

Note on COL215 Assignment 3

This note is in response to some queries that I have received from students which may be of general interest. Firstly, I want to correct a typo. Please consider the data_out port declaration in ROM to be as follows. This port is supposed to be 9 bits, not 8 bits.

```
data_out : out std_logic_vector(8 downto 0)
```

The overall design (let us call it “overall_design”) would consist of the following.

- a) a RAM
- b) a ROM
- c) a MAC
- d) a circuit (let us call it “part_d”) which performs filtering using the above three

The first three are instance of the given components. For creating instances of pre-designed components, see lecture 11 (20th Oct) or refer to the text book (pages 283 and 791). The fourth one you need to design afresh. You can do it in two ways.

- i. Design part_d as a separate component (entity + architecture). Then instantiate all four (RAM, ROM, MAC, part_d) in overall_design, connecting them through signals.
- ii. Instantiate only the first three (RAM, ROM, MAC) in overall_design. Here part_d will not be a separate component, but a bunch of concurrent statements in overall_design.

Note that to compute each pixel of the filter image, part_d needs to perform 9 MAC operations sequentially and then store the result in RAM. Before doing a MAC operation, one RAM read and one ROM read operations would be required. For each operation, part_d has to supply inputs to other components in one cycle and get the result in the next cycle. All this sequencing has to be done by an FSM in part_d. There will also be a bunch of counters that will help in producing addresses for RAM and ROM. These counters need not be separate components, these could be signals local to part_d.

This assignment does not involve design of a complete system. To keep it simple, input/output parts have been left out (except for a button, a switch and a clock). It is assumed that the image to be filtered and coefficients for both the filters are somehow pre-loaded and the filtered image remains in the memory till next filtering operation. You may store the image and filter matrices row-wise or column-wise. The choice has been left open.