Mini-Project Lab Assignment

(CAO Theory & CAD of EC Lab [KEC – 554])

A Preject report

to be **Submitted by** –

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Project GitHub link:- **https://github.com/collab456/CAO-mini-project**

Watch the compilation video of project:- https://github.com/collab456/CAO-mini-project/blob/main/compilation%20video.mp4

Objctive:

Given an input of 100 sorted data points, divide them into 4 groups, labelling from 1 to 4.

Easy approach(But not sufficient):

- I can use simply a for loop that iterate over all data points, and display them into given number of groups.
- So, here in this approach were are just printing data points in a row and labelling their group number.
- But this is not sufficient because we can't use those groups if future requirement.

(*just printing the data points in different group not a solution, we should divide the whole memory allocated into different groups to use those groups in efficient manner.)

My Approach to the problem:

- This problem is simply based on dividing the memory allocated to the points into different groups to perform different – different tasks on individual group.
- So, I'm going to create four different memories to store each group. (*I can also use that single memory, but right now the idea behind it just to make the project and idea clear to all and learning the concepts)
- Total number of data points in each group can be calculated by dividing the total number of data points by total number of groups.

- So, now according to the problem we are given total 100 data points, and we've to divide them into four groups, hence each group contains total 25 data points.(*Groups are labelling from 1 to 4).

An advanced idea to use different groups:

- Here I am using 4x1 MUX that contain 2 selection lines.
- By using the selection lines one can use the desired group to perform m any task.

Hardware Designing:

- Verilog HDL modelling language supports three kinds of modelling styles:
- gate-level, dataflow, and behavioral. The gate-level and dataflow modelling are
- used to model combinatorial circuits whereas the behavioral modelling is used for
- both combinatorial and sequential circuits.

  Here I am using behavioral modelling in most of the cases to make it more simple.

So let's start step-vise discussion for the designing.

1. **Identifying the required inputs:**
   - To get the input as 100 sorted data points I am reading an input file **"datazen.txt"** that contain 100 sorted data points in **Hexadecimal** number system.

2. Constraints (digit size):

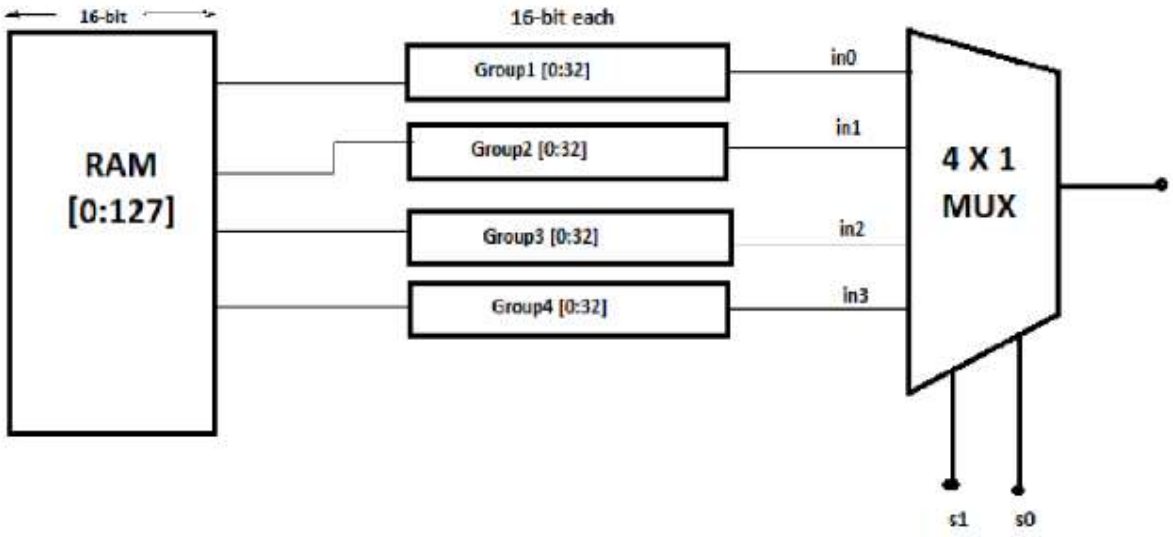
- Here I am creating **reg [15:0] RAM[0:127]** that has **16-bit** in each row to store a single digit in each row.
- So, we can store 128 digits total, and the digit can be size of maximum **$(6 \times 10^4)_{10}$** or **$(FFFF)_{Hex}$**
  (*input data points must be sorted).

3. Memory for Different groups:

- Here I am creating 4 different groups **Reg [16:0] group[0:32]** to store data points.

4. Selection of groups:

- Using **4x1 MUX** to select different groups.



Designing of Code: Project GitHub link:-

https://github.com/collab456/CAO-mini-project

Watch the compilation video of project:- **https://github.com/collab456/CAO-mini-project/blob/main/compilation%20video.mp4**

C:/Modeltech_pe_edu_10.4a/examples/group_divider.v (/group_divider) - Default

```
Ln#
 1  module group_divider;
 2  reg [15:0] RAM [0:127];          //memory for storing all data points (16-bit)
 3  reg [15:0] group1[0:31];         //memory for group 1
 4  reg [15:0] group2[0:31];         //memory for group 2
 5  reg [15:0] group3[0:31];         //memory for group 3
 6  reg [15:0] group4[0:31];         //memory for group 4
 7  integer i;                       //initialization iterator i for loop
 8  initial
 9  begin
10    $readmemh("datazen.txt",RAM);    //reading data file
11  end
12  initial
13  begin
14  for(i=0;i<=99;i=i+1)
15    begin
16
17          if(i<=24)group1[i]=RAM[i];                    //dividing into droup 1
18          if(i>24 && i<=49)group2[i-25]=RAM[i];         //dividing into droup 2
19          if(i>49 && i<=74)group3[i-50]=RAM[i];         //dividing into droup 3
20          if(i>74 && i<=99)group4[i-75]=RAM[i];         //dividing into droup 4
21
22    end
23  end
```

```
23  end
24  initial
25  begin
26    for(i=0;i<=99;i=i+1)
27    begin
28
29          if(i==0)$display("Here Group: 1\n");
30          if(i>=0 && i<=24)$display("point: %d\n",group1[i]);          //displaying group 1
31          if(i==24)$display("Here Group: 2\n");
32          if(i>24 && i<=49)$display("point: %d\n",group2[i-25]);       //displaying group 2
33          if(i==49)$display("Here Group: 3\n");
34          if(i>49 && i<=74)$display("point: %d\n",group3[i-50]);       //displaying group 3
35          if(i==74)$display("Here Group: 4\n");
36          if(i>74 && i<=99)$display("point: %d\n",group4[i-75]);       //displaying group 4
37
38    end
39  end
40  endmodule
41
```

Transcript | groups.v | group_divider.v | Project | Memory List | sim

Ln: 23 Col: 3 | Project : T_flipflop | Now: 100 ns Delta: 0 | sim:/group_di der

Output: Compilation Result – compile successfully

```
# Compile of group_divider.v was successful.
VSIM 15> vsim -gui work.group_divider
# vsim
# Start time: 16:51:26 on Dec 20,2020
# Loading work.group_divider
```

Groupwise Distribution:

```
# Loading work.group_divider
VSIM 16> run
# Here Group: 1
#
# point:      1
#
# point:      2
#
# point:      3
#
# point:      4
#
# point:      5
#
# point:      6
#
# point:      7
#
# point:      8
#
# point:      9
#
# point:     10
#
# point:     11
#
# point:     12
#
# point:     13
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# point:     14
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# point:     15
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# point:     16
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# point:     17
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# point:     18
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# point:     19
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# point:     20
#
# point:     21
#
# point:     22
#
# point:     23
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# point:     24
#
# point:     25
```

```
# Here Group: 2
#
# point:     26
#
# point:     27
#
# point:     28
#
# point:     29
#
# point:     30
#
# point:     31
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# point:     32
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# point:     33
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# point:     34
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# point:     35
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# point:     37
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# point:     40
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# point:     41
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# point:     42
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# point:     43
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# point:     44
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# point:     45
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# point:     46
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# point:     47
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# point:     48
#
# point:     49
#
# point:     50
```

```
# Here Group: 3
#
# point:     51
#
# point:     52
#
# point:     53
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# point:     54
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# point:     55
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# point:     56
#
# point:     57
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# point:     69
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# point:     70
#
# point:     71
#
# point:     72
#
# point:     73
#
# point:     74
#
# point:     75
```

```
# Here Group: 4
#
# point:     76
#
# point:     77
#
# point:     78
#
# point:     79
#
# point:     80
#
# point:     81
#
# point:     82
#
# point:     83
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# point:     95
#
# point:     96
#
# point:     97
#
# point:     98
#
# point:     99
#
# point:    100
#
VSIM 17>
```