Juliette Woodrow
CS 109

Section #4
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Section 4

1 Mental Gymnastics

Odysseus is preparing for the ancient Greek Olympic games, representing the Greek island of Ithaca. He has decided to participate in the Men's Gymnastics event and is aiming to set a new high score for the event.

It is common knowledge that the Olympic judges fairly score athletes according to their gymnastic skill level. Since Greek athletes' skill levels are normally distributed, athlete scores follow a normal distribution, with an average of 8.0 and a variance of 0.6. As one of these many Greek athletes, Odysseus knows that his score will follow this trend.

Odysseus feels unsure about whether he can accomplish his goal, so he asks his friend Mentor[1] for advice. Mentor watches Odysseus perform his gymnastic routine, full of tricks and twists, and remarks: "Were you to face off against a hundred athletes, I expect the judges would find you match or surpass the very best of them!"

1. Based on Mentor's assessment of Odysseus' performance, what is the minimum score Odysseus' routine would earn if he were to be judged in the Olympics? In other words, what is the minimum score Odysseus will achieve, given that he scores higher than 99% of athletes?

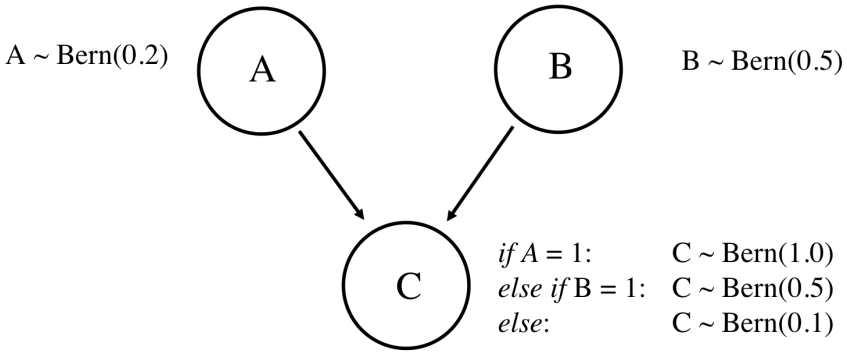
2. The current high score for men's gymnastics is 9.9. Given Odysseus will receive at least his minimum score from part 1, how likely is it that Odysseus is able to set a new high score for men's gymnastics at the Olympics?

[1] Fun fact: The modern English word "mentor" comes from the name of Telemachus' advisor, Mentor! Telemachus is Odysseus' son in the Ancient Greek Epic *The Odyssey*. As you might guess, the modern word "odyssey" also comes from Odysseus' epic journey in *The Odyssey*.

2 Understanding Bayes Nets

	A = 0		**A = 1**	
	B = 0	B = 1	B = 0	B = 1
C = 0	0.36	0.20	0.00	0.00
C = 1	0.04	0.20	0.10	0.10

The **joint probability table (above)** for random variables A, B and C is equivalent to the **bayesian network (below)**. Both give the probability of any combination of the random variables. In the Bayes network the probability of each random variable is provided given its causal parents.



a. Use the bayesian network to explain why $P(A = 0, B = 1, C = 1) = 0.20$.

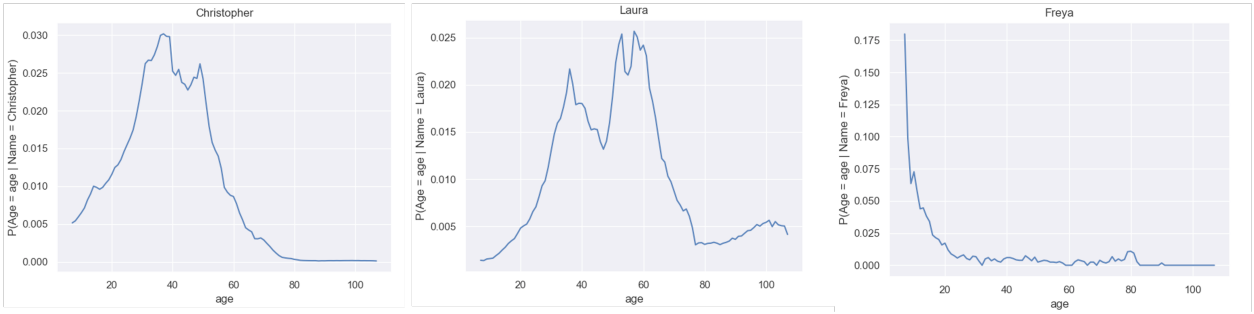
b. What is $P(A = 1|C = 1)$? Use the information in the table to justify your answer.

c. Is A independent of B? Explain your answer.

d. Is A independent of B **given** $C = 1$? Explain your answer.

3 Name2Age Inference

What is the probability distribution of someone's age given just their name? Here are a few example for the names 'Christopher' 'Laura' and 'Freya':



The U.S. Government released a dataset of the frequencies, by year, of all given names recorded in U.S. births at least 5 times. You can access this data via the function `get_count(name, year)` which returns the number of babies named `name` born in `year`. Since this data provides the joint distribution, it can be used to solve inference problems.

Write a function in pseudocode that 1) takes in a name and infers the conditional distribution $P(\text{Age} = \text{age}|\text{Name} = \text{name})$ across all of the ages covered by the dataset, and 2) plots this conditional probability function (see the plots above as examples).

```
def run_name_query(name, years_list):
```