

Homework Set 4

DUE: MAR 2, 2020 (AT THE BEGINNING OF CLASS)

The following problem builds on an example we did together in class:

To be handed in:*Please write your solution to Problem 1 on a single sheet of paper!*

1. At the end of a math course, a student takes a final exam consisting of 6 multiple choice questions, that have 5 alternatives each (and only 1 of these 5 is correct). Assume that the student learnt the material asked in question n with probability p_n , where $n = 1, 2, \dots, 6$. If the student learnt the material in that question, then he/she is guaranteed to answer that question correctly. If the student did not learn the material in question n , then he/she guesses the answer to that question at random.
 - a) **(4pts)** What is the probability that the student learnt all of the material the exam was about if he/she got a perfect score 6/6?
 - b) **(4pts)** What is the probability that the student got a perfect score 6/6 and did not learn any of the material the exam was about?
 - c) **(2pts)** Suppose that $p_n = \frac{1}{2}$, for all $n = 1, \dots, 6$, and find simplify your answers for a) and b) above as much as possible.

Note: when writing your solution, you may want to use the *shorthand product formula*:

$$\prod_{i=1}^k a_i = a_1 \cdot a_2 \cdot \dots \cdot a_k$$

which works in the exact same way as the *shorthand sum formula*, which is

$$\sum_{i=1}^k a_i = a_1 + a_2 + \dots + a_k$$

but with products \cdot instead of sums $+$.

Bonus: If you want a challenging extra question, that will not count towards your grade, but might be fun to think about, then try answering the following:

- d) What is the probability that the student guessed at least one answer if he/she got a perfect score 6/6?

Spoiler: Assuming $p_n = \frac{1}{2}$ for all $n = 1, \dots, 6$, the answer to d) is 66.51%