Stat 101 L – Homework 7
Solution

Assignment:

1. Below is a summary table of eye color and gender for students who took an introductory statistics course.

	Blue	Brown	Green	Hazel	Total
Female	313	291	175	156	935
Male	310	239	85	135	769
Total	623	530	260	291	1704

If one student is chosen at random from the 1,704, what is the probability, round the final fraction to 3 decimal places, that:

a) the student has blue eyes?

Prob(blue) = 623/1704 = 0.366 or 36.6%

b) the student is a female?

Prob(female) = 935/1704 = 0.549 or 54.9%

c) the student has green or brown eyes?

Prob(green or brown) = (260 + 530)/1704 = 790/1704 = 0.464 or 46.4%

d) the student is a female and has green eyes?

Prob(female and green) = 175/1704 = 0.103 or 10.3%

e) the student is male or has hazel eyes?

Prob(male or hazel) = Prob(male) + Prob(hazel) – Prob(male and hazel)
Prob(male or hazel) = 769/1704 + 291/1704 – 135/1704 = 925/1704 =0.543 or 54.3%

f) the student is a female given we know the person chosen has green eyes?

Prob(female | green) = 175/260 = 0.673 or 67.3%

g) the student has hazel eyes given we know the person chosen is a male?

Prob(hazel | male) = 135/769 = 0.176 or 17.5%

h) Are the events green eyes and blue eyes disjoint events? Explain briefly.

Yes, the events green eyes and blue eyes are disjoint events because you can not have both green eyes and blue eyes. Having one eye color excludes having a different eye color.

i) Are the events green eyes and female disjoint events? Explain briefly.

No, the events green eyes and female are not disjoint events because there are females who have green eyes.

j) Are the events green eyes and female independent events? Explain briefly.

Prob(green) = 260/1704 = 0.153 or 15.3%
Prob(green | female) = 175/935 =0.187 or 18.7%
Because the two probabilities above are not equal, the events are not independent.

Prob(female) = 935/1704 = 0.549 or 54.9%
Prob(female | green) = 175/260 = 0.673 or 67.3%
Because the two probabilities above are not equal, the events are not independent.

k) Are the events brown eyes and male independent events? Explain briefly.

Prob(brown) = 260/1704 = 0.311 or 31.1%
Prob(brown | male) = 239/769 =0.311 or 31.1%
Because the two probabilities above are equal, the events are independent.

Prob(male) = 769/1704 = 0.451 or 45.1%
Prob(male | brown) = 239/530 = 0.451 or 45.1%
Because the two probabilities above are equal, the events are independent.

2. Suppose an instructor offers students the following deal. Instead of taking the third exam in a course, the instructor will let them pick their grade from a bag that contains 5 A's, 7 B's, 11 C's, 1 D and 1 F. Two students decide to take the instructor up on the offer. The students begin to argue about who should go first. The instructor assures them that it doesn't matter as they both have the same chance of getting any grade.

a) If sampling is done **with replacement** give the probabilities associated with getting each grade and explain why both students have the same chance of getting any grade.

P(A) = 5/25 = 0.20
P(B) = 7/25 = 0.28
P(C) = 11/25 = 0.44
P(D) = 1/25 = 0.04
P(F) = 1/25 = 0.04

Because the grade is replaced after each draw, each student is drawing from the same set of grades whether a student goes first or second.

b) Suppose sampling is done **without replacement**? Demonstrate that the chance the second student to pick gets an F is the same as the chance that the first student to pick gets an F. Hint: Use a tree diagram to write out what can happen for the two students.

First Student	Second Student	Probability
A	A B C D F	**P(A and F) = 5/25*1/24**
B	A B C D F	**P(B and F) = 7/25*1/24**
C	A B C D F	**P(C and F) = 11/25*1/24**
D	A B C F	**P(D and F) = 1/25*1/24**
F	A B C D	**P(F and F) = 0**

P(F on 1st pick) = 1/25 = 0.04
P(F on 2nd pick) = 5/25*1/24 + 7/25*1/24 + 11/25*1/24 + 1/25*1/24 = 24/25*1/24 = 1/25 = 0.04
The two probabilities are the same.

3. There are more male babies born in the U.S. than female babies. The probability of having a male baby is 0.512 and the probability of having a female baby is 0.488. Suppose that there are 3 births at a local hospital and that the births are independent of each other. Construct the probability distribution for the number of male babies for the 3 births at the local hospital. Hint: Use a tree diagram to write out that can happen on each of the births.

1st birth	**2nd birth**	**3rd birth**	**Outcomes**	**Probability**
M	**M**	**M**	**M and M and M**	**(0.512)(0.512)(0.512) = 0.134**
		F	**M and M and F**	**(0.512)(0.512)(0.488) = 0.128**
	F	**M**	**M and F and M**	**(0.512)(0.488)(0.512) = 0.128**
		F	**M and F and F**	**(0.512)(0.488)(0.488) = 0.122**
F	**M**	**M**	**F and M and M**	**(0.488)(0.512)(0.512) = 0.128**
		F	**F and M and F**	**(0.488)(0.512)(0.488) = 0.122**
	F	**M**	**F and F and M**	**(0.488)(0.488)(0.512) = 0.122**
		F	**F and F and F**	**(0.488)(0.488)(0.488) = 0.116**

X = # of Males	**0**	**1**	**2**	**3**
P(X)	**0.116**	**0.366**	**0.384**	**0.134**