DEPARTAMENTO DE ELETRÓNICA, TELECOMUNICAÇÕES E INFORMÁTICA

MESTRADO INTEGRADO EM ENG. DE COMPUTADORES E TELEMÁTICA

ANO 2019/2020

DESEMPENHO E DIMENSIONAMENTO DE REDES

ASSIGNMENT GUIDE NO. 1

BASIC EXERCISES

Assignment Guide No. 1

RECALL FROM THEORETICAL CLASSES:

1. Bayes' law: consider a set of mutually exclusive events F_1, F_2, …, F_n such that its union is the set of all possible outcomes of a random experiment. Knowing that event E has occurred, the probability of event F_j, with $j = 1, 2, \ldots, n$, is given by:

$$P(F_j|E) = \frac{P(EF_j)}{P(E)} = \frac{P(E|F_j)P(F_j)}{\sum_{i=1}^{n} P(E|F_i)P(F_i)}$$

2. The probability function of a binomial random variable with parameters n and p is:

$$f(i) = \binom{n}{i} p^i (1-p)^{n-i} \quad , i = 0,1, \ldots n$$

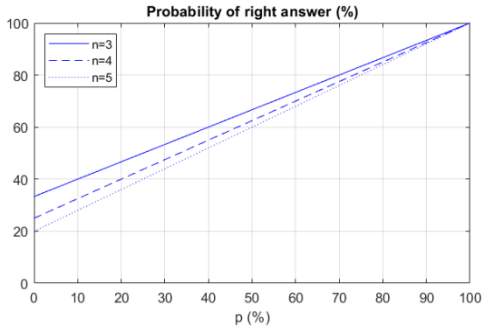
where $\binom{n}{i} = \frac{n!}{i!(n-i)!}$

1. On a multiple choice test, each question has n possible answers and only one is correct. Assume that the student has studied a percentage p (with $0\% \leq p \leq 100\%$) of the test content. When a question addresses the content the student has studied, he selects the right answer. Otherwise, he selects randomly one of the n answers.

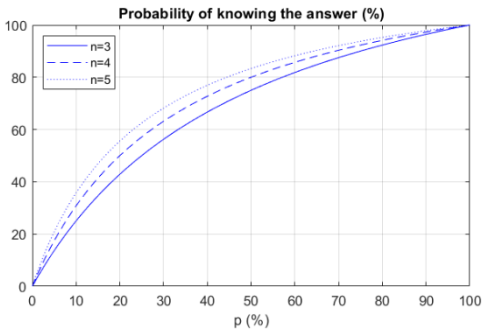
1.a. When $p = 60\%$ and $n = 4$, determine the probability of the student to select the right answer. Response: 70%

1.b. When $p = 70\%$ and $n = 5$, determine the probability of the student to known the answer when he selects the right answer. Response: 92.1%

1.c. Draw a plot of the probability of the student to select the right answer when $n = 3, 4, 5$ as a function of the probability p. Response:



1.d. Draw a plot of the probability of the student to known the answer when he selects the right answer when $n = 3, 4, 5$ as a function of the probability p. Response:



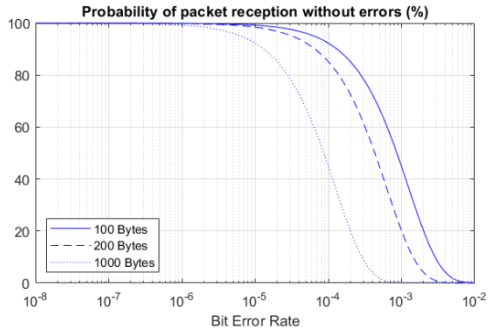
2. Consider a wireless link with a bit error rate (ber) of p. Assume that errors in the different bits of a data packet are statistically independent (i.e., the number of errors of a data packet is a binomial random variable).

2.a. Determine the probability of a data packet of 100 Bytes to be received without errors when $p = 10^{-2}$. Response: 0.0322%

2.b. Determine the probability of a data packet of 1000 Bytes to be received with exactly one error when $p = 10^{-3}$. Response: 0.2676%

2.c. Determine the probability of a data packet of 200 Bytes to be received with one or more errors when $p = 10^{-4}$. Response: 14.7863%

2.d. Draw a plot of the probability of a data packet (of 100 Bytes, 200 Bytes or 1000 Bytes) being received without errors as a function of the bit error rate (from $p = 10^{-8}$ up to $p = 10^{-2}$). Response:



2.e. Draw a plot of the probability of a data packet being received without errors (for $p = 10^{-4}$, 10^{-3} and 10^{-2}) as a function of the packet size (from 64 Bytes up to 1518 Bytes). Response: