Lab 2 – BCD Addition

What to do…

1) Simulate `bcd7seg.vhd`. Verify its correctness by forcing the input waves with arbitrary values as shown in class and comparing the 7-segment output values to what you would expect given the 7-segment figure below.

```
Figure 1
```

2) Modify `bcd7seg.vhd` to allow for a 4-bit input. Your code should be able to display the digits from 0 to 9, and should treat the valuations 1010 to 1111 as don’t-cares.

3) Simulate `part6.vhd`. Calculate the following by forcing the input waves with the respective input values and viewing the answer in the output wave. Verify that the output correctly represents the desired sum. **Note**: These are BCD additions (not binary!!) and the output is in 7-segment form (not binary!!).

- a. 0000 1000
- b. 0000 0101
- c. 1001 1001
  
  + 0001 1000
  
  + 0000 0001
  
  + 1001 1001

4) Modify the following pseudo-code (lines 1-19) to create an 8-digit BCD adder.

```
1   \( T_0 = A_0 + B_0 \)
2   if \( (T_0 > 9) \) then
3       \( Z_0 = 10; \)
4       \( c_1 = 1; \)
5   else
6       \( Z_0 = 0; \)
7       \( c_1 = 0; \)
8   end if
9   \( S_0 = T_0 - Z_0 \)
10   \( T_1 = A_1 + B_1 + c_1 \)
11   if \( (T_1 > 9) \) then
12       \( Z_1 = 10; \)
13       \( c_2 = 1; \)
14   else
15       \( Z_1 = 0; \)
16       \( c_2 = 0; \)
17   end if
18   \( S_1 = T_1 - Z_1 \)
19   \( S_2 = c_2 \)
```

5) Modify `part6.vhd` to create the 8-digit BCD adder as described above.
What to hand in…

A report describing exactly what you did for each part. Please explain all answers. If you clicked on something, write it down. If you calculated something, describe your thinking process. If you learned something (during lecture or while completing the lab), describe it in your own words. Include your code and screenshots of your results within your report.