## CH. 14 \& 15 PRACTICE

Complete from the book:
p. $338 \# 13,16,25,27,32,38,41$
p. $361 \# 8,11,13,19,22,28$

## p. 338

13) There is overlap between the two events (owning car and owning an SUV).
14) The two events are not independent. Siblings being left-handed are dependent events
15) (a) $\mathrm{P}(\mathrm{I})=0.3403$
(b) $\mathrm{P}(\mathrm{E} \mathrm{U} \mathrm{No})=0.0796$
16) (a) $\mathrm{P}(\mathrm{P} n \mathrm{P} n \mathrm{P})=0.1952$
(b) $\mathrm{P}\left(\mathrm{E}^{c} \mathrm{n} \mathrm{E}^{c} \mathrm{n} \mathrm{E}^{c}\right)=0.9131$
(c) Responses are independent
(d) As long as it is random polling, we can assume independence
17) (a) 1- $\mathrm{P}(\mathrm{AB})=0.04$

2- $\mathrm{P}(\mathrm{A} \mathrm{U} \mathrm{B})=0.51$
$3-\mathrm{P}\left(\mathrm{O}^{c}\right)=0.55$
(b) $\quad 1-\mathrm{P}(\mathrm{O}$ n O n O n O$)=0.041$

2- $\mathrm{P}\left(\mathrm{AB}^{\mathrm{c}} \mathrm{n} \mathrm{AB}{ }^{\mathrm{c}} \mathrm{nAB} \mathrm{AB}^{\mathrm{c}} \mathrm{AB}^{\mathrm{c}}\right)=0.8493$
3-1-P(A n A n A n A) $=0.9744$
4-1- $\mathrm{P}\left(\mathrm{B}^{\mathrm{c}} \mathrm{n} \mathrm{B}^{\mathrm{c}} \mathrm{n} \mathrm{B}^{\mathrm{c}} \mathrm{n} \mathrm{B}^{\mathrm{c}}\right)=0.3726$
38) (a) $\mathrm{P}\left(\mathrm{S}_{\mathrm{n}} \mathrm{Sn} \mathrm{S}^{\mathrm{c}} \mathrm{n} \mathrm{S}^{c} \mathrm{n}^{\mathrm{c}}\right)=0.01382$
(b) $\mathrm{P}\left(\mathrm{S}^{\mathrm{c}} \mathrm{n} \mathrm{S}^{\mathrm{c}} \mathrm{n} \mathrm{S}^{\mathrm{c}} \mathrm{n} \mathrm{S}\right)=0.0921$
(c) $\mathrm{P}(\mathrm{S} n \mathrm{~S} \operatorname{n~S~n~S~n~S})=0.0000759$
(d) $1-\mathrm{P}\left(\mathrm{S}^{\mathrm{c}} \mathrm{n} \mathrm{S}^{\mathrm{c}} \mathrm{n} \mathrm{S}^{\mathrm{c}} \mathrm{n} \mathrm{S}^{\mathrm{c}} \mathrm{n} \mathrm{S}^{c}\right)=0.5563$
41) $1-\mathrm{P}\left(\mathrm{D}^{\mathrm{c}} \mathrm{n}^{\mathrm{D}} \mathrm{D}^{\mathrm{D}} \mathrm{D}^{\mathrm{c}} \mathrm{n} \mathrm{D}^{\mathrm{c}}\right)=0.0776$

## p. 362

8) (a) $\mathrm{P}(\mathrm{M} \mid \mathrm{C})=6 / 18=0.3333$
(b) $\mathrm{P}(\mathrm{C} \mid \mathrm{F})=12 / 28=0.4286$
(c) $\mathrm{P}(\mathrm{F} \mid \mathrm{D})=16 / 24=0.6667$
9) (a) $\mathrm{P}(\mathrm{PG} n \mathrm{USA})=84 / 7690=0.0109$
(b) $\mathrm{P}(\mathrm{USA} \mid \mathrm{PG})=84 / 379=0.2216$
(c) $\mathrm{P}(\mathrm{PG} \mid \mathrm{USA})=84 / 1557=0.0539$
(d) $\mathrm{P}($ Primary $\mid$ China $)=506 / 1502=0.3369$
(e) $\mathrm{P}($ China $\mid$ Primary $)=506 / 1161=0.4358$
10) 

$\mathrm{P}(\mathrm{F})=0.70 \quad \mathrm{P}(\mathrm{S} \mid \mathrm{F})=0.30$
$\mathrm{P}(\mathrm{F} n \mathrm{~S})=\mathrm{P}(\mathrm{S} \mid \mathrm{F}) * \mathrm{P}(\mathrm{F})=0.70 * 0.30=0.21$
19) $\quad \mathrm{P}(\mathrm{S})=0.52 \quad \mathrm{P}(\mathrm{C})=0.23 \quad \mathrm{P}(\mathrm{S} \mathrm{n} \mathrm{C})=0.07$

(a) Eligibility $=P(S \mathrm{U} \mathrm{C})=P(\mathrm{~S})+\mathrm{P}(\mathrm{C})-\mathrm{P}(\mathrm{S} \mathrm{n} \mathrm{C})=0.68$

Ineligibility $=\mathrm{P}\left(\mathrm{S}^{\mathrm{c}} \mathrm{n} \mathrm{C}^{\mathrm{c}}\right)=1-0.68=\mathbf{0 . 3 2}$
(b) $\mathrm{P}(\mathrm{C} \mid \mathrm{S})=\underline{\mathrm{P}(\mathrm{C} \mathrm{n} \mathrm{S})}=\underline{0.07}=0.135$ $\mathrm{P}(\mathrm{S}) \quad 0.52$
(c) No. $\mathrm{P}(\mathrm{C} n \mathrm{~S}) \neq 0$
(d) No. $\mathrm{P}(\mathrm{C} \mid \mathrm{S}) \neq \mathrm{P}(\mathrm{C}) \quad$ OR $\quad \mathrm{P}(\mathrm{C} \mathrm{n} \mathrm{S}) \neq \mathrm{P}(\mathrm{C}) * \mathrm{P}(\mathrm{S})$
22) $\mathrm{P}(\mathrm{C})=0.18 \mathrm{P}(\mathrm{M})=0.09 \mathrm{P}(\mathrm{M} \mathrm{n} \mathrm{C})=0.04$

(a) $\mathrm{P}(\mathrm{C} \mid \mathrm{M})=\frac{\mathrm{P}(\mathrm{C} \mathrm{n} \mathrm{M})}{\mathrm{P}(\mathrm{M}) \quad 0.09}=\underline{0.04}=0.4444$
(b) No. $\mathrm{P}(\mathrm{C} n \mathrm{M}) \neq 0$
(c) No. $\mathrm{P}(\mathrm{C} n \mathrm{M}) \neq \mathrm{P}(\mathrm{C}) * \mathrm{P}(\mathrm{M})$

OR

$$
\mathrm{P}(\mathrm{C} \mid \mathrm{M}) \neq \mathrm{P}(\mathrm{C})
$$

28) Independent: $\mathrm{P}(\mathrm{B} \mid \mathrm{A})=\mathrm{P}(\mathrm{B})$

OR
$\mathrm{P}(\mathrm{A} \cap \mathrm{B})=\mathrm{P}(\mathrm{A}) * \mathrm{P}(\mathrm{B})$
Check:

| Does $\mathrm{P}(\mathrm{R} \mid \mathrm{F})=\mathrm{P}(\mathrm{R})$ ? | OR |
| :---: | :---: |
| $\underline{0.26}=0.30$ | Does $\mathrm{P}(\mathrm{R} \cap \mathrm{F})=\mathrm{P}(\mathrm{R}) * \mathrm{P}(\mathrm{F})$ ? |
| 0.62 | $0.26=0.30 * 0.62$ |
|  | $0.26 \neq 0.186$ |
| $0.4194 \neq 0.30$ |  |

So, no, they are not independent.

More practice.....remember to write everything in probability notation!!
A random sample of students at a high school finds 8 juniors that have only Calculus, 9 juniors that have only Statistics, 6 juniors that have both Calculus and Statistics, 10 seniors that have only Calculus, and 12 seniors that have only Statistics. If one of these students is randomly selected, what is the probability that they are:

1. A junior

$$
\mathrm{P}(\mathrm{~J})=23 / 45=0.511
$$

3. In Calculus
$\mathrm{P}(\mathrm{C})=24 / 45=0.533$
4. A senior in Statistics
$\mathrm{P}(\mathrm{Sn} \cap \mathrm{St})=12 / 45=0.2667$
5. A senior or in Statistics
$\mathrm{P}(\mathrm{Sn}$ U St $)=37 / 45=0.822$
6. A senior

$$
\mathrm{P}(\mathrm{Sn})=22 / 45=0.4889
$$

## 4. In Statistics

$\mathrm{P}(\mathrm{St})=27 / 45=0.60$

## 6. A junior in Calculus

$\mathrm{P}(\mathrm{J} \cap \mathrm{C})=14 / 45=0.311$
8. A junior or in Calculus
$\mathrm{P}(\mathrm{J} \mathrm{U} \mathrm{C})=33 / 45=0.733$

On a college campus a sample survey is taken by students in the student union. 130 students are surveyed. Of those surveyed 83 are women, 42 students said they currently own a credit card, and 22 of the women surveyed own a credit card. If a student is randomly selected what is the probability that they are: (Venn diagram)


1. A woman

$$
\mathrm{P}(\mathrm{~W})=83 / 130=0.6385
$$

0.3615
3. Own a credit card

$$
\mathrm{P}(\mathrm{C})=42 / 130=0.3231
$$

5. A woman and owns a credit card
$\mathrm{P}(\mathrm{W} \cap \mathrm{C})=22 / 130$
6. A man that doesn't own a credit card
$\mathrm{P}\left(\mathrm{W}^{c} \cap \mathrm{C}^{c}\right)=27 / 130$
7. A man

$$
\mathrm{P}\left(\mathrm{~W}^{c}\right)=1-(83 / 130)=47 / 130=
$$

4. Doesn't own a credit card

$$
\mathrm{P}\left(\mathrm{C}^{c}\right)=88 / 130=0.6769
$$

6. A woman or owns a credit card $\mathrm{P}(\mathrm{W} \mathrm{U} \mathrm{C})=103 / 130$
7. A man or doesn't own a credit card $\mathrm{P}\left(\mathrm{W}^{c} \mathrm{U} \mathrm{C}^{c}\right)=108 / 130$

The student council is thinking about holding a school dance as a fundraiser. In order to determine if the event will be profitable, representatives survey 60 students in the school. 32 girls were interviewed, 40 students said that they would attend, 27 were girls that said they would attend. If a student is selected at random, what is the probability that the student is:


## 1. A girl

$\mathrm{P}(\mathrm{G})=32 / 60$

## 2. Attending the school dance <br> $\mathrm{P}(\mathrm{A})=40 / 60$

3. A boy
$P\left(G^{c}\right)=28 / 60$

## 4. Not attending the school dance <br> $\mathrm{P}\left(\mathrm{A}^{\mathrm{c}}\right)=20 / 60$

5. A girl attending the dance $\mathrm{P}(\mathrm{G} \cap \mathrm{A})=27 / 60$
6. A girl or attending the dance $\mathrm{P}(\mathrm{G} \mathrm{U} \mathrm{A})=45 / 60$
7. A boy not attending the dance
$\mathrm{P}\left(\mathrm{G}^{\mathrm{c}} \cap \mathrm{A}^{\mathrm{c}}\right)=15 / 60$
8. A boy or not attending the dance $\mathrm{P}\left(\mathrm{G}^{\mathrm{c}} \mathrm{U} \mathrm{A}^{c}\right)=33 / 60$
9. A girl or not attending the dance $\mathrm{P}\left(\mathrm{G} \mathrm{U} \mathrm{A}^{c}\right)=47 / 60$

Use the probability rules to answer the following questions:

1. If $\mathrm{P}(\mathrm{W})=0.57$ and $\mathrm{P}(\mathrm{R})=0.30$ and $\mathrm{P}(\mathrm{W} \cap \mathrm{R})=0.17$, find the following:
a. $\mathrm{P}(\mathrm{W} U R)=\mathrm{P}(\mathrm{W})+\mathrm{P}(\mathrm{R})-\mathrm{P}(\mathrm{W} \cap \mathrm{R})=0.70$
b. $P(R \mid W)=\frac{P(W \cap R)}{P(W)}=\frac{0.17}{0.57}=0.298$
c. Are W and R disjoint events? Why or why not?

No. $\mathrm{P}(\mathrm{W} \cap \mathrm{R}) \neq 0$
d. Are W and R independent? Why or why not?

No. $\mathrm{P}(\mathrm{R} \mid \mathrm{W}) \neq \mathrm{P}(\mathrm{R}) \quad$ OR $\quad \mathrm{Yes}, \mathrm{P}(\mathrm{R} \mid \mathrm{W})=\mathrm{P}(\mathrm{R})$ (approximately)
2. If $\mathrm{P}(\mathrm{M})=0.42, \mathrm{P}(\mathrm{J})=0.31$ and M and J are disjoint, what is the probability of M or J ?

Disjoint means $\mathrm{P}(\mathrm{M} \cap \mathrm{J})=0$
$\mathrm{P}(\mathrm{M} \mathrm{U} \mathrm{J})=\mathrm{P}(\mathrm{M})+\mathrm{P}(\mathrm{J})=0.42+0.31=0.73$
3. If $\mathrm{P}(\mathrm{O})=0.61, \mathrm{P}(\mathrm{H})=0.23$ and O and H are independent, what is the probability of O and H ?

$$
\begin{aligned}
& \text { Independent means } \mathrm{P}(\mathrm{O} \cap \mathrm{H})=\mathrm{P}(\mathrm{O}) * \mathrm{P}(\mathrm{H}) \\
& \mathrm{P}(\mathrm{O} \cap \mathrm{H})=(0.61)(0.23)=0.1403
\end{aligned}
$$

4. If $\mathrm{P}(\mathrm{F})=0.41$ and $\mathrm{P}(\mathrm{Z})=0.19$ and $\mathrm{P}(\mathrm{Z} \mid \mathrm{F})=0.22$, find the following:
a. $\mathrm{P}(\mathrm{F}$ and Z$)=\mathrm{P}(\mathrm{F} \cap \mathrm{Z})=\mathrm{P}(\mathrm{Z} \mid \mathrm{F})$ * $\mathrm{P}(\mathrm{F})=0.0902$
b. $\mathrm{P}(\mathrm{F}$ or Z$)=\mathrm{P}(\mathrm{F} \mathrm{UZ})=\mathrm{P}(\mathrm{F})+\mathrm{P}(\mathrm{Z})-\mathrm{P}(\mathrm{F} \cap \mathrm{Z})=0.41+0.19-0.0902=0.5098$
