

Lab Challenge 04 – Probability Laws and Conditional Probability

Due Date: 11:59pm, three days after class (four if over the weekend)

Each challenge is graded out of 2 points:

- 0 points – no attempt or no progress to a solution
- 1 point – challenge not fully completed or completed with major errors
- 2 points – challenge fully completed with at most a small error

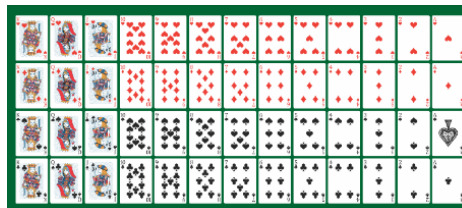
Deliverables

1. A single pdf document containing your solutions to the challenges you completed.
2. An RStudio file (.R extension) containing a *complete* script used to generate your results. The script must run without errors!

Challenges

1. Answer the following two questions using classical probability laws (not simulation). Support your answer with details.

Suppose you randomly select five cards without replacement from a standard deck of 52 cards.



- a. What is the probability that all five cards are the same colour?
- b. What is the probability that *at least* one card is red?
- c. What is the probability of getting a “full house” (3 cards of the same value and 2 cards of the same value).



2. Assume that the proportion of iPhone users among BCIT students is $p = 0.4$. Suppose you randomly select a sample of $n = 10$ students. Let X = the number of iPhone users in the sample.

Calculate each of the following using either exact probability laws or using simulation in R. Round answers to four decimal places.

- a. $P(X = 1)$
- b. $P(X \geq 1)$
- c. $P(X = 4)$

3. The original “Birthday Problem” concerned *two* people in a room having the same birthday. Now you must solve the Birthday Problem for *three* people. Specifically, what is the minimum number of people you need in a room so that there is a greater than 50% chance that *three* people have the same birthday? Use simulation in R.

Hint: you might use an R expression like `max(table(values))`