2-point Homework 1

Use the last 3 digits of your personal number (PN) to select which question you have to answer. Modulo divide your 3 digits with the number of questions, in this case, 3, plus 1. The resulting number is the question that you should answer.

!!! (PN mod 3) + 1 !!!

For example, if your PN ends in 730, then (730 mod 3) + 1 = 2, meaning you must answer question 2.

Make sure you comment on the top of each file you submit, your PN, name and the question you are answering.

!!! Important !!!

If you answer the wrong question, your submission will be invalid.

We can call you to explain your solution. If you cannot explain your answer, the homework will be invalid!

KTH has a zero-tolerance policy against cheating.

https://www.kth.se/en/student/stod/studier/fusk-1.997287

If you have questions or need clarifications, you can ask in the discussion forum in Canvas.

Questions

1.1 Question 1

A) Model using HDL an unsigned multiplier that can be used to multiply two 16-bit numbers. The multiplier should be built using components of multiple 4-bit multipliers.
B) Draw a schematic of your design.

1.2 Question 2

Model using HDL, a 4-bit BCD (Binary-coded decimal) adder. The design should take two BCD values, and it should calculate their sum in BCD form and carry out.

Deliverables:

A) HDL implementation of the design
B) Draw a schematic of your design.

Do **not** use a generic multiplexer structure. The BCD encoding can be seen in the table.

Decimal	BCD			
	8	**4**	**2**	**1**
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

1.3 QUESTION 3

A) Model using HDL a design that can add 6 N-bit numbers. The design should be parametric with parameter N. You must ensure that your design does not overflow or underflow and assign the correct bit width for all intermediate and output signals. The design should implement the following equation:

$$out = \sum_{k=0}^{5} X_k$$

Your design should have an optimal critical path (i.e. the path from the input to the output should pass through the minimum amount of adders).

B) Draw a schematic of your design. Assume a value for the N=4 parameter.