(\text{at least one}) = 1 - .51$
$\approx .49$

$$\begin{array}{r} 1.00 \\ -\ .51 \\ \hline .49 \end{array}$$



$P(N,N,N) = .80(.80)(.80) = .512$

$P(N,N,H) = (.80)(.80)(.20) = .128$

$P(N,H,N) = (.80)(.20)(.80) = .128$

$P(N,H,H) = .80(.20)(.20) = .032$

$P(H,N,N) = .20(.80)(.80) = .128$

$P(H,N,H) = .20(.80)(.20) = .032$

$P(H,H,N) = .20(.20)(.80) = .032$

$P(H,H,H) = .20(.20)(.20) = .008$

$P(\text{at least one } H) = .488$

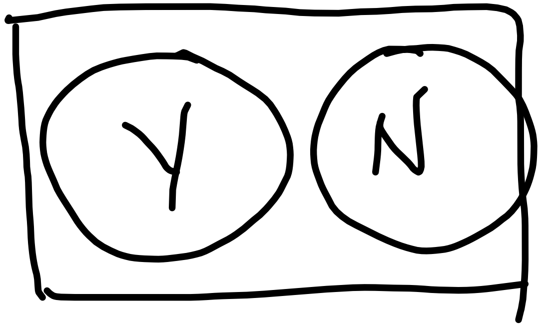
$1 - .512 = .488$

Joint Probability of Mutually Exclusive Events

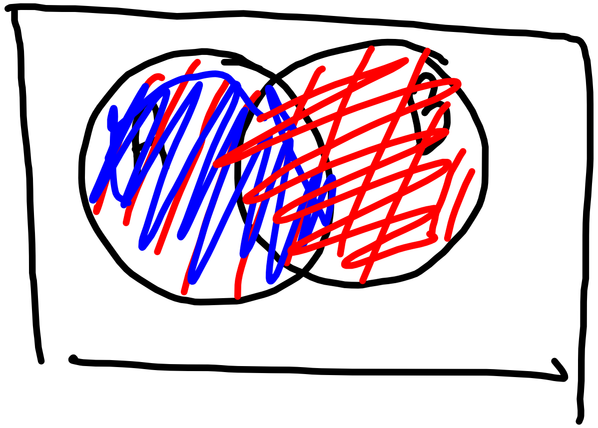
If A & B are mutually exclusive

$$P(A \text{ and } B) = 0$$

$$P(\text{Yes} \; \& \; \text{No}) = 0$$



Union



A U B = all outcomes in A and in B or in both

$P(A \cup B) = P(A) + P(B) - P(A \& B)$

$P(A \text{ OR } B)$

4.116
pg 175

$P(BW) = .25$

$P(D) = .15$

$P(BW \& D) = .08$

Find $P(BW \text{ or } D) = P(BW) + P(D) - P(BW \& D)$

$= .25 + .15 - .08$

$= .32$

Mutually Exclusive Events

$P(A \text{ or } B) = P(A) + P(B)$

because $P(A \& B) = 0$