Conditional Probabilities

1. Use the table below to find each probability for a randomly selected employee:

EDUCATION AND SALARY OF EMPLOYEES				Total
	Under $20,000	$20,00 to $30,000	Over $30,000	
Less than high school	69	36	2	107
High School	112	98	14	224
Some College	102	193	143	438
College	13	173	245	431
Total	296	500	404	1200

a) P(employee has less than a high school education)

$$\frac{107}{1200} = .0892 \qquad 8.92\%$$

b) P(employee earns under $20,000)

$$\frac{296}{1200} = .2467 \qquad 24.6\%$$

c) P(employee earns over $30,000 and has less than a high school education)

$$\frac{2}{1200} = .0017 \qquad .17\%$$

d) P(employee earns under $20,000 and has a college degree)

$$\frac{13}{1200} = .0108 \qquad 1.08\%$$

e) P(employee earns over $30,000 | has only high school education)

$$\frac{14}{224} = .0625 \qquad 6.25\%$$

f) P(employee has less than high school education | earns over $30,000)

$$\frac{2}{404} = .0050 \qquad .5\%$$

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2. Use the table to find each probability for a randomly chosen student.

a) P(male) $\dfrac{91}{150}$ $= .6067 = 60.67\%$

GENDER AND COLLEGE MAJORS				
	Biology	Physics	Chemistry	Total
Male	40	16	35	91
Female	15	24	20	59
Total	55	40	55	150

b) P(male or majors in Chemistry)

$P(M \cup C) = \dfrac{91}{150} + \dfrac{55}{150} - \dfrac{35}{150} = \dfrac{111}{150}$

75%

c) P(majors in Physics | male)

$\dfrac{16}{91} = .176 = 17.6\%$

3. Use the sample space {5, 6, 7, 8, 9, 10, 11, 12, 13, 14} to find the probability for a randomly selected #.

a) P(integer)

$\dfrac{10}{10} = 1 = 100\%$

b) P(less than 10 | less than 13)

$\dfrac{5}{8} = .625 = 62.5\%$

c) P(greater than 8 | less than 11)

$\dfrac{2}{6} = \dfrac{1}{3} = .33\overline{3} = 33.\overline{3}\%$

d) P(greater than 7 | greater than 12)

$\dfrac{2}{2} = 1 = 100\%$

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4. a) Complete the tree diagram below showing the appropriate probabilities.

Maria travels to school either by walking or by bicycle. The probability she cycles to school is 0.75. If she walks, the probability that she is late for school is 0.1 and if she cycles, the probability that she is late for school is 0.05.

Walk: .25
.10 — Late .025
.90 — Not Late .225

Cycle: .75
.05 — Late .0375
.95 — Not Late .7125
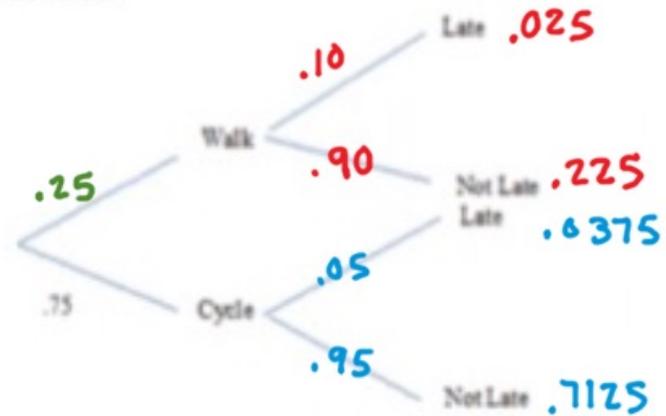
b) Find the probability that Maria is late for school.

.025 + .0375

.0625   6.25%

5. a) Complete the tree diagram below showing the appropriate probabilities.

Sharon and Lisa share an apartment. Sharon cooks dinner three nights out of ten. If Sharon does not cook dinner, then Lisa does. If Sharon cooks dinner the probability that they have pasta is 0.75. If Lisa cooks dinner the probability that they have pasta is 0.12.

Sharon: .30
.75 — Pasta .225
.25 — Not Pasta .075

Lisa: .70
.12 — Pasta .084
.88 — Not Pasta .616
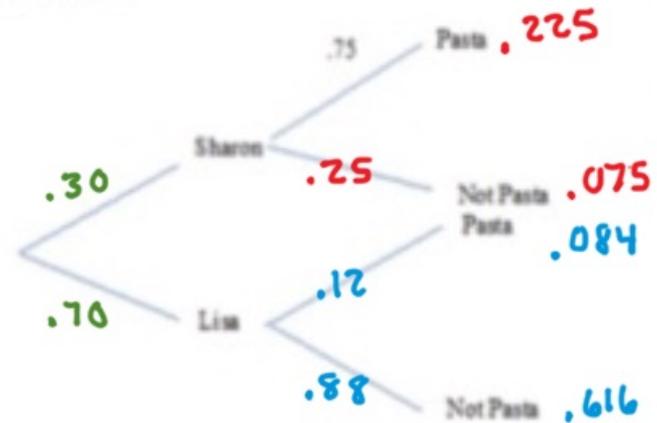
b) Find the probability that Lisa cooks dinner and they do not have pasta.

.616   61.6%

c) Find the probability they do not have pasta.

.075 + .616 = .691   69.1%

d) Given that they do not have pasta, find the probability that Lisa cooked dinner.

$$\frac{.616}{.691} = .8915 = 89.15\%$$

A B C D E F G H I J K L M|N oP Q R S T U V W X Y Z

½

6. The letters in the word **AARDVARK** are printed on square pieces of cardboard with one letter per card. The eight letters are placed in a hat and one letter is chosen at random. Find the following probabilities.

a) P(the letter chosen is a vowel | the letter falls in the first half of the alphabet)

$$\frac{3}{5} = .60 \qquad = 60\%$$

b) P(the letter falls in the first half of the alphabet | letter chosen is a vowel)

$$\frac{3}{3} = 1 \qquad = 100\%$$

Draw a tree diagram. Find each probability.

7. A softball game has an 80% chance of being canceled for a light drizzle and a 30% chance of being canceled for a heavy fog when there is no drizzle. There is a 70% chance of heavy fog and a 30% chance

a) Find the probability that the game will be canceled.

b) Find the probability there will be a light drizzle and the game will not be canceled.

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Light Drizzle

Canceled

.80

.20

Not Canceled

Heavy Fog

Canceled

.30

.70

Not Canceled
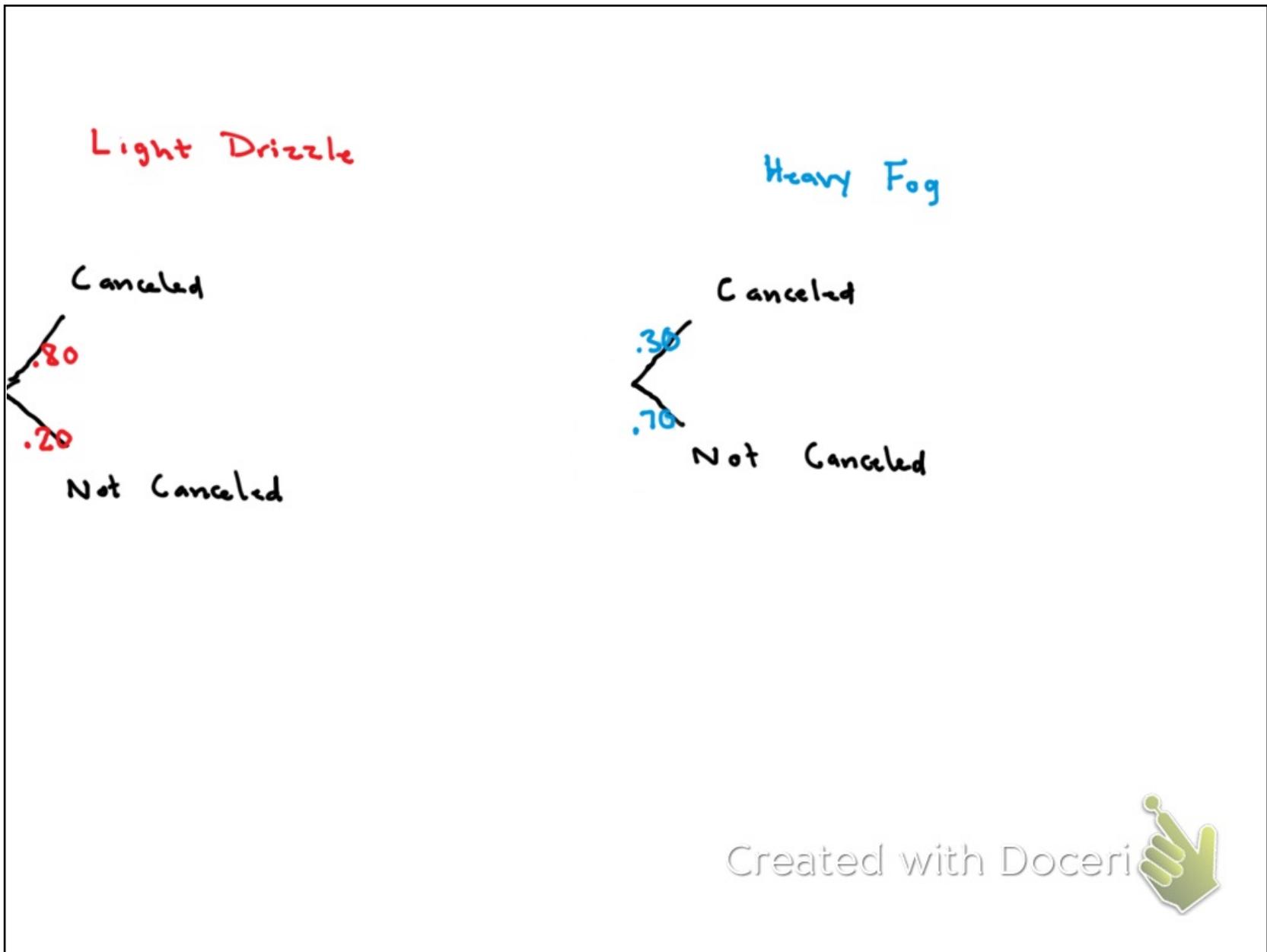
8. Given two events X and Y: Event X has probability $\frac{5}{6}$. If event X happens, then the probability of event Y is $\frac{2}{5}$. If event X does not happen, then the probability of event Y is $\frac{1}{4}$.

a) Label each branch of this tree diagram with a probability. (Any probabilities that are not already stated can be figured out from the given information.)

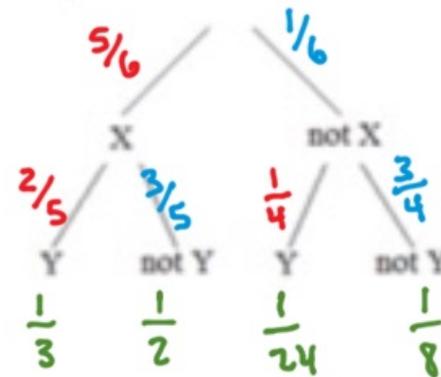Find these probabilities.

b) $P(\text{not } X) = \dfrac{1}{6}$

c) $P(Y \mid (\text{not } X)) = \bullet$

d) $P((\text{not } Y) \mid X) = \dfrac{1}{\cancel{2}^{1}} \cdot \dfrac{\cancel{6}^{3}}{5} = \boxed{\dfrac{3}{5}}$

$\dfrac{\frac{1}{2}}{\frac{5}{6}}$

e) $P(X \text{ and } Y) = \bullet$

f) $P((\text{not } X) \text{ and } (\text{not } Y)) =$

Tree diagram:
- $\frac{5}{6}$ → X ; $\frac{1}{6}$ → not X
- X: $\frac{2}{5}$ → Y , $\frac{3}{5}$ → not Y
- not X: $\frac{1}{4}$ → Y , $\frac{3}{4}$ → not Y
- Y: $\frac{1}{3}$; not Y: $\frac{1}{2}$; Y: $\frac{1}{24}$; not Y: $\frac{1}{8}$

c) $\dfrac{\frac{1}{24}}{\frac{1}{6}}$ $\dfrac{1}{\cancel{24}_{4}} \cdot \dfrac{\cancel{6}^{1}}{1} = \boxed{\dfrac{1}{4}}$

E) $P(X \cap Y) = \dfrac{5}{\cancel{6}_{3}} \cdot \dfrac{\cancel{2}^{1}}{5} = \boxed{\dfrac{1}{3}}$

f) $P(\text{Not } X \cap \text{not } Y) = \dfrac{1}{6} \cdot \dfrac{3}{4} = \dfrac{3}{24} = \boxed{\dfrac{1}{8}}$

9. High school students in one school chose their favorite leisure activity. Find each probability. Round to the nearest tenth of a percent.

Favorite Leisure Activities

	Sports	Hiking	Reading	Texting	Shopping	Other	
Female	39	48	85	62	71	29	**334**
Male	67	58	76	54	68	39	**362**
	106	**106**	**161**	**116**	**139**	**68**	**696**

a) P(sports | female)

$$\frac{39}{334} \quad .1168 \quad 11.68\%$$

b) P(female | sports)

$$\frac{39}{106} \quad .3679 \quad 36.79\%$$

c) P(reading | male)

$$\frac{76}{362} \quad .2099 \quad 20.99\%$$

d) P(male | reading)

$$\frac{76}{161} \quad .4220 \quad 42.2\%$$

e) P(hiking | female)

$$\frac{48}{334} \quad .1437 \quad 14.37\%$$

f) P(hiking | male)

$$\frac{58}{362} \quad .1602 \quad 16.02\%$$

g) P(male | shopping)

$$\frac{68}{139} \quad .4892 \quad 48.92\%$$

h) P(female | shopping)

$$\frac{71}{139} \quad .5108 \quad 51.08\%$$

10. The senior class is 55% female, and 32% are females who play a competitive sport. Find the probability that a student plays a competitive sport, given that the student is female.

.55   .45
F   M
.32   .68
S   NS   S   NS

$$\frac{.32}{.55} = .5818 \quad 58.18\%$$