DEPARTAMENTO DE ELETRÓNICA, TELECOMUNICAÇÕES E INFORMÁTICA

**MESTRADO EM ENGENHARIA DE COMPUTADORES E TELEMÁTICA**

ANO 2021/2022

# MODELAÇÃO E DESEMPENHO DE REDES E SERVIÇOS

PRACTICAL GUIDE

Task 1

Consider a multiple choice test such that 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 with 100% of probability. Otherwise, the student always selects randomly one of the n answers with a uniform distribution.

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

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

1.c. Draw a plot with the same look as the plot below with the probability of the student to select the right answer as a function of the probability p (consider $n = 3, 4$ and 5). What do you conclude from these results? <u>Answer:</u>
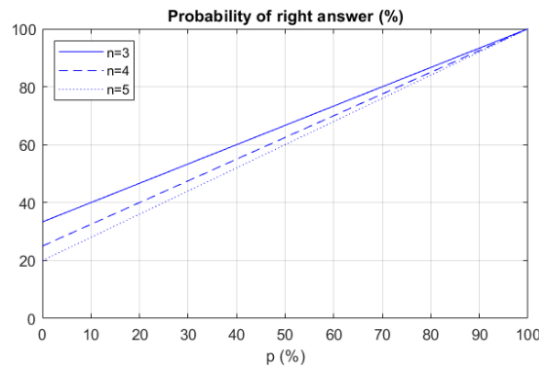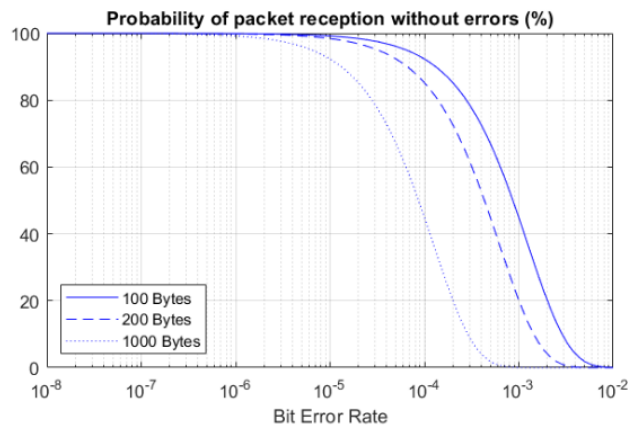

1.d. Draw a plot with the same look as the plot below with the probability of the student to know the answer when he selects the right answer as a function of the probability p (consider $n = 3, 4$ and 5). What do you conclude from these results? <u>Answer:</u>
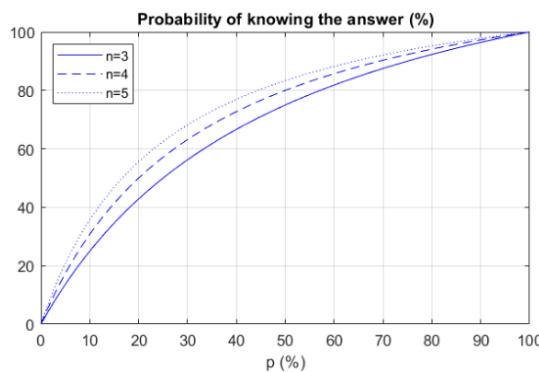
Task 2

Consider a wireless link between multiple stations for data communications 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 $p = 10^{-2}$. <u>Answer: 0.0322%</u>

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

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

2.d. Draw a plot using a logarithmic scale for the X-axis (use the MATLAB function `semilogx`) with the same look as the plot below with the probability of a data packet (of size 100 Bytes, 200 Bytes or 1000 Bytes) being received without errors as a function of the *ber* (from $p = 10^{-8}$ up to $p = 10^{-2}$). What do you conclude from these results? <u>Answer:</u>

2.e. Draw a plot using a logarithmic scale for the Y-axis (use the MATLAB function `semilogy`) with the same look as the plot below with 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 (all integer values from 64 Bytes up to 1518 Bytes). What do you conclude from these results? <u>Answer:</u>