Homework 1

P8120 Spring 2022

Due: **Sunday, January 30th at 11:59pm ET.**

* HW must be TYPED and submitted to CourseWorks as a **PDF**.
* Problems must be completed in order.
* Please provide your answers below each of the prompts. Use a different color or bold your answers to make it easier for your TA to grade.
* Every question must be answered with a full and meaningful sentence using the words of the problem.
* Any assumptions must be stated and checked.
* Don’t forget to **SHOW KEY STEPS OF YOUR WORK**! Partial credit is awarded for showing meaningful steps. A final answer is not enough for full credit. See practice problems for examples.
* You can discuss the problems with your classmates. However, your **written answers and solutions must be strictly your own and cannot be an exact copy of your classmates’ answers.**
* **For TA use (DO NOT DELETE):**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q1** | **Q2** | **Q3** | **Q4** | **TOTAL** |
|  |  |  | **YES**  **/ NO** |  |

1. Researchers are interested in the relationship between vaping and upper respiratory infections. Suppose that 15% of their population of interest has vaped in the past year and 25% have had an upper respiratory infection in the past year. In addition, they know that 10% have both vaped and had an upper respiratory infection in the past year.
   1. What percent of the population has neither vaped nor had an upper respiratory infection in the past year?
   2. What is the probability of having an upper respiratory infection in the past year given that the person has vaped in the past year?
   3. What is the complement of the event in part b)? Be sure to interpret this probability in the context of the problem.
   4. What is the probability of having an upper respiratory infection in the past year given that the person has not vaped in the past year?
   5. Are the two events independent? Be sure to justify your answer.
   6. Based on your calculations what can you conclude about the relationship between vaping and upper respiratory infections? Does vaping increase/decrease/have no impact on risk of upper respiratory infections? Explain your reasoning.
2. The Chinese Mini-Mental Status Test (CMMS) consists of 114 items intended to identify people with Alzheimer’s disease and senile dementia among people in China. An extensive clinical evaluation of this instrument was performed, whereby participants were interviewed by psychiatrists and nurses and a definitive diagnosis of dementia was made. The table below shows the results of the study.

|  |  |  |
| --- | --- | --- |
| CMMS score | No Dementia | Dementia |
| 0-5 | 0 | 2 |
| 6-10 | 0 | 1 |
| 11-15 | 3 | 4 |
| 16-20 | 9 | 5 |
| 21-25 | 16 | 3 |
| 26-30 | 18 | 1 |
| Total | 46 | 16 |

Suppose a cutoff value of ≤ 20 on the test is used to identify people with dementia. Further assume the rate of dementia in the population of interest is approximately 10%.

* 1. What is the sensitivity of this test?
  2. What is the specificity of this test?
  3. Suppose your grandmother receives a negative test result. What are the chances that she actually has dementia?

1. Researchers are interested in the overall COVID-19 test positivity rate for the tri-state area (New York - NY, New Jersey - NJ, and Connecticut - CT). Based on 2019 data, 19.45 million people live in NY, 8.88 in NJ, and 3.57 in CT, for a total of 31.9 million people.
   1. If the COVID-19 test positivity rate is 10% in NY, 15% in NJ, and 20% in CT, what is the COVID-19 test positivity rate across the tri-state area?
   2. Suppose a given person in the tri-state area has tested positive for COVID-19. What are the chances they are from NJ?
2. How much time did you spend on this assignment? \_\_\_\_\_\_\_\_hour(s)? *Estimate it to the nearest half hour (Example: 6.5 hours)*