**CODE DOCUMENTATION**

Introduction to Computer Communications

Programming Assignment 1 - Noisy Channel

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**RUNNING INSTRUCTIONS**

Running the program is as required in the assignment.

1. Running the Channel exe file with the relevant parameters.
2. The channel will print the IP addresses and ports for the sender and receiver connections.
3. Running the sender and receiver exe files with the IP addresses and ports that the channel printed.

**SENDER MAIN FLOW**

* Parsing arguments.
* Initializing Winsock.
* Asking user to enter file name and read it.
* While user didn't enter "quit":
  + Opening the file.
  + Connecting to socket (using **ConnectToSocket**() function).
    - Calling "socket" syscall to create a TCP socket.
    - Creating channel address struct using inet\_pton for converting IP string to an IP address and using htons to convert port to network endian.
    - Connecting to the socket.
  + Creating three buffers (using **createBuffers**() function):
    - rawBytesFileBuffer - buffer for raw file, size of 26 bytes.
    - originalBitsFileBuffer - buffer for original bits, size of 26\*8 bytes (208 binary chars, e.g. '0' / '1').
    - encodedBitsFileBuffer - buffer for encoded bits, size of 31 bytes (binary chars).
  + While finished flag if 0 (using while true and break):
    - Initilizing buffers values to '\0' (for cases when the file size is not a divided by 26).
    - Reading section of 26 bytes from file (using **readSectionFromFile**() function) and adding the number to the bytesReadTotal variable. If bytesRead is 0 then we finished reading the file and the finished flag is changed to 1.
    - If finished flag is 1, we break the loop.
    - Else, translating the section from bytes to char bits (using **translateSectionFromBytesToCharBits**() function):
      * Based on answer from: https://www.dreamincode.net/forums/topic/134396-how-to-convert-a-char-to-its-8-binary-bits-in-c/
      * The translation is done using a binary calculation - going over every byte in the section and translate the bits of the byte to '1' and '0' chars, putting in originalBitsFileBuffer.
    - For every block (26 bytes that are 26 char bits) in the section, if the block starts with actual data (and not '\0'):
      * Copying data to encoded buffer (using **copyDataToEncodedBuffer**() function) in order to encode the data with hamming. Also, initilazing parity check bits to '0'.
      * Adding hamming parity bits (using **addHummingCheckBits**() function that calls **generateParityBit**() function with the five power-of-two indexes that are the parity check bits indexes. The generation function counts the number of '1's in the relevant bits to the parity and write the parity bits to buffer (ignore '\0' that we have when the file size is not a divided by 26).
      * Writing block to socket (using **writeBlockToSocket**() function) - writing 31 char bits, that are 31 encoded bits, to socket.
  + Closing the socket and the file.
  + Printing the relevant messages.
  + Asking the user to enter a new file name and reading it.
  + Initializing some of the variables.
* Cleaning up Winsock and exits successfully.

**RECIEVER MAIN FLOW**

* Parsing arguments.
* Initializing Winsock.
* Asking user to enter file name and read it.
* While user didn't enter "quit":
  + Opening the file.
  + Connecting to socket (using **ConnectToSocket**() function).
    - Calling "socket" syscall to create a TCP socket.
    - Creating channel address struct using inet\_pton for converting IP string to an IP address and using htons to convert port to network endian.
    - Connecting to the socket.
  + Creating two block buffers (using **createBlockBuffers**() function):
    - encodedBitsFileBuffer- buffer for encoded noised content - size 31 bytes (bit chars).
    - decodedBitsFileBuffer- buffer for decoded content - size 26 bytes (bit chars).
  + Creating two section buffers (using **createSectionBuffers**() function):
    - sectionFileBuffer - buffer for section file content, size 208 (26 bytes \* 8 bits per bytes, 26 char bytes).
    - bytesFileBuffer - buffer for file content, size 26 bytes.
  + While finished flag if 0 (using while true and break):
    - Reading section of 31 bytes from socket (using **readBlockFromSocket**() function) and adding the number to the bitsReadTotal variable. If bitsRead is 0 then we finished reading and the finished flag is changed to 1. We are also checking for first occurrence of '\0' in the data, for cases when the file size is not divided by 26.
    - If finished flag is 1, we break the loop.
    - Else, Decoding the block (using **hummingDecode**() function) by checking parity bits (using **IsCheckBitWrong**() function) which compares check parity bit value it should have based on calculation. If error was found we get it's index using hamming code calculations, and we correct it accordingly (using **flipBit**() function).
    - Copying the (corrected, if needed) buffer to decodedBitsFileBuffer (using **copyToDecodedBuffer**() function), writing block to section buffer (using **writeBlockToSectionBuffer**() function) and initializing the values of the block buffers for file who are not divided by 26 (using **createBlockBuffers**() function).
    - After that, if the section is not empty, translating the decoded char bits ('0'/'1') to bytes (using **translateSectionFromCharBitsToBytes**() function):
      * Based on answer from: https://www.dreamincode.net/forums/topic/134396-how-to-convert-a-char-to-its-8-binary-bits-in-c/
      * The translation is done using a binary calculation - going over every byte in the section and translate the char bit to bytes, putting in bytesFileBuffer.
    - Writing section to file (using **writeSectionToFile**() function) and initializing the values of the section buffers for file who are not divided by 26 (using **createSectionBuffers**() function).
  + Closing the socket and the file.
  + Printing the relevant messages.
  + Asking the user to enter a new file name and reading it.
  + Initializing some of the variables.
* Cleaning up Winsock and exits successfully.