**2 JUNE 2020**

|  |  |  |  |
| --- | --- | --- | --- |
| **Date:** | **02 June 2020** | **Name:** | **Srinidhi J C** |
| **Course:** | **DIGITAL DESIGN USING HDL** | **USN:** | **4AL16EC078** |
| **Topic:** | **FPGA** | **Semester & Section:** | **8TH & b** |
| **Github Repository:** | **SrinidhiJC078** |  |  |

|  |
| --- |
| **FORENOON SESSION DETAILS** |
| **Image of session** |
| **Report – Report can be typed or hand written for up to two pages.**  **Fpga basics**  **Architecture**  **FPGA Architecture**  **A basic FPGA architecture (Figure 1) consists of thousands of fundamental elements called configurable logic blocks (CLBs) surrounded by a system of programmable interconnects, called a fabric, that routes signals between CLBs. Input/output (I/O) blocks interface between the FPGA and external devices.**  **Depending on the manufacturer, the CLB may also be referred to as a logic block (LB), a logic element (LE) or a logic cell (LC).**    **Figure 1: The fundamental FPGA architecture (Image Source: National Instruments)**  **An individual CLB (Figure 2) is made up of several logic blocks. A lookup table (LUT) is a characteristic feature of an FPGA. An LUT stores a predefined list of logic outputs for any combination of inputs: LUTs with four to six input bits are widely used. Standard logic functions such as multiplexers (mux), full adders (FAs) and flip-flops are also common.**  **FPGA Applications**  **Many applications rely on the parallel execution of identical operations; the ability to configure the FPGA’s CLBs into hundreds or thousands of identical processing blocks has applications in image processing, artificial intelligence (AI), data center hardware accelerators, enterprise networking and automotive advanced driver assistance systems (ADAS).**  **Many of these application areas are changing very quickly as requirements evolve and new protocols and standards are adopted. FPGAs enable manufacturers to implement systems that can be updated when necessary.**  **A good example of FPGA use is high-speed search: Microsoft is using FPGAs in its data centers to run Bing search algorithms. The FPGA can change to support new algorithms as they are created. If needs change, the design can be repurposed to run simulation or modeling routines in an HPC application. This flexibility is difficult or impossible to achieve with an ASIC.**  **Other FPGA uses include aerospace and defense, medical electronics, digital television, consumer electronics, industrial motor control, scientific instruments, cybersecurity systems and wireless communications.**  **2. Verilog hdl basics by intel**    **3. Verilog test bench code to verify the design under test**    **Example**  **y = (b' ∙ c') + (a ∙ b')**  **module sillyfunction(input a, b, c, output y);assign y = ~b & ~c | a & ~b;endmodule**  **Test bench code**  **module testbench1();**  **reg a, b, c;**  **wire y;**  **sillyfunction dut (.a(a), .b(b), .c(c), .y(y) );d**  **initial begin**  **a = 0; b = 0; c = 0; #10;**  **c = 1; #10;**  **b = 1; c = 0; #10;**  **c = 1; #10;**  **a = 1; b = 0; c = 0; #10;**  **end**  **endmodule**  **Task 2**  **Implement a 4:1 MUX and write the test bench code to verify the module**    **module mux\_4to1\_assign ( input [3:0] a, b, c, d, input [1:0] sel, output [3:0] out);**  **assign out = sel[1] ? (sel[0] ? d : c) : (sel[0] ? b : a);**  **endmodule**    **Testbench**  **module tb\_4to1\_mux;**  **reg [3:0] a, b, c, d;**  **wire [3:0] out;**  **reg [1:0] sel;**  **integer i;**  **mux\_4to1\_case mux0 ( .a (a), .b (b), .c (c), .d (d), .sel (sel), .out (out));**  **initial begin**  **$monitor ("[%0t] sel=0x%0h a=0x%0h b=0x%0h c=0x%0h d=0x%0h out=0x%0h", $time, sel, a, b, c, d, out);**  **sel <= 0; a <= $random; b <= $random; c <= $random; d <= $random;**  **for (i = 1; i < 4; i=i+1) begin**  **#5 sel <= i;**  **end**  **#5 $finish;**  **end**  **endmodule** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Date:** | **02 June 2020** | **Name:** | **Srinidhi J C** |
| **Course:** | **Python** | **USN:** | **4al16ec078** |
| **Topic:** |  | **Semester & Section:** | **8th & b** |
| **AFTERNOON SESSION DETAILS** | | | |
| **Image of session**    **Report – Report can be typed or hand written for up to two pages.**  **Installing Bokeh**  **If you haven't installed Bokeh yet, you can easily install it with pip from the terminal:**  **pip install bokeh**  **Or you use pip3:**  **pip3 install bokeh**  **Plotting Triangles and Circle Glyphs (Practice)**  **Write two code snippets, each producing the following graphs. The first graph has triangles as glyphs and the second graph has circles as glyphs. You can use triangle , and circle instead of line. You should have the same coordinates as shown in the plots below.**    **Solution**  **#Snippet producing the triangle based plot**  **#Making a basic Bokeh line graph**  **#importing Bokeh**  **from bokeh.plotting import figure**  **from bokeh.io import output\_file, show**  **#prepare some data**  **x=[3,7.5,10]**  **y=[3,6,9]**  **#prepare the output file**  **output\_file("Line.html")**  **#create a figure object**  **f=figure()**  **#create line plot**  **f.triangle(x,y)**  **#write the plot in the figure object**  **show(f)**  **#Snippet producing the circle based plot**  **#Making a basic Bokeh line graph**  **#importing Bokeh**  **from bokeh.plotting import figure**  **from bokeh.io import output\_file, show**  **#prepare some data**  **x=[3,7.5,10]**  **y=[3,6,9]**  **#prepare the output file**  **output\_file("Line.html")**  **#create a figure object**  **f=figure()**  **#create line plot**  **f.circle(x,y)**  **#write the plot in the figure object**  **show(f)**  **Plotting Education Data (Practice)**  **The following line graph shows the percentage of women who have received a bachelor's degree over the years in USA. The graph was produced from the Year and Engineering columns of the CSV file provided in the following link:**  **http://pythonhow.com/data/bachelors.csv**  **Try to reproduce the graph using Bokeh.**    **Solution**  **#Plotting percentage of women who received an engineering degree over years**  **#importing bokeh and pandas**  **from bokeh.plotting import figure**  **from bokeh.io import output\_file, show**  **import pandas**  **#prepare some data**  **df=pandas.read\_csv("http://pythonhow.com/data/bachelors.csv")**  **x=df["Year"]**  **y=df["Engineering"]**  **#prepare the output file**  **output\_file("Line\_from\_bachelors.html")**  **#create a figure object**  **f=figure()**  **#create line plot**  **f.line(x,y)**  **#write the plot in the figure object**  **show(f)**  **Plot Properties**  **You can add a title to the plot, set the figure width and height, change title font, etc. Below is a summary of properties which can be added to change the style of the plot:**  **import pandas**  **from bokeh.plotting import figure, output\_file, show**    **p=figure(plot\_width=500,plot\_height=400, tools='pan',logo=None)**    **p.title.text="Cool Data"**  **p.title.text\_color="Gray"**  **p.title.text\_font="times"**  **p.title.text\_font\_style="bold"**  **p.xaxis.minor\_tick\_line\_color=None**  **p.yaxis.minor\_tick\_line\_color=None**  **p.xaxis.axis\_label="Date"**  **p.yaxis.axis\_label="Intensity"**    **p.line([1,2,3],[4,5,6])**  **output\_file("graph.html")**  **show(p)**    **Plotting Weather Data (Practice)**  **Produce the following graph using the data from this Excel file: http://pythonhow.com/data/verlegenhuken.xlsx**    **Solution**  **import pandas**  **from bokeh.plotting import figure, output\_file, show**  **df=pandas.read\_excel("http://pythonhow.com/data/verlegenhuken.xlsx",sheet\_name=0)**  **df["Temperature"]=df["Temperature"]/10**  **df["Pressure"]=df["Pressure"]/10**  **p=figure(plot\_width=500,plot\_height=400,tools='pan')**  **p.title.text="Temperature and Air Pressure"**  **p.title.text\_color="Gray"**  **p.title.text\_font="arial"**  **p.title.text\_font\_style="bold"**  **p.xaxis.minor\_tick\_line\_color=None**  **p.yaxis.minor\_tick\_line\_color=None**  **p.xaxis.axis\_label="Temperature (°C)"**  **p.yaxis.axis\_label="Pressure (hPa)"**  **p.circle(df["Temperature"],df["Pressure"],size=0.5)**  **output\_file("Weather.html")**  **show(p)**  **Visual Attributes**  **Once you have built a basic plot, you can customize its visual attributes including changing the title color and font, adding labels for xaxis and yaxis, changing the color of the axis ticks, etc. All these properties are illustrated in the diagram below:**    **And here is the code if you want to play around with it:**  **from bokeh.plotting import figure, output\_file, show**  **p = figure(plot\_width=500, plot\_height=400, tools = 'pan, reset')**  **p.title.text = "Earthquakes"**  **p.title.text\_color = "Orange"**  **p.title.text\_font = "times"**  **p.title.text\_font\_style = "italic"**  **p.yaxis.minor\_tick\_line\_color = "Yellow"**  **p.xaxis.axis\_label = "Times"**  **p.yaxis.axis\_label = "Value"**  **p.circle([1,2,3,4,5], [5,6,5,5,3], size = [i\*2 for i in [8,12,14,15,20]], color="red", alpha=0.5)**  **output\_file("Scatter\_plotting.html")**  **show(p)**  **For a complete list of visual attributes, see the Styling Visual Attributes documentation page of Bokeh.**  **Request Headers**  **Note**  **When I use this code in the next video:**  **r = requests.get("http://www.pythonhow.com/example.html")**  **please use this instead:**  **r = requests.get("http://www.pyclass.com/example.html", headers={'User-agent': 'Mozilla/5.0 (X11; Ubuntu; Linux x86\_64; rv:61.0) Gecko/20100101 Firefox/61.0'})**  **The rest of the code stays the same.**  **So, we're just changing the domain name from pythonhow to pyclass and we're adding a header argument. Some webpages don't like scripts sometimes, so adding a header allows the script to impersonate a web browser.** | | | |