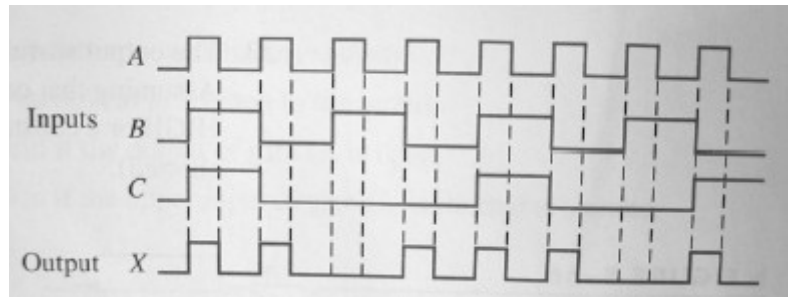


1. Design a logic circuit that provides the function seen in the following timing diagram.

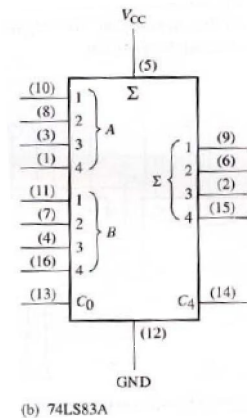


2. a) An A/D converter has a 4 bit binary output. You want to connect it to a logic circuit, which switches its output HIGH, when its input is over twelve or under three. Write an expression for the circuit and simplify it using a Karnaugh map.

b) Draw the circuit from part a)

c) The TTL components you're using have a propagation delay of 10 ns. Estimate the maximum clock frequency you can use.

3. Following logic levels are measured from the pins of a 74LS83A adder circuit: 1-LOW, 2-HIGH, 3-HIGH, 4-HIGH, 6-HIGH, 7-HIGH, 8-LOW, 9-LOW, 10-LOW, 11-LOW, 13-LOW, 14-HIGH, 15-LOW and 16-HIGH. Does the circuit function correctly?



4. You've been tasked to design a breath alcohol ignition interlock device for a car. The customer wants the device to meet the following criteria:

- The driver must be seated and the passenger's seat must be empty
- The doors must be closed
- The key must be inserted
- The driver's seat belt must be fastened
- Alcohol content in the breath sample must be under a certain limit.

You know the pressure sensors in the seats are in HIGH state when a person is seated, the door sensors are in LOW state when the doors are open, the key sensor is in HIGH state when the key is inserted and the seatbelt sensors are in LOW state when the seat belt is fastened. Breath analysis is done with a comparator circuit that is in HIGH state when measurement is within allowed limits.

Design a circuit that fulfills the requirements.