1. A certain process is to count the number of true-to-false transitions on input I:0.0/0 for a 10 second period. Counting is to occur if input word I:0.1 has a value less than 10000 or greater than 20000. The 10 second counting period is to begin 15 seconds after the process starts. I:0.0/1 is a process start input and input I:0.0/2 is a process stop input. The count display is to be output to word O:0.0 only at the end of the count period. All outputs are to be de-energized 5 seconds after the count period. The process should repeat only after another distinct press of the process start input. Write an efficient ladder logic program for this process.

2. Write a program that ANDs B3:0 with B3:1 when I:0.0/0 is energized, ORs B3:0 with B3:1 when I:0.0/1 is energized, XORs B3:0 with B3:1 when I:0.0/2 is energized and COMPLEMENTS B3:0 when I:0.0/3 is energized. B3:1 is to hold the result in each case. If more than one input I:0.0/0-I:0.0/3 is energized, only one of the operations will be performed. The precedence order for operations should be from AND (highest precedence) to COMPLEMENT (lowest precedence).

3. Discuss the setup and use of subroutines within the Allen Bradley PLCs.

4. Assume there are sixteen stations along a conveyor system. The stations are numbered from 0-15 with station zero being the first (i.e. the point where parts enter the conveyor). Parts are to advance along the conveyor at the rate of one station every four seconds. A part may or may not be at a given station at any point in time. An input sensor I:0.0/0 is used to detect a part entering the conveyor. At station 5, parts are checked for defects and an input sensor I:0.0/1 is energized if the part is defective. At station 10, any defective parts are to be removed from the conveyor by energizing output O:0.0/0. Write an efficient ladder logic program for this process.

5. Label the following statements as TRUE or FALSE.

   PLC scan time is dependent on the complexity of the PLC program

   Most PLC timers have microsecond resolution

   The BINARY data file may be used to hold preset values for Allen Bradley timer instructions.

6. Design an efficient ladder logic program that samples analog input (I:1.0) at the rate of 2Hz and outputs the average value to analog output O:1.0 once every two seconds.