ECO220Y: Homework, Lecture 6

Readings: Chapter 6 (skip section 6.9)

Problems: Chapter 6: 1, 3, 8, 9, 10, 11, 15, 19, 23, 25, 32, 34

(1) The first step of solving a probability problem—understanding what types of probabilities are given and what is being asked for—requires developing a skill. For each of the following, identify what kind of probability the text indicates (marginal, conditional, joint) and write it out in probability notation (eg. P(A) = 0.5 or P(A | B) = 0.5 or P(B | A) = 0.5 or P(A and B) = 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)** Question is focused on U of T students. 15% of U of T students are part-time
- **(f)** Question is focused on Canadian students. 15% of U of T students are part-time
- **(g)** 90% of tenured faculty members in economics are male
- **(h)** There is a 5% chance that a student fails both ECO100 and the qualifying exam
- **(i)** There is a 90% chance that a student that fails ECO100 also fails the qualifying exam
- **(j)** 10% of people dislike the color green
- **(k)** People that dislike red also dislike green with probability 0.05
- **(l)** 60% of students that take ECO220 are simultaneously enrolled in ECO200
- **(m)** 70% of students take ECO220 and ECO200 simultaneously

(2) To answer the following reconsider example in Lecture 6 about the methods of payment and amount paid.

(a) P(Credit card | Under $20)=0.1875 and P(Cash | Under $20)=0.5625. Does this mean that customers are more likely to pay cash when they spend small amounts?

(b) P(Under $20 | Credit card)=0.06 and P(Under $20 | Cash)=0.529. Does this mean that more customers spend under $20 when paying by cash compared to when paying with a credit card?

(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(5th card a ♥ | 4 ♥'s) = P(5th card a ♥)? So what?

(b) If sampling without replacement, which means holding on to each card you draw, is P(5th card a ♥ | 4 ♥'s) = P(5th card a ♥)? So what?

(4) Chevalier de Mere's Problem (arguably the one that started the probability theory as we know it). Chevalier de Mere liked games of chance. His favourite bet was that he could get "at least one six in 4 rolls of a die". His second favourite bet was "at least one double-six in 24 rolls of two dice". The problem was that he used to lose badly in the second case. According to the reasoning of Chevalier de Mere, the odds of winning should be equal because: (1) two six in two rolls are 1/6 as likely as one six in one roll. To compensate for that, Chevalier de Mere reasoned, (2) the two dice should be rolled 6 times; (3) and to achieve the probability of one six in 4 rolls, the number of rolls should be increased four fold – to 24. Find the flaw in the Chevalier de Mere's reasoning, and compute the correct probabilities.