HW 12-4

1. See table on work slide.
2. Answers will vary. 1) The probability a member who saw the ad plans to vacation in NY and 2) The probability a member who did not see the ad is planning to vacation in NY.
3. 1) P(NY vaca given watched ad) = .40, 2) P(NY vaca given did not watch ad) = .40
4. No, the conditional probabilities are the same. Watching the ad did not appear to encourage people to vacation in NY.
5. No, it means if a randomly selected student is an engineering major, they are more likely to be in the marching band than a non-engineering major.
6. See table on work slide.
7. a) Complement: A randomly selected student is not in the marching band.
   b) M and E: A randomly selected student is in the marching band and an engineering major.
   c) M or E: A randomly selected student is in the marching band or is an engineering major.
8. a) .199 b) .217 c) .050 d) .149
9. a) .229 b) .190
10. Yes, the claim is accurate because 22.9% of engineering majors are in the marching band while 19% of non-engineering majors are in the marching band.

Name Key Alg 2 HW 12-4

A state nonprofit organization wanted to encourage its members to consider the State of New York as a vacation destination. They are investigating whether their online ad campaign influenced its members to plan a vacation in New York within the next year. The organization surveyed its members and found that 75% of them have seen the online ad. 40% of its members indicated they are planning to vacation in New York within the next year, and 15% of its members did not see the ad and do not plan to vacation in New York within the next year.

1. Complete the following hypothetical 1000 two-way frequency table:

	Plan to Vacation in New York Within the Next Year	Do Not Plan to Vacation in New York Within the Next Year	Total
Watched the Online Ad	300	450	750
Did Not Watch the Online Ad	100	150	250
Total	400	600	1000

2. Based on the two-way table, describe two conditional probabilities you could calculate to help decide if members who saw the online ad are more likely to plan a vacation in New York within the next year than those who did not see the ad. Column 1.

1) The probability a member who saw the add plans to vacation in NY.

2) The probability a member who did not see the ad is planning to vacation in NY.

P(NY | Watched)

P(NY | Didn't Watch)

3. Calculate the probabilities you described in #2.

1) P(Vacation in NY given Watched Ad) $= \frac{300}{750} = .40$

2) P(Vaca in NY given did not watch Ad) $= \frac{100}{250} = .40$

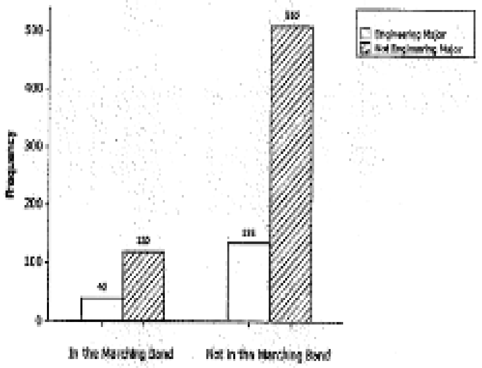
4. Based on the probabilities calculated in #3, do you think the ad campaign is effective in encouraging people to vacation in New York? Explain your answer.

No, the conditional probabilities are the same. Watching the ad did not appear to encourage people to vacation in NY.

5. Oostburg College has a large marching band. Engineering majors were heard bragging that students majoring in engineering are more likely to be involved in the marching band than students from other majors. If this claim is accurate, does this mean that most of the band is engineering students? Explain your answer.

No, it means if a randomly selected student is an engineering major, they are more likely to be in the marching band than a non-engineering major.

6. The following graph was prepared to investigate the claim in #5.



(not a 1000 table)

Based on the graph, complete the following two-way frequency table:

	In the Marching Band	Not in the Marching Band	Total
Engineering major	40	135	175
Not an Engineering major	120	510	630
Total	160	645	805

7. Let M represent the event that a randomly selected student is in the marching band. Let E represent the event that a randomly selected student is an engineering major.

a. Describe the event represented by the complement of M.

A randomly selected student is not in the marching band.

b. Describe the event M and E ($M \cap E$).

A randomly selected student is in the marching band and an engineering major.

c. Describe the event M or E ($M \cup E$).

A randomly selected student is in the marching band or is an engineering major.

8. Based on the completed two-way frequency table in #6, determine the following probabilities: (round to nearest thousandth)

a. A randomly selected student is in the marching band.

$\frac{160}{805}$ or .199 or 19.9%

b. A randomly selected student is an engineering major.

$\frac{175}{805}$ or .217 or 21.7%

c. A randomly selected student is in the marching band and an engineering major.

$\frac{40}{805}$ or .050 or 5%

d. A randomly selected student is in the marching band and not an engineering major.

$\frac{120}{805}$ or .149 or 14.9%

9. Based on the completed two-way frequency table in #6, determine the following conditional probabilities. (round to nearest thousandth)

a. A randomly selected student is majoring in engineering. What is the probability that this student is in the marching band?

P(M|E) $\frac{40}{175}$ or .229 or 22.9%

b. A randomly selected student is not majoring in engineering. What is the probability that this student is in the marching band?

P(M | Not E) $\frac{120}{630}$ or .190 or 19%

10. Based on the conditional probabilities calculated in #9, do you think the claim that students majoring in engineering are more likely to be in the marching band than students for other majors is accurate? Explain your answer.

Yes, the claim is accurate because 22.9% of engineering majors are in the marching band while 19% of non-engineering majors are in the marching band.

Day 5 Conditional Probability & Independence

Today we will look at how conditional probabilities can be used to tell if two events are independent or not independent.

		P	NP	
		Poisonous	Not Poisonous	Total
D	Dead	132	308	440
A	Alive	168	392	560
	Total	300	700	1000

1. Re-calculate the following probabilities from yesterday using Table 4. Determine and explain whether or not it is a conditional probability by definition.

a. The probability that a randomly selected snake is poisonous.

Calculate:
$P(P)$ $300/1000 = .3000$

Conditional Probability? No (Entire snake population)

b. The probability that a randomly selected snake who is dead was poisonous.

Calculate:
$P(P|D) = 132/440 = .300$

Conditional Probability? yes - just dead snakes
"Known" or "Given"

c. The probability that a randomly selected snake who is alive is poisonous.
fix

Calculate:
$P(P|A) = 168/560 = .300$

Conditional Probability? yes - just alive snakes
"Known" or "Given"

2. Would your prediction of whether or not a snake was poisonous change if you knew it was dead or alive?

No because the snakes are equally likely to be poisonous whether they are dead or alive.

Independence: Two events are Independent when knowing that one event has occurred does not change the likelihood that the second event has occurred.

Consider the following two events:

A: the event that a randomly selected snake is poisonous

B: the event that a randomly selected snake is dead

A and B would be independent if the probability that a randomly selected snake is poisonous is equal to the probability a randomly selected snake is poisonous given that it's dead. (or alive) If this were the case, knowing that a randomly selected snake is poisonous does not change the probability that the selected snake is dead. Therefore A and B would be independent.

$$\boxed{\therefore P(A) = P(A|B)}$$

general conditional

3. Based on the definition of independence, are the events (randomly selected snake is poisonous and a randomly selected snake is dead) independent? Explain.

Yes b/c P(Poisonous) = P(Poisonous | alive)
= P(Poisonous | Dead)

	Poisonous	Not Poisonous	Total
Dead	132	308	440
Alive	168	392	560
Total	300	700	1000

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4. A randomly selected snake is dead.

a. What is the probability this snake is poisonous?

P(P | D) = 132/440 = .3

b. Using only your answer from part (a), what is the probability that this snake is not poisonous? Explain how you arrived at your answer.

P(Not P | D) = 1 − P(P | D) = 1 − .3 = .7

Prob. of not happening = 1 − probability it does

Table 2: Student has asthma or not and is from a household with a smoker or not

	No household Member smokes	At least one household member smokes	Total
Student indicates he or she has asthma	69	113	182
Student indicates he or she does not have asthma	473	282	755
Total	542	395	937

5. You are asked to determine if the two events (a randomly selected student has asthma and a randomly selected student has a household member who smokes) are independent. What probabilities could you calculate to answer this question?

P(asthma)
P(asthma | Smoker)
P(asthma | Not Smoker)

choose any 2 to compare

6. Calculate the probabilities you described in #6. Determine if these two events are independent or not independent.

P(asthma) = 182/937 = .19
P(asthma | Smoker) = 113/395 = .29
P(asthma | Not Smoker) = 69/542 = .13
Not independent

7. A student is selected at random. The selected student indicates that he or she has a household member who smokes. What is the probability that the selected student has asthma?

P(A | Smoker) = 113/395 = .29

8. Use probabilities from the completed frequency table below to determine whether the two events (*Student Takes Algebra 2* and *Student Takes Chemistry*) are independent or not independent. Explain your answer.

	Chemistry	Not Chemistry	Total
Algebra 2	250	150	400
Not Algebra 2	100	500	600
Total	350	650	1000

P(alg 2) = 400/1000 = .400
P(alg 2 | chem) = 250/350 = .714
P(alg 2 | No Chem) = 150/650 = .231

Not indep. b/c P(Alg 2) ≠ P(Alg 2 | Chem)

or students in chem are **more** likely to take alg 2 than those not in Chem

OR

P(chem) = 350/1000 = .35
P(chem | Alg 2) = 250/400 = .625
P(chem | No Alg 2) = 100/600 = .167

FYI: Not Independent is not the same as Dependent.