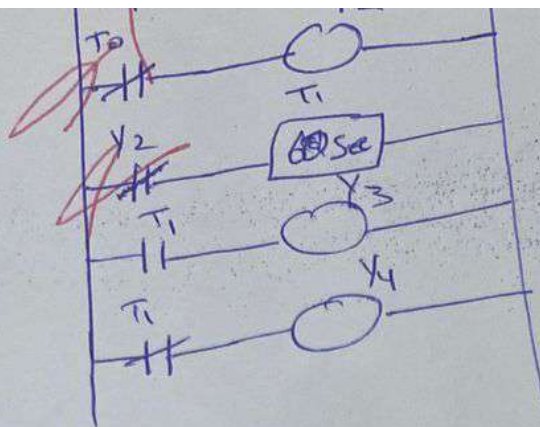


MIDTERM EXAMINATION

Semester	: Summer	Year	: 2022/ 2023
Course Title	: Industrial Automation		
Course Code	: IE0906542	Exam Version	: B

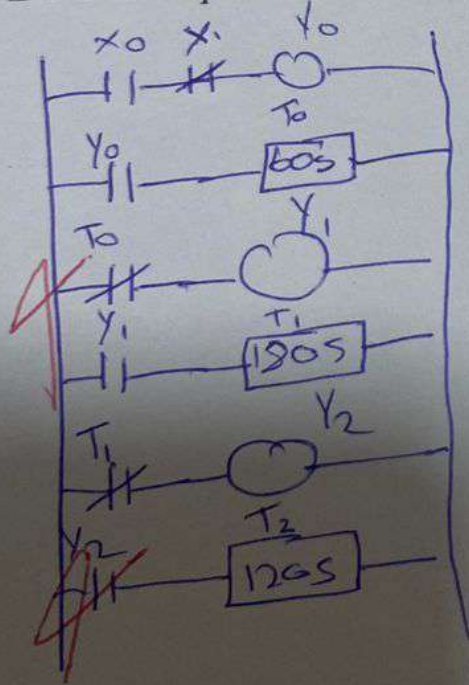
Q1 (10 marks) Choose the correct answer for the following multiple-choice questions:

- (1) Automation and control are related to each other as :
- ☒ A) Automation is a multi-level control, monitoring and supervising process.
- ☐ B) Automation system is a special case of control system.
- ☐ C) Automation and control are the same.
- ☒ D) Control is a broad branch of automation.
- (2) The three basic elements of any automation system are:
- ☒ A) Controller, sensors and actuators.
- ☐ B) Software, hardware and power.
- ☒ C) Power, control system and program of instructions.
- ☐ D) B + C.
- (3) Which of the following sentences is true about the automation hierarchy:
- ☒ A) Automation becomes more about planning and supervising as we go up from the field level to the company level.
- ☐ B) Automation becomes more about control as we go up from the field floor level to the company level.
- ☐ C) Automation becomes more about planning and supervising as we go down from the field level to the company level.
- ☒ D) All of the above
- (4) In which of the following manufacturing automation levels process planning is taking place?
- ☒ A) Device level.
- ☐ B) Plant level.
- ☐ C) Enterprise level.
- ☐ D) Factory level.
- (5) In order to have a high production volume, the recommended type of automation to use is:
- ☐ A) Flexible automation.
- ☒ B) Fixed automation.
- ☐ C) Programmable automation.
- ☒ D) A + C.



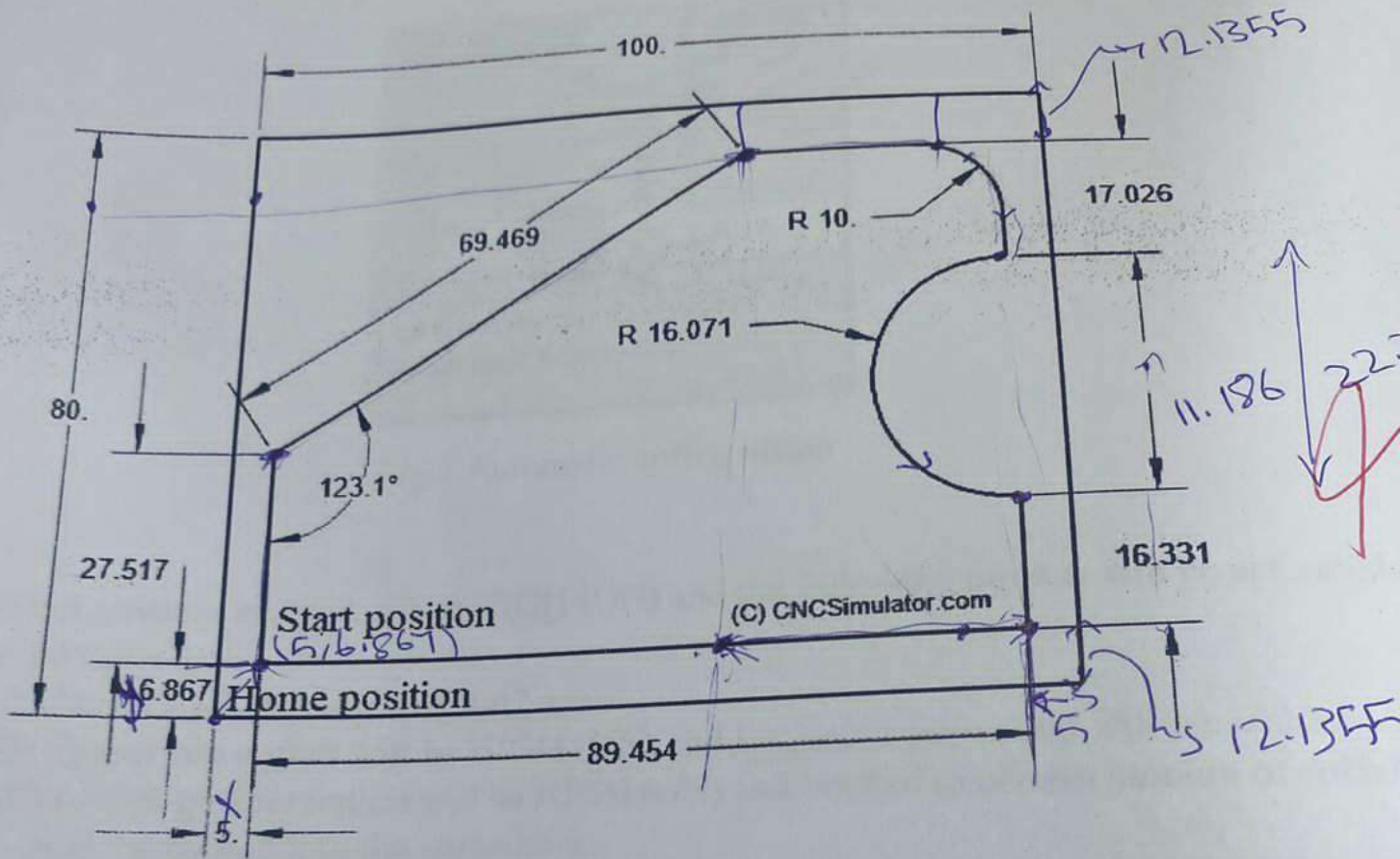
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- 4 marks) Design ladder diagram for an oven. The operations are as listed below:
1. An operator presses a start button and an ALARM output is turned on for 1 minute.
 2. The ALARM output is turned off and the HEAT is turned on for 3 minutes to allow the temperature to rise to the acceptable range.
 3. The CONVEYOR output is turned on.
 4. If the STOP input is activated (turned off) the HEAT will be turned off, but the CONVEYOR output will be kept on for two minutes.



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Q3) (5 marks) Write the G & M code program to do the following counter milling.



G90
 G00 X0 Y0
 G01 X5 Y27.517
 G01 X ~~69.469~~ Y69.469
 G01 ~~X89.454 Y17.026 R10~~ → G01 X ~~55.729~~ Y55.729
 G02 X89.454 Y17.026 R10
 G03 X89.454 Y22.372 R16.071
 G01 X89.454 Y16.331
 G00 X5 Y6.867

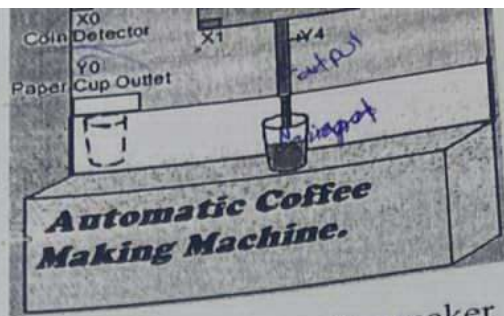
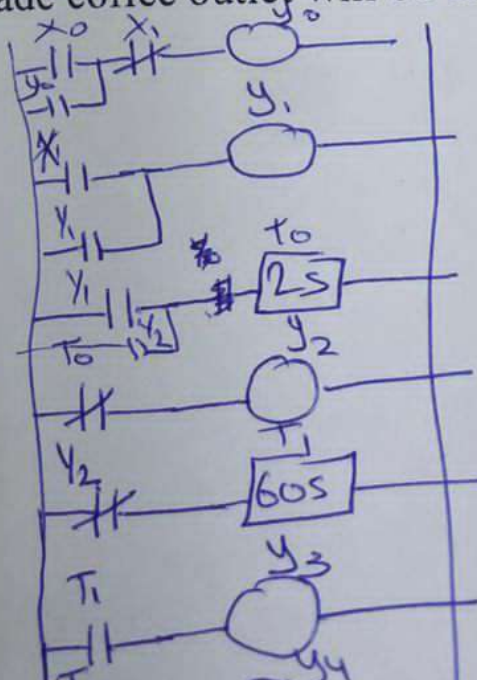


Fig.1 Automatic coffee maker

1. When a coin is inserted, X0 is HIGH (ON) and the following outputs will be activated at the same time:
 - A timer T0 will be activated for 2 sec
 - Y0 (paper cup outlet) will be HIGH (ON) and latched (a paper cup will be sent out)
 - Y1 (coffee powder outlet) will be HIGH (ON) and latched (a certain amount of coffee will be poured into the container).
 - Y0 and Y1 will be HIGH (ON) for 2 sec, which is the set value of the timer T0.
 2. After 2 sec, Y2 (hot water outlet) will be activated HIGH (ON), and the hot water will be poured in the container. At the same time, Y0 and Y1 will be closed LOW (OFF).
 3. When the liquid in the container reaches a certain amount of pressure:
 - A pressure sensor X1 will be activated HIGH (ON).
 - Y2 will be reset LOW (OFF)
 - Timer T1 will be activated HIGH (ON) for 60 sec.
 - The agitator Y3 will be HIGH (ON) for 60 sec, which is the set value of Timer T1.
 4. After 60 sec, the agitator Y3 will be Low (OFF) and Y4 (the ready-made coffee outlet) will be HIGH (ON) and latched and the ready-made coffee will be pouring out from Y4 outlet.
 5. When the coffee is poured into the paper cup completely, X1 will be LOW (OFF) and Y4 will be reset LOW (OFF) the ready-made coffee outlet will be closed.
- For the system above:
Draw the PLC ladder diagram.



arks) Draw the ladder diagram for an indicator system with the following
l and devices:

ling the indicator (Y) to be ON after a 5 sec delay (T0), and OFF after
by switch (X1). X1 will be on when the switch is turned ON.

