HW07 - More Probability

Stat 131A, Fall 2018

Due Oct-15

General Instructions

- Write your narrative and code in an `Rmd` (R markdown) file.
- Name this file as `hw07-first-last.Rmd`, where `first` and `last` are your first and last names (e.g. `hw07-gaston-sanchez.Rmd`).
- Please do not use code chunk options such as: `echo = FALSE`, `eval = FALSE`, `results = 'hide'`. All chunks must be visible and evaluated.
- Submit your Rmd and html files to bCourses.

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1) A club has 90 members: 50 are lawyers and 50 are liars. Everyone is either a lawyer or a liar. Consider the experiment of randomly selecting a member. Let A be the event of selecting a lawyer. Let B be the event of selecting a liar.

a. What is P(A), the probability that a randomly selected member is a lawyer?

b. What is P(B), the probability that a randomly selected member is a liar?

c. What is P(Not B), the probability that a randomly selected member is not a liar?

d. What is P(A *and* B), the probability that a randomly selected member is both a lawyer and a liar?

e. What is P(A | B), the probability of randomly selecting a lawyer given that the member is a liar?

f. What is P(A *and* Not B), the probability that a randomly selected member is both a lawyer but not a liar?

g. What is P(Not B | A), the probability that a lawyer is not a liar?

2) A large company has instituted a mandatory employee drug screening program. Assume that the drug test used is known to be 99% accurate. That is, if an employee is a drug user, the test will come back positive ("drug detected") 99% of the time. If an employee is a non-drug user, then the test will come back negative ("no drug detected") 99% of the time. Assume that 2% of the employees of the company are drug users.

In constructing the hypothetical two-way table, it is convenient to start by assuming that the company has 10,000 employees (10,000 is a large enough number to ensure that all calculations result in whole numbers).

	drug user	non drug user	Row Totals
drug test: positive	C	E	G
drug test: negative	D	F	H
Column Totals	A	B	10,000

a. Find the values for A, B, C, D, and so on.

b. If an employee's drug test comes back positive, what is the probability that the test is wrong (i.e. the employee is in fact a non drug user)? Which of the following is a correct representation of the probability above:

i) P(positive | non drug user)
ii) P(positive and non drug user)
iii) P(non drug user | positive)

c. If an employee's drug test comes back positive, what is the probability that the test is wrong (i.e. the employee is in fact a non drug user)?

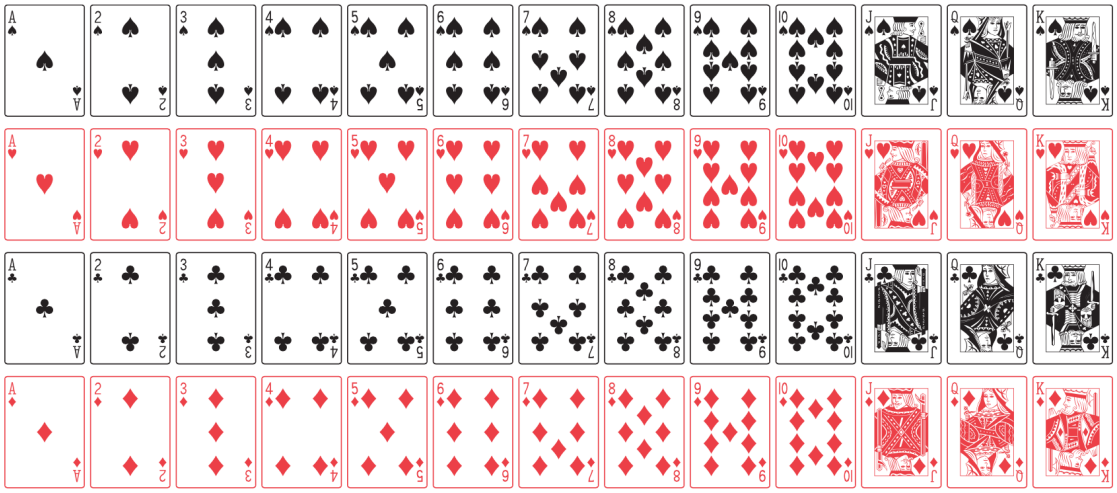
i) 0.01
ii) 0.33
iii) 0.99
iv) 0.0098

3) One event has chance 1/2, another has chance 1/3. Fill in the blanks using one phrase from each pair below, to make up two true sentences. Write out both sentences.

"If you want to find the chance that (i) will happen, check to see if they are (ii). If so, you can (iii) the chances."

i. at least one of the two events, both events.
ii. independent, mutually exclusive.
iii. add, multiply.

4) Consider a standard deck of 52 cards, as displayed in the following figure.



Consider the following events when a card is randomly selected.

- A: card selected is a king.
- B: card selected is a heart.
- C: card selected is a face card (i.e. J, Q, K)
- D: card selected is not a face.

Find the probabilities of:

a. $P(A)$

b. $P(B)$

c. $P(C)$

d. $P(D)$

e. $P(A \text{ and } B)$

f. $P(A|B)$

g. $P(B|A)$

h. $P(B^c|D)$

i. $P((C \text{ and } B)^c)$

j. $P(A \text{ or } B)$

k. $P(B \text{ or } C)$

l. $P(A^c \text{ or } B^c)$

m. Are A and B independent?

n. Are B and C independent?

o. Among all pairwise composite events "A and B", "A and C", "A and D", "B and C", "B and D", and "C and D", which ones are mutually exclusive?

5) Two fair dice are tossed.

a. What is the probability of a sum of six?

b. What is the probability of a sum of five?

c. What is the probability of a sum of five or a sum of six?

d. What is the probability of doubles?

e. What is the probability of a sum of six or doubles?

f. What is the probability of a sum of six and doubles?

g. What is the probability of a sum of five or doubles?

h. What is the probability of a sum of five and doubles?