

ECO220Y: Homework 7

Required Exercises: Chapter 8: 2, 8, 9, 11, 14, 15, 17, 21, 25, 33, 37 – 42, 47, 49, 53, 57, 58, 62, 65, 70, 79 and the “Air Canada” Mini Case Study (on pages 231 – 232)

Required Problems:

(1) Reconsider the joint probability table from lecture reproduced below.

Education	Employed	Unemployed	Not in labor force	Total
Not HS graduate	0.0614	0.0082	0.0292	0.0988
HS graduate	0.1463	0.0104	0.0312	0.1879
Some post-sec.	0.0387	0.0028	0.0080	0.0495
Post-sec. degree	0.3151	0.0180	0.0377	0.3707
University degree	0.2524	0.0127	0.0280	0.2931
Total	0.8139	0.0521	0.1341	1.0000

(a) $P(\text{Not HS graduate} \mid \text{Unemployed}) = 0.1574$ and $P(\text{HS graduate} \mid \text{Unemployed}) = 0.1996$. Does this mean that HS graduates are more likely to be unemployed compared to non-HS graduates?

(b) $P(\text{Unemployed} \mid \text{Not HS graduate}) = 0.0830$ and $P(\text{Unemployed} \mid \text{HS graduate}) = 0.0553$. Does this mean that more unemployed individuals are non-HS graduates than are HS graduates?

(c) What if the population of interest were people “*in the labor force* who are 25 – 54 years old” rather than people “who are 25 – 54 years old”? Create a new joint probability table for this new situation. Clearly it will not have a column for “Not in the labor force” because everyone in the population of interest is in the labor force.

(2) A company has a very large number of customers with subscriptions set to expire. When it contacts each customer asking her/him to renew, it decides to offer each one of these options at random: no discount (ND), a modest discount (MD), or a large discount (LD). This table shows the results:

	No disc.	Modest disc.	Large disc.
Renewed	0.20	0.10	0.07
Did not renew	0.50	0.10	0.03

What if the company did the same experiment (mailed out offers in the same proportions as originally), *BUT customers were totally indifferent to discounts*? Suppose further that 37% renewed overall (like original). Fill in the six empty cells below to show what the new results would be in this scenario (where customers do not care about discounts). *Show your work and explain why the numbers differ from the original table.*

	No disc.	Modest disc.	Large disc.
Renewed			
Did not renew			

(3) Suppose you draw 4 cards from deck and all are ♥’s.

(a) If sampling with replacement, which means returning card to deck and reshuffling after each draw, is $P(5\text{th card a } \heartsuit \mid 4 \heartsuit\text{'s}) = P(5\text{th card a } \heartsuit)$?

(b) If sampling without replacement, which means holding on to each card you draw, is $P(5\text{th card a } \heartsuit \mid 4 \heartsuit\text{'s}) = P(5\text{th card a } \heartsuit)$?

(4) Reconsider the 2016 NBER Working Paper from class: “The Market for Financial Adviser Misconduct” by Mark Egan, Gregor Matvos, and Amit Seru (<http://www.nber.org/papers/w22050>). The paper’s abstract is below.

Abstract: We construct a novel database containing the universe of financial advisers in the United States from 2005 to 2015, representing approximately 10% of employment of the finance and insurance sector. Roughly 7% of advisers have misconduct records. Prior offenders are five times as likely to engage in new misconduct as the average financial adviser. Firms discipline misconduct: approximately half of financial advisers lose their job after misconduct. The labor market partially undoes firm-level discipline: of these advisers, 44% are reemployed in the financial services industry within a year. Reemployment is not costless. Following misconduct, advisers face longer unemployment spells, and move to less reputable firms, with a 10% reduction in compensation. Additionally, firms that hire these advisers also have higher rates of prior misconduct themselves. We find similar results for advisers of dissolved firms, in which all advisers are forced to find new employment independent of past misconduct or performance. Firms that persistently engage in misconduct coexist with firms that have clean records. We show that differences in consumer sophistication may be partially responsible for this phenomenon: misconduct is concentrated in firms with retail customers and in counties with low education, elderly populations, and high incomes. Our findings suggest that some firms “specialize” in misconduct and cater to unsophisticated consumers, while others use their reputation to attract sophisticated consumers.

(a) Translate this statement into a formal (mathematical) probability statement: “Prior offenders are five times as likely to engage in new misconduct as the average financial adviser.” Make sure to formally define events.

(b) Translate these statements into a formal (mathematical) probability statements: “Firms discipline misconduct: approximately half of financial advisers lose their job after misconduct. The labor market partially undoes firm-level discipline: of these advisers, 44% are reemployed in the financial services industry within a year.” Make sure to formally define events. Further, use the results from Table 8a, reproduced below, to show where the number 44% comes from.

Table 8a. Consequences of Misconduct: Industry and Firm Discipline

	No Misconduct	Misconduct
Remain with the Firm	81.29%	51.99%
Leave the Firm	18.71%	48.01%
Leave the Industry	8.92%	26.96%
Join a Different Firm (within 1 year)	9.79%	21.05%

Note: Table 8a displaces the average annual job turnover among financial advisers over the period 2005-2015. The table shows, on average, the percentage of advisers that remain with their firm, leave the industry (for at least one year) or join a new firm (within a year). The job transitions are broken down by whether or not the advisor was disciplined for misconduct in the previous year.

(5) When learning about probability and the fallacy of the “law of small numbers” too many people think it is abstract and not relevant to everyday life. To help you appreciate just how relevant this is to so many different aspects of life, consider a 2016 NBER Working Paper entitled “Decision-Making under the Gambler’s Fallacy: Evidence from Asylum Judges, Loan Officers, and Baseball Umpires” by Daniel Chen, Tobias J. Moskowitz and Kelly Shue (<http://www.nber.org/papers/w22026>). First, read the publically available one-page digest (summary) of the paper, which is meant to be accessible to reporters and hence will be easy for you to understand: see page 5 of <http://www.nber.org/digest/jun16/jun16.pdf>. Next, read the paper’s abstract (below), which is more challenging (but appropriate for a student in ECO220Y1Y, even if hard for a reporter).

Abstract: We find consistent evidence of negative autocorrelation in decision-making that is unrelated to the merits of the cases considered in three separate high-stakes field settings: refugee asylum court decisions, loan application reviews, and major league baseball umpire pitch calls. The evidence is most consistent with the law of small numbers and the gambler's fallacy – people underestimating the likelihood of sequential streaks occurring by chance – leading to negatively autocorrelated decisions that result in errors. The negative autocorrelation is stronger among more moderate and less experienced decision-makers, following longer streaks of decisions in one direction, when the current and previous cases share similar characteristics or occur close in time, and when decision-makers face weaker incentives for accuracy. Other explanations for negatively autocorrelated decisions such as quotas, learning, or preferences to treat all parties fairly, are less consistent with the evidence, though we cannot completely rule out sequential contrast effects as an alternative explanation.

(a) In the word autocorrelation, “auto” means self, as in autoimmune disease when the body’s immune system attacks itself. Autocorrelation in the paper above means that your current decision is affected by your past decisions. What does *negative* autocorrelation mean? What would *no* autocorrelation mean?

(b) Suppose after reading this you think about a group project submitted in another course. You know the professor is grading the 30 projects (in a random order and anonymously, which is what most professors do) and you worry that if your professor happens to pick up your group’s project after just giving the previous project an A+ that s/he will be less inclined to give you an A+. You bring this up with a classmate who jokes “Well, by the same token, if we really bombed it and the prof happens to mark another failing project right before ours, at least s/he will be less inclined to give us an F!” Does this conversation (including the joke) reflect an understanding or a misunderstanding of the main point of the NBER paper? Is there any nuance that is missed?

Extra Problems (for those wanting more practice):

(6) To solve probability problems requires identifying the types of probabilities given and asked for. Identify the type of probability (marginal, conditional, joint) and write it using formal notation (eg. $P(\text{drinks beer} \mid \text{drinks wine}) = 0.5$).

- (a)** 65% of women work
- (b)** 45% of workers are women
- (c)** Of students enrolled in the Commerce program, 66% do not have English as their first language
- (d)** The chance of choosing a minor in Philosophy for students who major in economics is 25%
- (e)** Population of interest is U of T students. 15% of U of T students are part-time
- (f)** Population of interest is Canadian students. 15% of U of T students are part-time
- (g)** 90% of tenured faculty members in economics are male
- (h)** 10% of people dislike the color green
- (i)** People that dislike red also dislike green with probability 0.05
- (j)** 60% of students that take ECO220 are simultaneously enrolled in ECO204
- (k)** 70% of students take ECO220 and ECO204 simultaneously