Combinational Circuit Design

Design the following circuits with Verilog using assign statements.

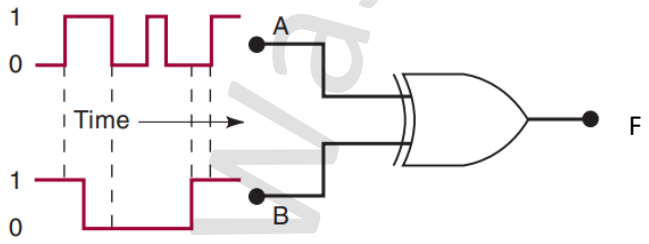
1) A four-bit binary number is represented as A3A2A1A0, where A3, A2, A1, and A0 represent the individual bits and A0 is equal to the LSB. Design a logic circuit using Verilog that will produce a HIGH output whenever the binary number is greater than 0010 and less than 1000.

- The design takes 1 input **A** (4-bits) and output **out** (1-bit)

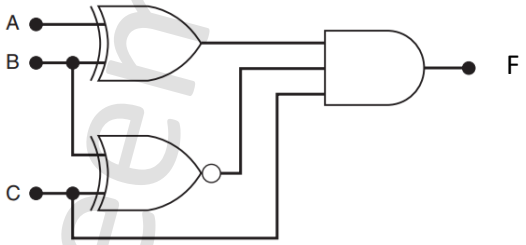
2) (a) Determine the output waveform for the circuit of Figure below.

(b) Repeat with the B input held LOW.

(c) Repeat with B held HIGH.



3) Design the following circuit using Verilog and determine the input conditions needed to produce F = 1



4) Write a Verilog description for a circuit that accepts a three-bit input A and outputs true if the input is a prime number

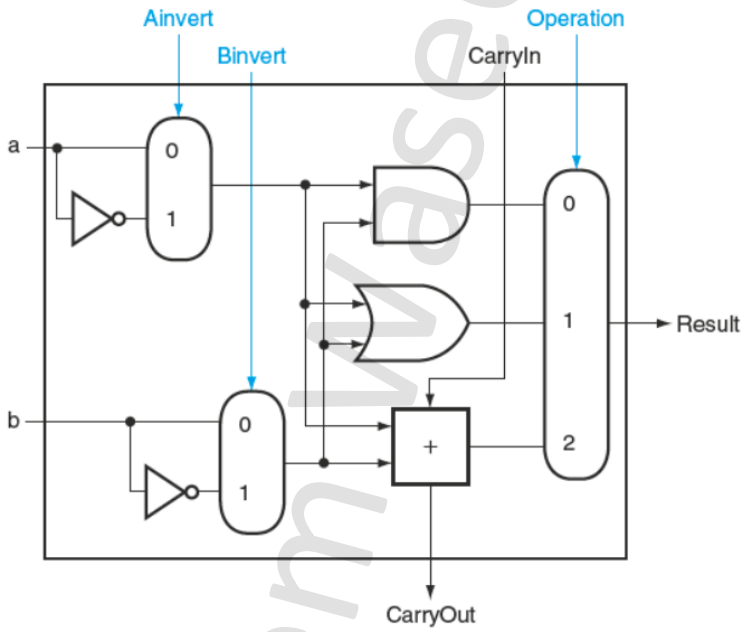
5) Design a circuit using Verilog that takes two 4-bit numbers A and B and outputs two 4-bit numbers F and K so that F is the greatest of A and B and K is the lowest of A and B

6) We need to design a circuit called "Check" to ensure that the temperature sensor B, which measures the outgoing air temperature in an air conditioning (AC) system, always reads a value that is less than or equal to the temperature measured by sensor A, which measures the incoming air temperature. Both sensors generate 4-bit digital values in the range of 0 to 15ºC. The circuit should compare the values of Ta and Tb and activate the AC system when necessary by generating a HIGH output named 'on'.

- Inputs **Ta, Tb**
- 1-bit output **on**

7) Implement the following 1-bit ALU. If you are unfamiliar with the concept of an ALU, you can find more information by clicking here. Use conditional operator for the multiplexers. For the 3-to-1 Mux, you can use the following format for the conditional operator.

assign <output_signal> = <condition1> ? <value1> : <condition2> ? <value2> : <default_value>);



Port Name	Type	Size	Description
A	Input	1 bit	Input a
B			Input b
Ainvert			Select signal for the multiplexer to select a or a complement
Binvert			Select signal for the multiplexer to select b or b complement
CarryIn			Carry in
Operation		2 bits	Select signal for the multiplexer to drive the Result output
CarryOut	Output	1 bit	Carry out
Result		1 bit	Output of the multiplexer

Deliverables: The assignment should be submitted as a PDF file with this format <your_name>_Assignment1 for example Kareem_Waseem_Assignment1_Extended

Note that your document should be organized as 7 sections corresponding to each design above, and in each section, I am expecting the Verilog code.