

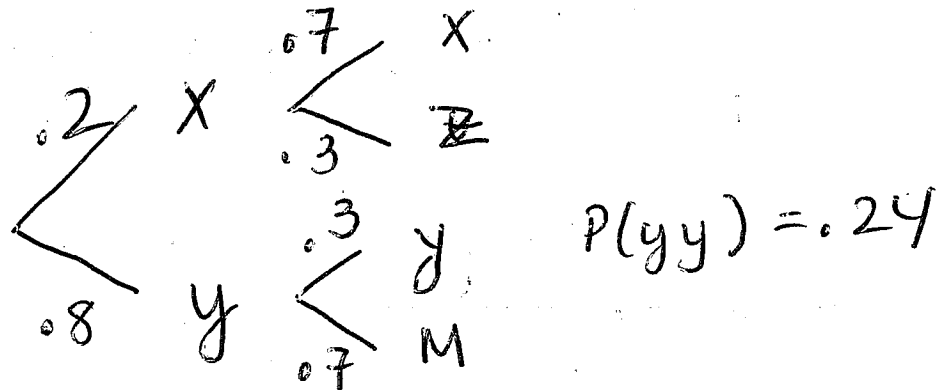
1. (15 points) The following data was collected from several large companies identifying the number of male and female employees who did or did not graduate from college. The data is summarized below:

	College Graduate	Not College Graduate	
Male	40	45	85
Female	20	45	65
	60	90	150

If an employee is selected at random from these companies, find the following probabilities.

- a. $P(\text{college graduate}) = \frac{60}{150}$
 b. $P(\text{female and college graduate}) = \frac{20}{150}$
 c. $P(\text{male or college graduate}) = \frac{105}{150}$
 d. $P(\text{male} \mid \text{college graduate}) = \frac{40}{60}$
 e. $P(\text{college graduate} \mid \text{female}) = \frac{20}{65}$

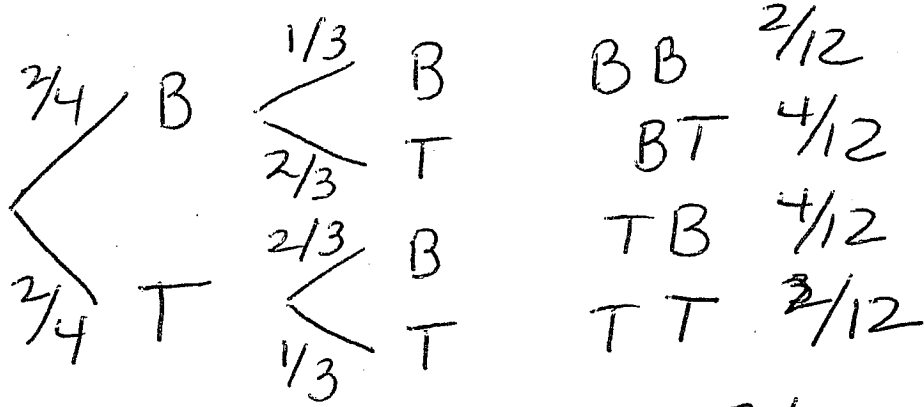
2. (6 points) For some unusual two-step experiment, only the data shown below is given and we know that $P(Y, Y) = 0.24$



What is $P(X, Z)$? $\frac{(.2)(.3)}{.06}$

What is $P(Y, M)$? $\frac{(.8)(.7)}{.56}$

3. (10 points) Suppose that you have one pair of black shoes (B) and one pair of tan shoes (T) that are similar except for color. When you were cleaning, they were thrown randomly into your closet. On a dark morning you reach into your closet and pull out two shoes. Draw a tree diagram for this situation, including the sample space and probabilities. (Do not worry about left and right feet).



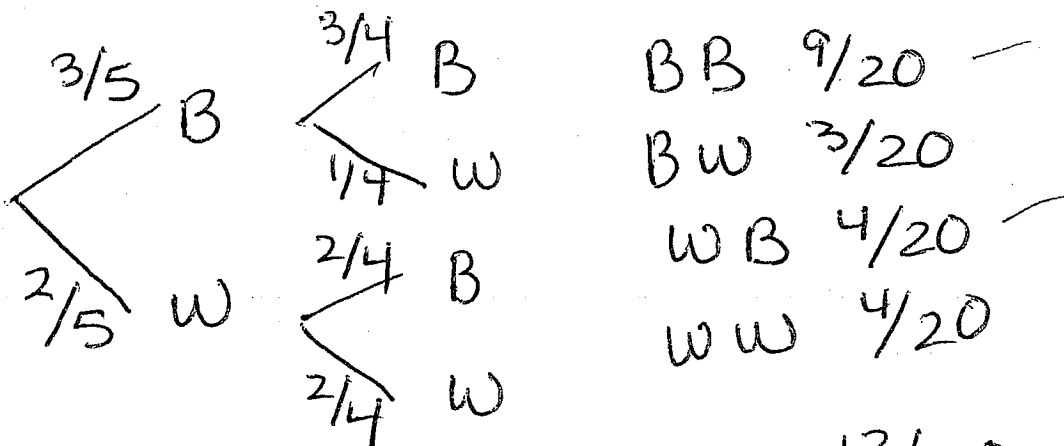
- a. The probability that you pull out a pair of black shoes = $\frac{2}{12} = \frac{1}{6}$
- b. The probability that the shoes are different colors = $\frac{8}{12} = \frac{4}{6} = \frac{2}{3}$

4. (12 points) Experiment: Draw a ball from Box 1, note its color and then **put it in Box 2**. Then draw a ball from Box 2 and note its color.

B B B W W
Box 1

B B W
Box 2

- a. Make a tree diagram for this experiment, note the sample space and probabilities.



- b. What is the probability that both balls are the same color? $\frac{13}{20}$
- c. What is the probability that the second ball is B? $\frac{13}{20}$

5. (11 points) A friend tells you about a couple they know that has three children.

a. List the complete sample space for having 3 children:

BBB BGB GBB GGB
BBG BGG GBG GGG

b. Without knowing any more information, what is the probability that they have at least one girl?

$$7/8$$

c. If you know that one of the children is a girl, what is the probability that they have at least two girls?

$$4/7$$

6. (6 points) Suppose that $P(A) = 0.7$ and $P(B) = 0.6$ and $P(A \text{ and } B) = 0.3$. Using the terms independent and disjoint, what can you say about events A and B. Explain fully.

If independent

$$P(A \text{ and } B) = P(A) \times P(B) = 0.7 \times 0.6 = 0.42$$

So not independent

If disjoint

$$P(A \text{ and } B) = 0, \text{ so not disjoint}$$

7. (9 points) Find the following probabilities:

a. J and K are mutually exclusive events. $P(J) = 0.6$ and $P(K) = 0.5$, find $P(J | K)$.

$$P(J | K) = 0$$

b. E and F are independent events. $P(E) = 0.3$ and $P(F | E) = 0.7$, find $P(F)$.

$$P(F | E) = P(F) = 0.7$$

c. Q and R are independent events. $P(Q \text{ and } R) = .14$ and $P(R) = .5$, find $P(Q)$.

$$P(Q \text{ and } R) = P(Q) \cdot P(R)$$

$$0.14 = P(Q) \times 0.5$$

$$0.14 / 0.5 = \boxed{0.28 = P(Q)}$$

8. (21 points) Find the following probabilities in fraction form.

a. Suppose that you toss a standard tetrahedron die (numbered 1 - 4) 5 times and get a 3 on every roll. What is the probability of rolling a 3 on the next toss? $\frac{1}{4}$

b. You have a spinner with 7 equal pieces, each a different color. What is the probability of landing on the same color two spins in a row? $\frac{1}{7} \cdot \frac{1}{7} = \frac{1}{49}$

c. You have an unfair coin where the $P(H) = \frac{5}{8}$. What is the probability of getting three heads in a row when tossing this coin? $\frac{5}{8} \cdot \frac{5}{8} \cdot \frac{5}{8} = \frac{125}{256}$

d. You have a bag containing 2 red and 5 yellow balls. What is the probability that you draw a red ball followed by a yellow ball, if the ball is replaced between the draws? $\frac{2}{7} \cdot \frac{5}{7} = \frac{10}{49}$

e. You have a bag containing 2 red and 5 yellow balls. What is the probability that you draw a red ball followed by a yellow ball, if the ball is **not** replaced between the draws? $\frac{2}{7} \cdot \frac{5}{6} = \frac{10}{42}$

f. You have a bag containing 2 red and 5 yellow balls. What is the probability that you draw three yellow balls in a row, if the ball is **not** replaced between the draws? $\frac{5}{7} \cdot \frac{4}{6} \cdot \frac{3}{5} = \frac{60}{210}$

g. You have a bag containing 2 red and 5 yellow balls. What is the probability that you draw three red balls in a row, if the ball is **not** replaced between the draws?
 \emptyset

9. (2 points each) Answer the following True / False questions.

T F a. The rule $P(A \text{ or } B) = P(A) + P(B)$ holds when A and B are disjoint.

T F b. The rule $P(A \text{ and } B) = P(A) \cdot P(B)$ always holds.

T F c. For most kids, the amount of TV time and the amount of homework completed are independent events.

T F d. Rolling a 2 on one die and a 5 on the other die is not disjoint, but is independent.

T F e. The probability of having 3 heads in a row while tossing a coin is the same as the probability of two tails followed by a head.