**Sorting & Memory:**

* **Memory\_init\_uinit.v** – This module initializes memory from the memfile2.dat file.
* **DFFA**.v – This module models a settable DFF with clock enable. It is used to hold the addresses when sorting.
* **DFF**.v – Same as DFFA but it is used to hold the lengths or codewords.
* **Comparator**.v – This module compares the two inputs and outputs A<=B.
* **Submodule**.v – This module is used in data sorting to hold on to the largest value given. It also outputs the control signals for the Address sub module. Uses comparator and dff modules.
* **Addrmodule**.v – This module is used in address sorting to hold on to the values specified by the data submodule. Uses DFFA module.
* **Sort**.v – This module sorts the addresses and frequencies based on the address. And uses the previous sorting modules.
* **Sort\_alpha**.v – This module is similar to previous sort module except it sorts address, length, and codeword based on address.

**Huffman Encoding:**

* **Length\_finder\_fsm.v** - This module generates the length given the frequency and the alphabet. A one hot encoding is then generated for the alphabet. The length is generated by sorting the frequencies and combining the lowest two. And incrementing the length for those combined.
* **Parallel2Serial\_alpha.v** – This module takes in a parallel series of codewords and their lengths. It then outputs serially the codewords shortened to their desired lengths. This is done by having register that only holds one codeword at a time. This register is then parsed and only the bits less than the length are outputted. When that codeword is done the next one is loaded in.
* **Shfreg**.v – This module is a variable left shift register. It initialized with increasing BCD. This is used for generating codewords. The ena signal is pulsed to generate output.
* **Testbench**.v – initialized the top module and waits until top finishes before printing the outputs.
* **Top**.v – This module connects the sorting modules, length generator, shifters, and parallel to serial modules.

**Results:**

