1. There are three machines, each with its own start and stop buttons. Any two machines may run at one time (also, any one may run by itself). Each start button is to have a sealing circuit. Construct a PLC circuit with appropriate interlocking for this problem.

2. Construct a PLC timing circuit that will output (using output O:2/0) a 0.5 second pulse every two seconds (i.e. on for 0.5s then off for 2s) if a switch (using I:1/0) is closed and a 1 second pulse every two seconds if the switch is open.

3. Label the following statements as TRUE or FALSE.

   a) Most PLCs have a fixed number of timers
      
   b) Normally closed contacts “invert” the state of the signal they reference

   c) PLCs are advantageous for use in fixed-circuit or fixed program operations

4. Complete the following statements.

   a) PLC process scanning consists of the _______________ scan, _______________ scan and _______________ scan.

   b) _______________ scanning and _______________ scanning are the two methods (orders) in which PLCs solve ladder logic programs.

5. Describe the differences between an [XIC] and an [OSR] instruction.

6. A certain switch (I:1/0) is to start a process. The process is to run for 30 seconds, stop for 10 seconds and then repeat as long switch I:1/0 remains closed. Opening I:1/0 at any time is to reset all timers and de-energize all outputs. Output O:2/0 is to be energized during the 30s run period and output O:2/1 is to be energized during the 10s stop period. During the run period, a single output O:2/2 is controlled by input I:1/1. If I:1/1 is open (at the beginning of the run period) O:2/2 is to be off for the first 5 seconds then on for 10 seconds. If I:1/1 is closed (at the beginning of the run period) O:2/2 is to be off for the first 10 seconds then on for 15 seconds. Changing I:1/1 after the run period has begun should not change the above sequence. Output O:2/2 is always to be off during the stop period.