

Sample Questions: Conditional Probability¹

1. The table below shows percentages of passengers on the Titanic.

	Died	Lived
1st Class	9	15
2nd Class	13	9
3d Class	40	14

For a randomly chosen passenger, what is

- (a) The probability of living?
 - (b) The probability of living
 - i. Given 1st class?
 - ii. Given 2nd class?
 - iii. Given 3d class?
- (c) The probability of being in first class given that the person died?

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2. A jar contains two fair coins and one fair die. The coins have a “1” on one side and a “2” on the other side. Pick an object at random, roll or toss, and observe the number.

(a) What is $P(2 \cap C)$?

(b) What is $P(6|C)$?

(c) Make a tree diagram.

(d) List the outcomes with their probabilities.

(e) What is $P(C|2)$?

3. Let $S = \cup_{k=1}^{\infty} A_k$, disjoint, with $P(A_k) > 0$ for all k . Using the formula sheet and the tabular format illustrated in lecture, prove $P(B) = \sum_{k=1}^{\infty} P(B|A_k)P(A_k)$.

4. Prove the following version of Bayes' Theorem. Let $S = \cup_{k=1}^{\infty} A_k$, disjoint, with $P(A_k) > 0$ for all k . Then

$$P(A_j|B) = \frac{P(B|A_j)P(A_j)}{\sum_{k=1}^{\infty} P(B|A_k)P(A_k)}.$$

You may use anything from the formula sheet except Bayes' theorem itself.

5. Two balls are drawn in succession from a jar containing three red balls and four white balls. What is the probability that the first ball was white given that the second ball was red? The answer is a number. Circle your answer.

6. This is an important real-world application of Bayes' Theorem. Suppose only one person in a thousand has some rare disease. We have a screening test for the disease, and it's a good test.

- 90% of those with the disease test positive.
- 95% of those without the disease test negative.

Given a positive test, what is the probability that the person actually has the disease? The answer is a number. Circle your answer.

This assignment was prepared by [Jerry Brunner](#), Department of Mathematical and Computational Sciences, University of Toronto. It is licensed under a [Creative Commons Attribution - ShareAlike 3.0 Unported License](#). Use any part of it as you like and share the result freely. The L^AT_EX source code is available from the course website:

<http://www.utstat.toronto.edu/~brunner/oldclass/256f19>