Assignment 1 – Instructions

Assignment Instructions:
Please consider the following scenario as providing the context for this assignment. Make all your choices, assumptions, ideas, suggestions, and explanations explicit. Please pay attention to every single detail and answer the questions as precisely as you can. **Be concise and organize your answers in sections that map directly onto the tasks below.**

Submission guidelines:
Please write your answers in a MS Word file, name the file using the format Group#.docx (e.g. Group1-A1.docx), upload it to your group folder, and give me a printed hard copy in class.

Scenario:
You are a networking and communications consultant working for HoustonComm Services, Inc, further referred to as HCS. HCS is a company providing technology consulting services to start-ups and established large companies. Recently HCS has been approached by Mr. Smith, the Chief Operations Officer of Procter & Gamble (PG). PG has many regional divisions across US, each organized around a central regional headquarter. They are now trying to expand into the South US area and are working on the logistics for opening a new regional headquarter just south of Dallas. As part of these efforts, Mr. Smith has recently contacted HCS to provide them with one consultant to help with few communications-oriented tasks. You are assigned to this role.

Available information as provided by PG:
The communications architecture for the new regional headquarter has been established already. The new location south of Dallas will include a 3-story office building and a very large warehouse in close proximity to the office building.

Task 1:
It has been established that communication between a supervisor's computer and a computer that controls equipment within the warehouse will use an encoding of 8 bits per symbol. What is the baud rate if the bit rate of the communication line is 1,024,000 bps?

Task 2:
It is known that the established architecture includes a direct wired voice communication option between supervisors and workers (using voice terminals at set locations) in the warehouse. For that part, the communication has a wavelength of 0.4 meters and a speed of 4×10^6 meters per second. What is the frequency of this communication?

Task 3:
For the voice communication in task 2, it has been decided that a 16-QAM (2 phase shifts and 8 amplitude levels) will be used. If the maximum frequency for this voice circuit is the frequency calculated for Task 2, then what is the data capacity of the analog line, assuming ideal conditions (no noise)?

Task 4:
Communication among office computers is based on a protocol that uses CRC-32 for error detection. A series of 100 identical test messages are being exchanged between office computers in an attempt to test the reliability of communication lines. The decimal value corresponding to the binary version of each one of these test messages is 22,405. According to the used protocol, what is the expected EDV (error detection values) that the testing professionals should read for these messages once they arrive at a destination computer?

Task 5:
The communication protocol used between office computers makes use of the following fields in each frame that it creates:

- 2 address fields of 8 bytes each
- 4 additional address fields of 8 bytes each
- 8 control flags of 2 bytes each
- 1 sequencing and synchronization field of 4 bytes
- 1 combined preamble field of 32 bytes
- 1 start flag of 1 byte
- A message area of fixed length (1000 bytes)
- A CRC-64 field for error detection
- 1 end flag of 1 byte

What is the transmission efficiency?
We know that throughput is defined as the total number of information bits transmitted (sent) per second. Let's assume that 1 in 5 frames transmitted will have errors, and that the communication infrastructure allows for up to 1000 frames per second to be communicated among computers. What is the throughput under these conditions? We define goodput as the total number of useful bits (message) communicated (received) per second. What is the goodput under the conditions stated above?