ASSIGNMENT 1

BLG 337E Principles of Computer Communication

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Encoding and Modulation Techniques in Computer Communication

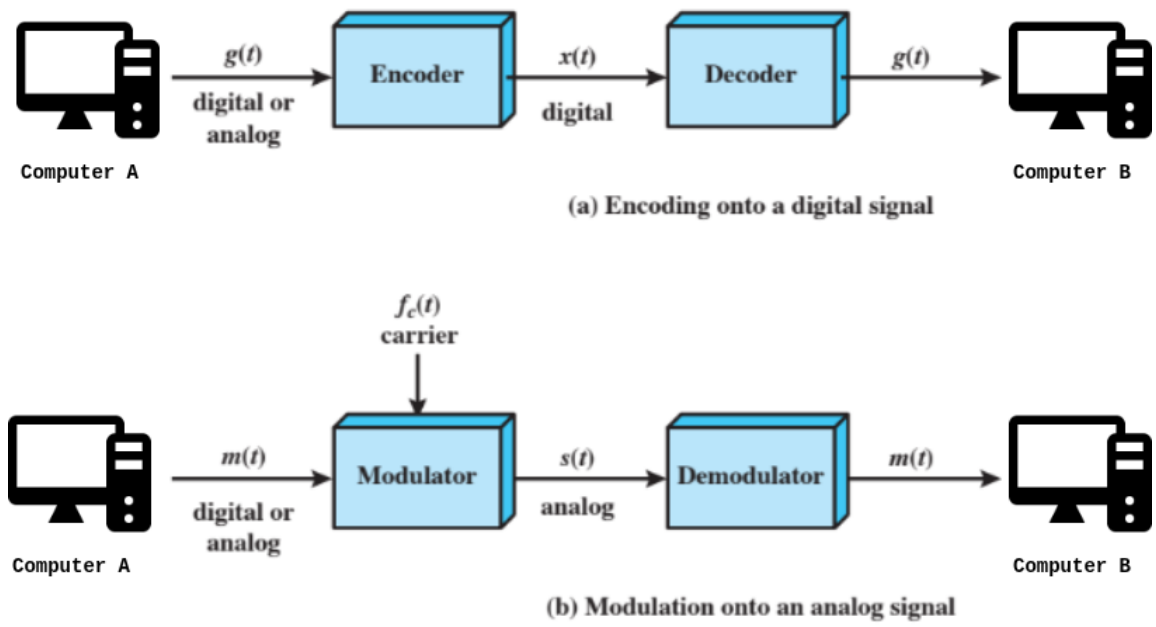

Figure 1: Encoding and Modulation Techniques

The purpose of this assignment is to simulate and analyze the process of data transmission between two computers (Computer A and Computer B) using encoding, decoding, modulation, and demodulation techniques taught during the course. Each student will design and implement algorithms for these operations, build a simple interactive interface, and then use artificial intelligence tools to optimize their implementation.

Students are required to simulate the transmission of data from Computer A to Computer B in four different conversion modes:

- Digital-to-Digital (Encoding and Decoding)
- Digital-to-Analog (Modulation and Demodulation)

- Analog-to-Digital (Encoding and Decoding)
- Analog-to-Analog (Modulation and Demodulation)

A simple user interface (such as a basic GUI or web-based dashboard) must allow users to select one of these four transmission modes. The algorithms used should be based on those covered in the course.

A user interface must be developed to enable users to select:

- The desired transmission mode (one of the four listed above).
- The specific algorithm to be used for each stage — encoding, decoding, modulation, and demodulation — among all techniques covered in class.

For example, the interface should allow students to choose from different encoding or modulation algorithms (such as those explained during lectures) and then test how each algorithm affects the data transmission process. The interface can be a simple GUI, console-based menu, or a lightweight web interface. The main focus is on functionality, correctness, and clarity.

AI-Based Optimization

After completing the main implementation, each student must optimize their code using at least two different AI tools (e.g., ChatGPT, Gemini, Copilot, etc.). These AI assistants should be instructed to enhance the performance, efficiency, and readability of the original code. The student will then benchmark and compare the optimized versions based on factors such as runtime performance and memory usage. A short analysis of these results must be included in the report.

Evaluation

Each student must submit:

- The original source code and the two AI-optimized versions.
- A written report in PDF format that includes:
  - A short introduction explaining the theoretical background of encoding and modulation.
  - A description of the implemented algorithms.
  - A short benchmark analysis comparing performance differences.
  - Discussion and conclusions.

- A live demonstration will be held during the final week of the semester. During this demo, each student will present their program, explain the selected algorithms, and show how the system performs under different settings. Both the original and AI-optimized codes must be submitted before the demo date.

The grading will be based on the following criteria:

- **Demo (40%)** – Functionality, clarity, and successful demonstration of the program.
- **Report (30%)** – Completeness, structure, and analysis quality.
- **Code (30%)** – Correctness, readability, and algorithmic implementation.

Notes

Students are encouraged to clearly comment and document their code. The interface does not need to be complex, but it should be user-friendly enough to demonstrate the functionality of all four transmission types.