Alexandria University
Faculty of Engineering
Electrical and Electronics Engineering
Department
Fall semester, 2023/2024

جامعة الإسكندرية
كلية الهندسة
قسم الهندسة الكهربية
الفصل الدراسى الأول, 2024/2023

DIGITAL COMMUNICATIONS LAB

Experiment 1

Basics of BER calculations and channel models

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Experiment

Part 1

Example 1: the receiver gives a 0 bit as output. This output does not depend at all on what the channel is giving out.

Questions	
What is the corresponding BER for that receiver? You do not need to implement it in the m-file to answer.	**Given the channel input has 50% chance of 1s or 0s the BER = 0.5**
What is the reason behind the performance of this receiver?	**Each 1 input gives of an error, while each 0 input is correct, so always 50% of the bits are received incorrectly, assuming the channel input is of truly random 0s and 1s, if 1s are 70% of the input then the BER is 70%**

Example 2: the receiver gives random output, i.e., 0s and 1s with a probability of 0.5. Again, this output is not based on what the channel is giving out.

Questions	
What is the corresponding BER for that receiver? You do not need to implement it in the m-file to answer.	**chance of 1s and 0s, the BER is 0.5**
What is the reason behind the performance of this receiver?	**Each 1 input has error probability of 50% and each 0 input has error probability of 50%, and at whatever percentage mix of 1s and 0s the error rate will be 50%**

Questions	
What is the corresponding BER for receivers 1 and 2 above? You do not need to implement the two receivers to answer.	**Receiver 1 depends on the number of 1s in the input (would be 0.5 in case of random input), receiver 2 is always 0.5**
What is the reason behind the performance of these two receivers?	**For receiver 1: Each 1 input gives of an error, while each 0 input is correct, so always 50% of the bits are received incorrectly, assuming the channel input is of truly random 0s and 1s, if 1s are 70% of the input then the BER is 70%** **For receiver 2: Each 1 input has error probability of 50% and each 0 input has error probability of 50%, and at whatever percentage mix of 1s and 0s the error rate will be 50%**
What is the BER of the best receiver?	**Last receiver BER = 0.207**

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Part 2

Questions	
What is the BER of the best receiver?	**The best receiver with 5 repetitions has a better BER at lower p values than 0.5 specifically at p = 0.2 the BER =0.0608**
What is the expected (theoretical) BER if the number of repetitions is increase to 10?	**Theoretically it should reach 0.049, by analysis of the valid bit condition from symbols (1-2*p) = (1-2*BER)^(N/2)**
What is the cost/downside of using the transmitter in Part 2?	**The number of repetitions means using more resources whether time or bandwidth**

Part 3

Questions	
What is the BER of the best receiver?	**The last receiver achieved similar results to the part 1 -a receiver with approx. 0.2 BER, the best so far is part2a**
What is the reason behind such a performance?	**The correlation between bits make them reducible to one bit similar to part1-a case**

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Part 3-a

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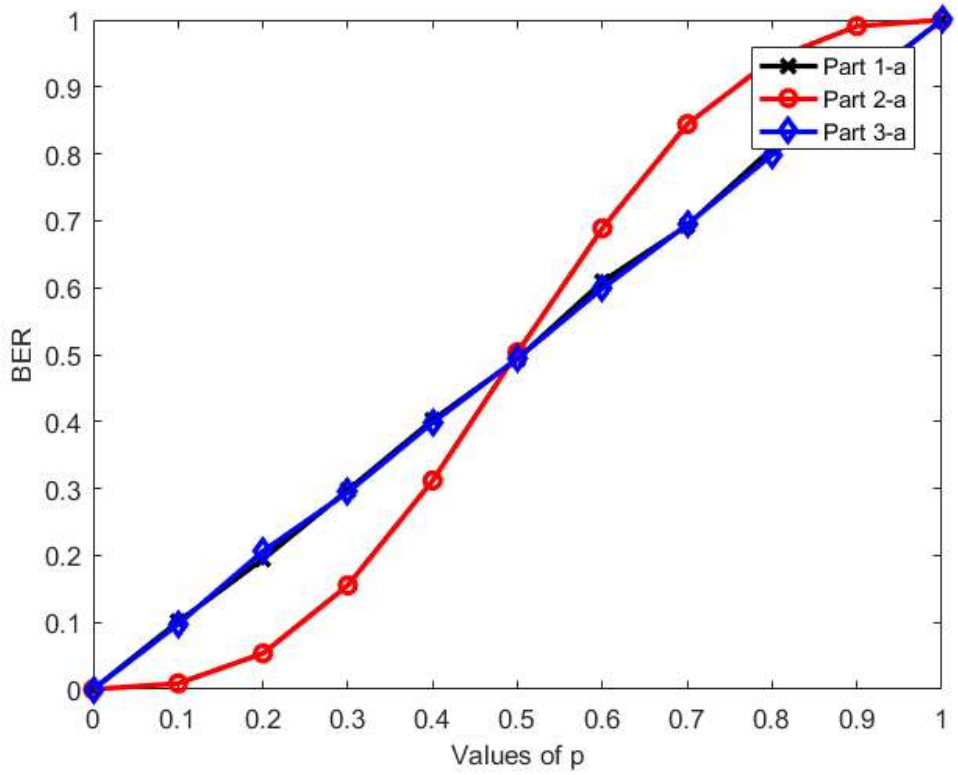

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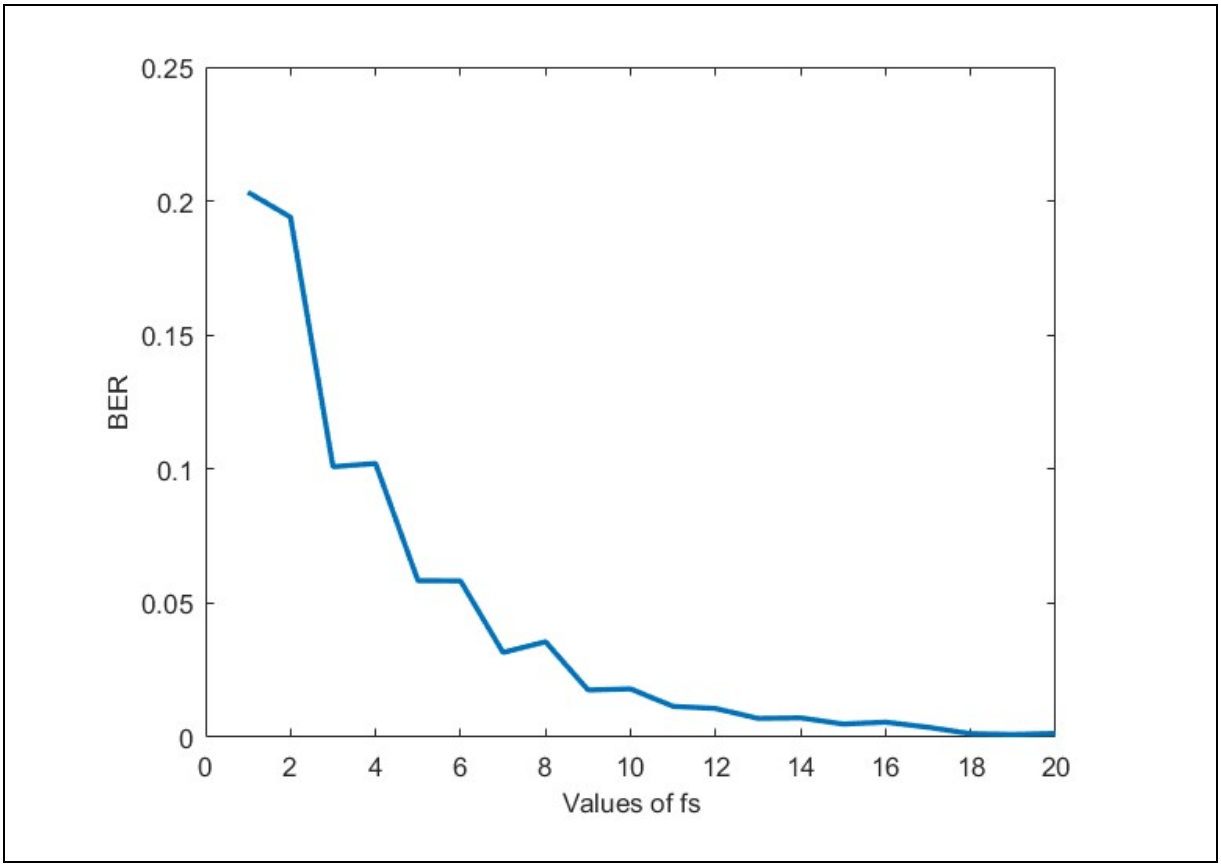

Which of the three systems have the best performance in terms of BER?	**Part 2-a with 5 repetitions**
If the receiver you designed in any of the previous parts attain a BER more than 0.5, how can it be changed to attain a maximum of 0.5 BER?	**Just flipping the logic of the system, would yield new BER of 1- old BER**