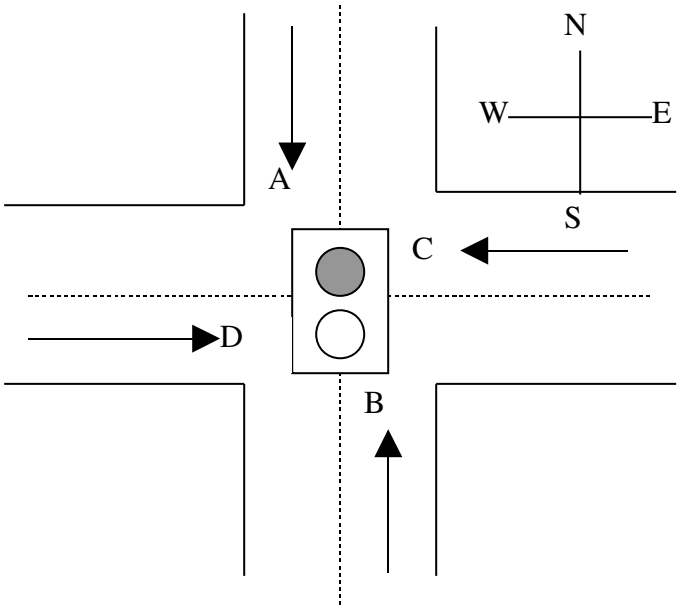
CMSC 130: Laboratory Exercise #5: DESIGN OF COMBINATIONAL CIRCUITS

Instructions: Write your answers neatly in a whole sheet of yellow paper. Pass this questionnaire together with your paper. DO NOT WRITE ANYTHING ON THIS PAPER.

1. Figure below shows the intersection of main highway with a secondary access road. Vehicle-detection sensors are placed along lanes C and D (main road) and lanes A and B (access road). These sensor outputs are LOW (0) when no vehicle is present and HIGH (1) when a vehicle is present. The intersection traffic light is to be controlled according to the following logic.



   a.) the east-west(E-W) traffic light will be green whenever both lanes C and D are occupied.
   b.) the E-W light will be green whenever either C or D is occupied but lanes A and B are not both occupied
   c.) The north-south (N-S) light will be green whenever both lanes A and B are occupied but C and D are not both occupied.
   d.) The N-S light will also be green when either A or B is occupied while C and D are both vacant.
   e.) The E-W light will be green when no vehicles are present.

   Using the sensors A, B, C, and D as inputs, design a logic circuit that controls the traffic light. There should be two outputs, N-S and E-W, which go HIGH when the corresponding light is to be green. Simplify the circuit using K-map and draw the corresponding logic diagram of N-S and E-W.

2. It is necessary to multiply two binary numbers, each two bits long, in order to form their product in binary. Let the two numbers be represented by *AB* and *CD.* Design a combinational circuit that computes for the product of two 2-bit numbers.