HACETTEPE UNIVERSITY

BBM 231 - Logic Design Verilog Programming Final Project Assignment

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Subject:

MORSE DECODER DESIGN

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Introduction

Morse code was once widely used World over by almost everyone needing distant communication. Military, overseas shipping and the railroad relied on Morse code to provide reliable messages via wires. After the invention of radio during the first years of the 1900s, communication became more widespread and predictable. Industries relied on it to send simple and rapid messages to their distant clients and employees. Now, amateurs use Morse code since it requires a much smaller footprint on the band, enabling low power contacts. Navigation beacons help pilots find proper headings even today [1].

Problem Definition

Morse code is a method of transmitting text information as a series of on-off tones, lights, or clicks that can be directly understood by a skilled listener or observer without special equipment. The International Morse Code encodes the ISO basic Latin alphabet, some extra Latin letters, the Arabic numerals and a small set of punctuation and procedural signals as standardized sequences of short and long signals called "dots" and "dashes", or "dits" and "dahs". Because many non-English natural languages use more than the 26 Roman letters, extensions to the Morse alphabet exist for those languages.

Each character (letter or numeral) is represented by a unique sequence of dots and dashes. The duration of a dash is three times the duration of a dot. Each dot or dash is followed by a short silence, equal to the dot duration. The letters of a word are separated by a space equal to three dots (one dash), and the words are separated by a space equal to seven dots. The dot duration is the basic unit of time measurement in code transmission. To increase the speed of the communication, the code was designed so that the length of each character in Morse varies approximately inversely to its frequency of occurrence in English. Thus the most common letter in English, the letter "E", has the shortest code, a single dot [2].

The main purpose of this assignment is to design a Morse decoder accepting "dash" and "dot" inputs, decoding this series of characters, and displaying all the corresponding letters of the English alphabet (A − Z) as well as all of the decimal digits of the Arab numerals (0 − 9) according to those inputs using International Telecommunication Union standard in the light of the above. Figure shows International Morse code alphabet.

A	·−	J	·−−−	S	···	1	·−−−−
B	−···	K	−·−	T	−	2	··−−−
C	−·−·	L	·−··	U	··−	3	···−−
D	−··	M	−−	V	···−	4	····−
E	·	N	−·	W	·−−	5	·····
F	··−·	O	−−−	X	−··−	6	−····
G	−−·	P	·−−·	Y	−·−−	7	−−···
H	····	Q	−−·−	Z	−−··	8	−−−··
I	··	R	·−·	0	−−−−−	9	−−−−·

Objective

You are expected to design a Morse Decoder using International Telecommunication Union standard.

Specification

- **Input:** Single input (only one bit(0-1))

- **Outputs:** You should print at least one sentence(ASCII characters) to screen on Xilinx Environment. (Exp: 1 THE BEST ADVICE IS FOUND ON THE PILLOW)

- **Timing:** Decoding a character should last at most 30 seconds. International Morse code is composed of five elemenets:

  - ✓ **short mark,** dot or "dit" (.): "dot duration" is one time unit long
  - ✓ **longer mark,** dash or "dah" (-): "dot duration" is three time units long
  - ✓ **inter-element gap** between dots and dashes within a character: one dot duration or one unit long
  - ✓ **short gap** (between letters): three time units long
  - ✓ **medium gap** (between words): seven time units long

Report

- **Objective:** Write a project report about your Morse Decoder design.

- **Submission:** Send all design files and your report in pdf format via submit system(`https://submit.cs.hacettepe.edu.tr/`) until Dec 20, 2015 23:59. **student_number.zip** folder includes

  - ✓ morse_decoder.v
  - ✓ tb_morse_decoder.v
  - ✓ screen_output.jpg
  - ✓ report.pdf

- **Format**

  - ✓ Title Page
  - ✓ Introduction
  - ✓ Problem Definition
  - ✓ Design Description
  - ✓ Simulation results from Xilinx Environment
  - ✓ Conclusion
  - ✓ Bibliography
  - ✓ Appendicies

Useful Links

[1]`https://www.youtube.com/watch?v=hlOxnydhfLE`
[2]`ftp://ftp.cs.hacettepe.edu.tr/pub/dersler/BBM2XX/BBM233_MT-Lab/Verilog/`

Bibliography

[1] `http://www.cq2k.com/about_morse_code/Whatis_morse_code.htm`
[2] `http://en.wikipedia.org/wiki/Morse_code`