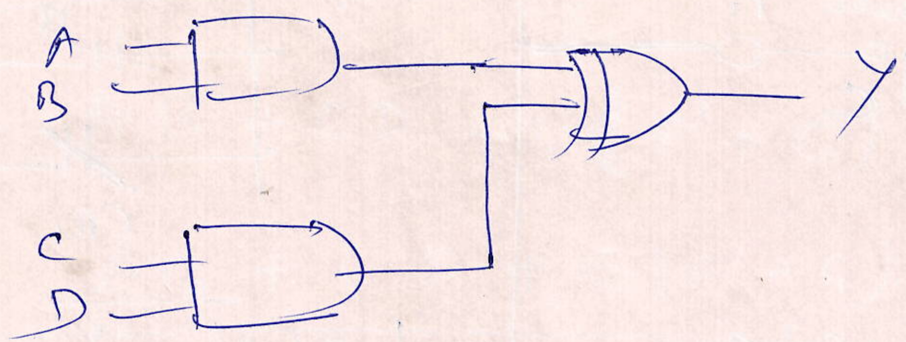
DMT.

(2)

PLC + DPLC

15 ©



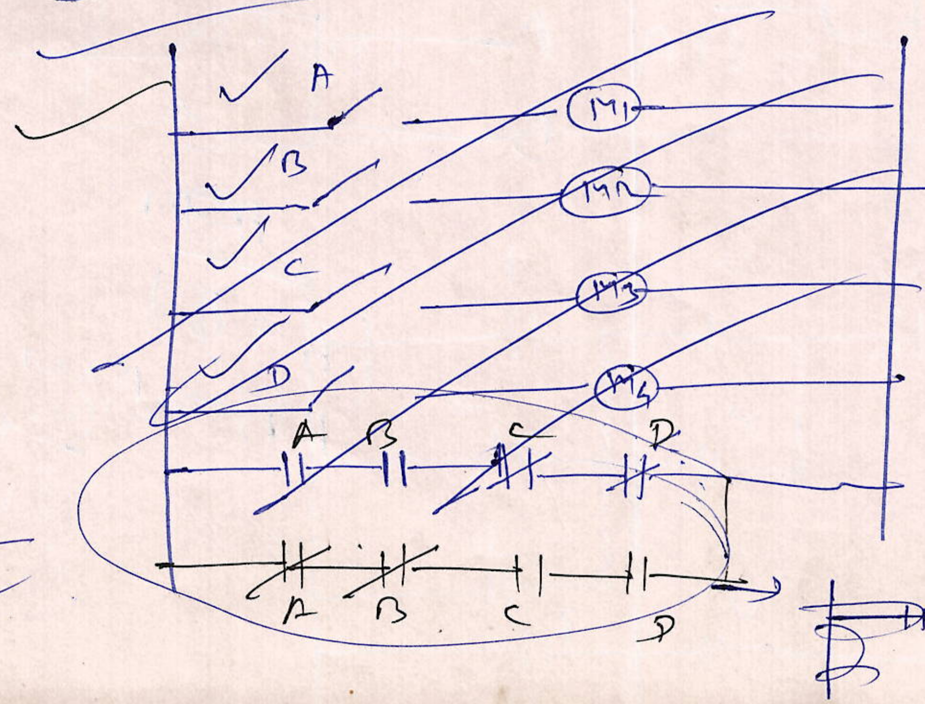
$\overline{CD} = C' + D'$

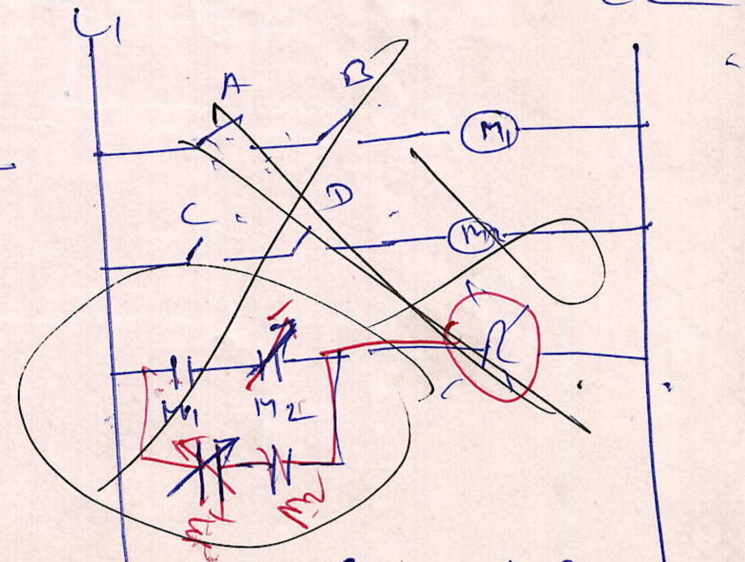
$\overline{C+D}$

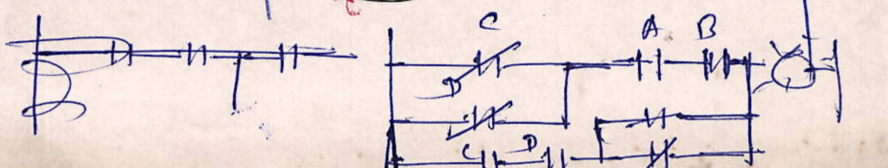
$Y = \sout{AB}\ AB \oplus CD$

$= (AB)\cdot(CD)' + (AB)'(CD)$

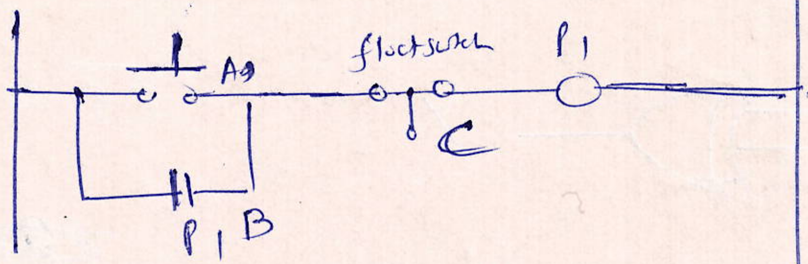
(AB)'





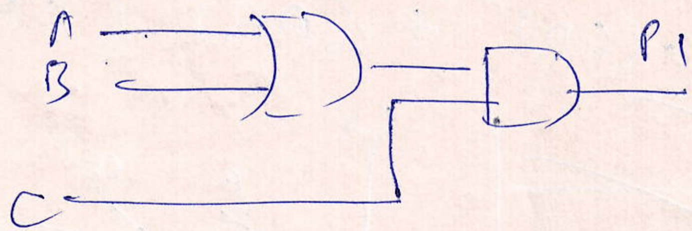


(15) . Design gate 21

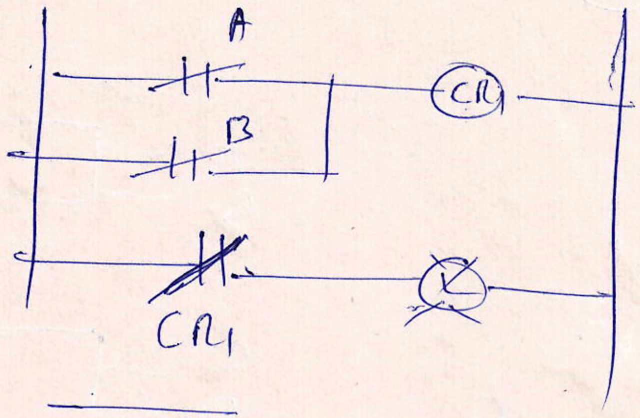


Let

$P_1 = (A+B) \cdot C$

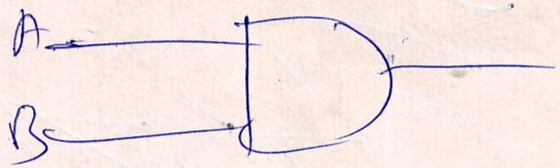


(16)



$L = \overline{(A' + B')}$

$C = A \cdot B$



$\overline{(\bar{A} + \bar{B})}$

$= AB = A \cdot AND$

(17)

% o/p = ?

fig A

$Y = AB + CD + E(F' + G) = (1 \cdot 2) + (3 \cdot 4) + 5 \cdot (\bar{6} + 7)$

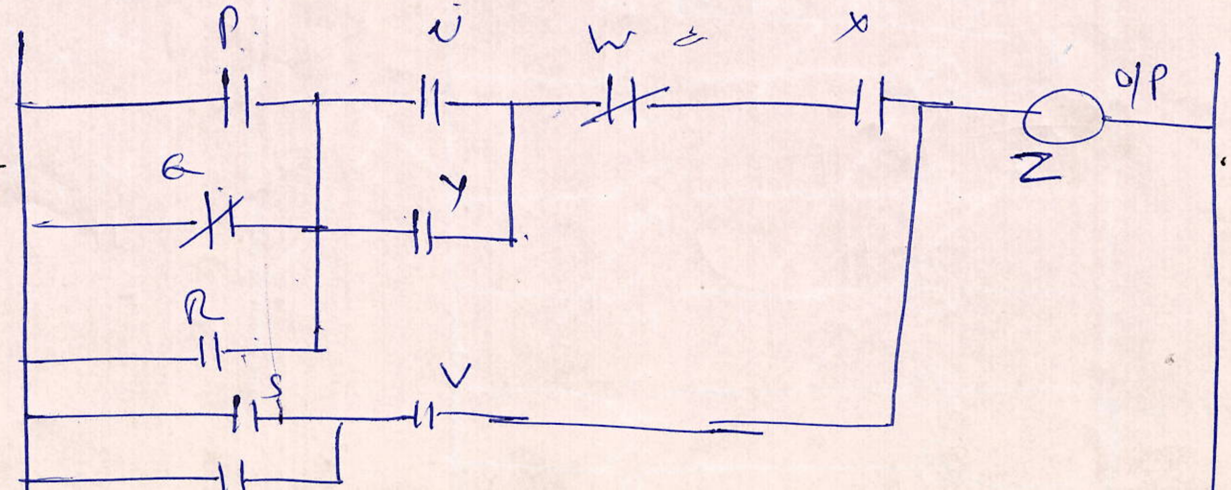
$Y = AB + CD + E(F' + G)$

fig C

$Y(o/p) = AB + C + D + EF$

fig b

$Z = \{(P + Q' + R)(U + Y)(W')(X) + (S + T)V\}$

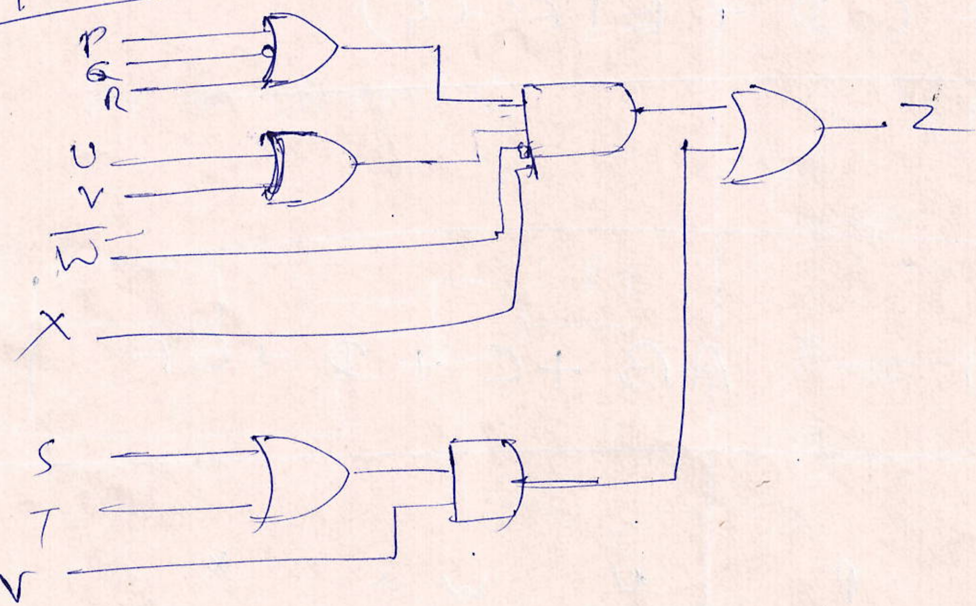


Ans ~~$Z = \{(S+T)\cdot V\}$~~

i.e. if

$Z = [(P+\bar{G}+R)\cdot(U+V)\cdot\bar{W}\cdot X] + (S+T)\cdot V$

Bqew Gate



① 1-
②
③
④
⑤

18

fig A

$S = \left[\overline{(L+M'+N) + (QR)}\right] . R$

$= \left[\overline{(L+M'+N)} . \overline{QR}\right] R$

$= \left[(L' . M . N') . (Q' + R')\right] R$

$\overline{(L+M'+N)} = L'MN'Q'R$

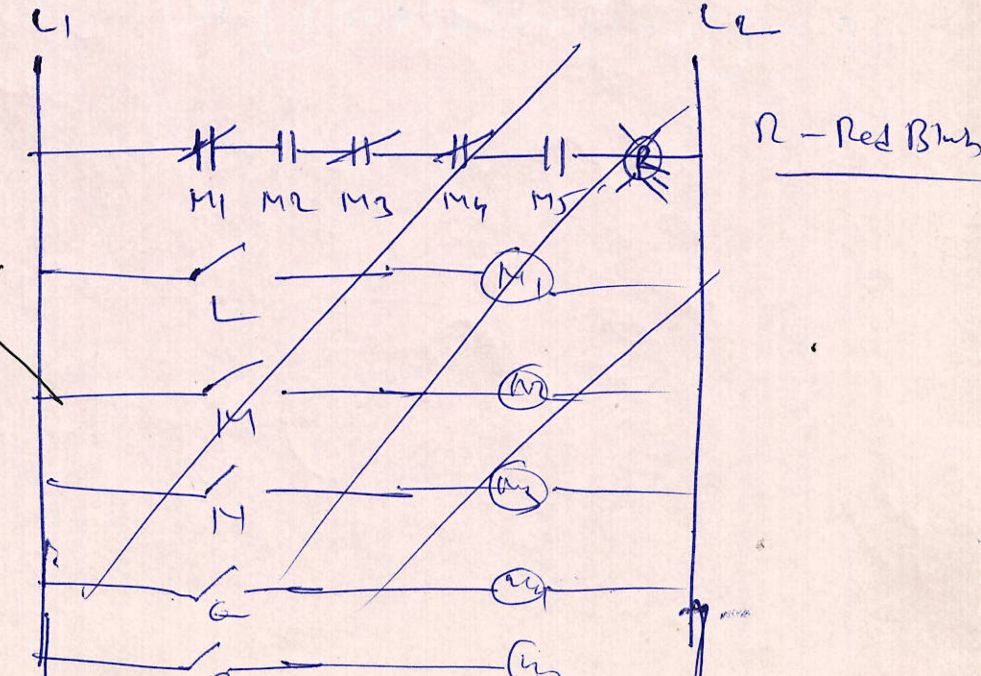
let $L+M' = x$

$M = y$

$\overline{(L+M')} . \bar{N}$

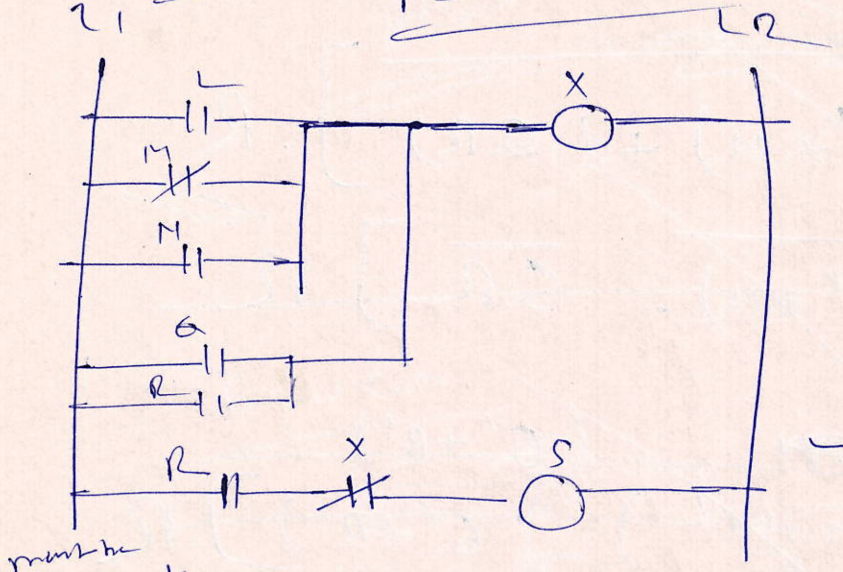
$= L' . M . N'$

Sm



(18) fig A

PLC ladder Dia



must be two separate contacts for R

Boolean Exp

$$S = \left[\overline{(L+\bar{M}+N)+(G+R)}\right] R$$

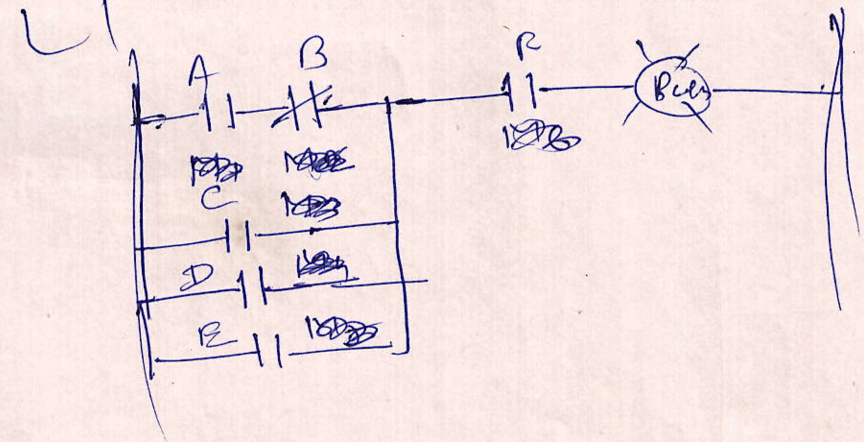
fig(3)

M1 to M6

1	2	3	4	5	6
A	B	C	D	E	F

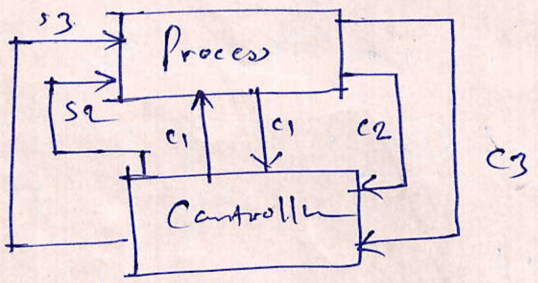
O/P = [(A B') + (C + D) + E] F

~~A B' F + (C + D) F + E F~~



Discrete State Process Control & Measurement

①



Process & Control

② Refrigerator / freezer system I/P & O/Ps

Fig

* The Discrete-state I/P variables are :-

1. Door open / closed
2. Power switch ON/OFF
3. The frost eliminator timer time out / not time out
4. freezer temp. high / low
5. Cooler temp. high / low
6. frost detector ON/OFF

* The discrete state O/P variables ⇒

1. Compressor — ON/OFF
2. Light — ON/OFF
3. frost eliminator timer — started / not started
4. frost eliminator Heater/Fan — ON/OFF
5. Cooler baffle — open / close

So the total no. of events are
= 6 (I/P) + 5 (O/P) = 11 two state variables. ∴ i.e $2^{11} = 2048$ possible states / events. Of course ; few of these are necessary. So the sequence of serial / ||el events are ⇒

ⓐ if the door is open;
the light is turn ON.

ⓑ if cooler temp is high
↓
and frost eliminator is off
then ⇒ compressor → ON
↓
cooler baffle → open
until the cooler temp is low.

ⓒ If freezer temp is high
and frost eliminator is off
then ⇒ compressor → ON
until,
the freezer temp is low.

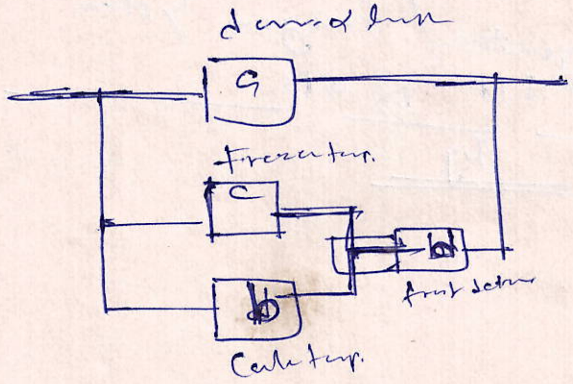
ⓓ frost detector is ON
↓
timer is started
↓
compressor is ~~off~~ turning off
+
frost eliminator is turn ~~off~~ ON
until the timer is timeout

∴ send & ||el

① ⓐ in ||el of ⓑ, ⓒ & ⓓ.
② ⓑ & ⓒ in ||el to each other
but ⓓ is in series of either ⓑ or ⓒ.

is

Reliability diagrams

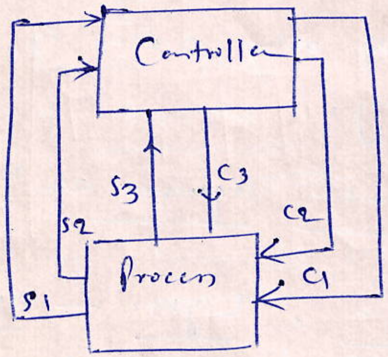


Ans

Discrete state Process Control

Definition ⇒ mean two states.

Ex:- Pistol mark on/off
open/close of valve.



Let us, call mean of I/P variable (S_1, S_2, S_3) & call control O/P variable (C_1, C_2, C_3) of the process can take on / be assigned only two values.

Ex:- Motor — on/off
valve — open/close
temp — high/Low
Limit switch — closed/open & so on.

so because of each variable ⟶ there is 6 ~~state~~ variable
∴ $n = 6$
∴ total possible state $= 2^6 = 64$ states
out of which few will be important & needs to consider.

Hence ⇒ Discrete state process Control is a particular sequence of events through which the process accomplished some objective.

For a simple heater

1.	Temp.	L	Heater	OFF
2.	"	L	"	ON
3.	"	H	"	OFF
4.	"	H	"	ON

so the system is called completely digitized if there is only two state at a time.

Char. of the system ⇒ Disc. state Process Control is called Master control system.

Unit 4 Assignment : (4)

Frost - free Refrigerator / freezer

Ans Discription of the system

① I/P discrete variable :⟹

I/P variable		States
1. Apply the power	—	ON / OFF
2. Door	—	open / close
3. Freezer temp.	—	low / high
4. Cooler temp.	—	low / high
5. Frost Eliminator Timer	—	timeout / not time out
6. Frost Detector	—	ON / OFF

② O/P discrete variable ⟹

O/P variables		States
1. Frost eliminator heater / fan	—	ON / OFF
2. Frost ~~detector~~ eliminator timer	—	time started / not started
3. Light	—	on / off
4. Cooler baffle	—	open / closed
5. Compressor	—	ON / OFF.

~~of~~ so the total no. of (I/P + O/P) variables = ~~6~~ 5 + 5 = 11 variables.

So total possible discrete states are = 2^{11} = 2048.

out of ~~them~~ only a few of them are necessary.

" The Event Sequences are " :—

1. if Door → open , Light — ON.

2. if Cooler temp is high & frost eliminator is OFF , the compressor is turned on & the cooler baffle is opened until the cooler temp is low.

(C.T → H & F.E. → OFF ; Comp. → ON & C.B. → open until C.T → L.)

3. if Freezer temp. → is high & frost eliminator is OFF , the compressor is turn on ~~& the cooler~~ until the Freeze temp comes down.

(F.T. → H & F.E → OFF ; Comp. → ON until C.T. → L)

4. if the frost detector is ON

~~Frost eliminator~~
- → Timer → started &
- → Compressor → turned off
- → F.E. fan → ON.

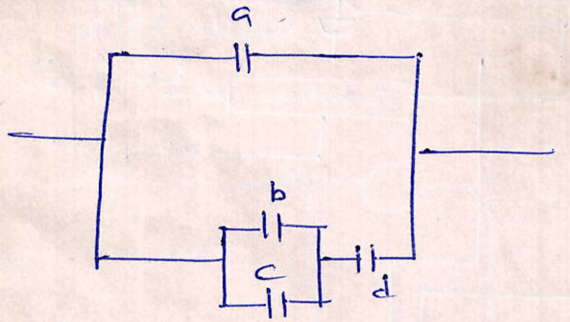
until the frost elimination time is time out.

* Sequence of series & ||el events :—

① ⓐ || ⓑ, ⓒ & ⓓ.

② ⓑ || ⓒ

and ③ ⓓ is in series either with ⓑ or ⓒ.



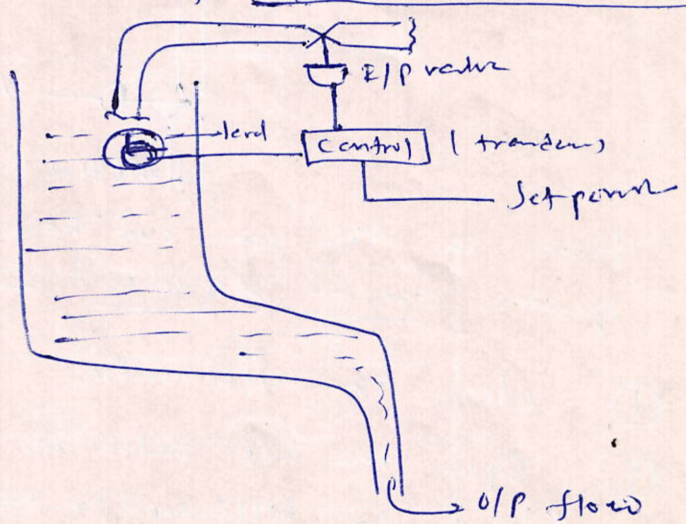
Assignment 6, 7, 8, 9

Detail Approach of Discrete state variables

⑥ i.e finite set of variables = generally two state.

It is imp. to be able to distinguish betn the nature of variables in a discrete-state system & those in continuous control system. To define in a better way; let us take an example ⇒

⑦ Continuous Control ⇒ Ex:- consider the case of liquid level in a tank

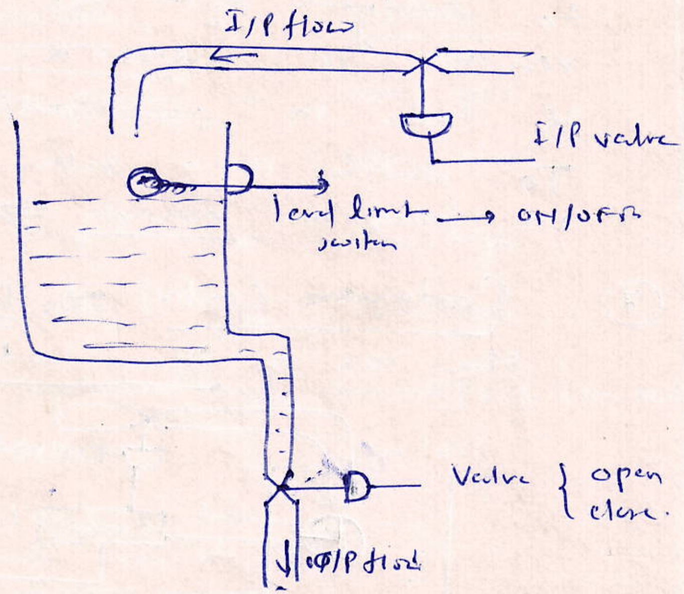


Continuous Control System

* According to flow of liquid at o/p; transducer changes the set point & valve position of I/P valve to maintain

as O/P flow is an unspecified flow & there is no control on O/P flow is called Continuous Control System.

(8) Discrete State Control System



Here in this case we have some specific event sequence :—

1. close the O/P valve
2. Open the I/P valve & let the tank to fill up to the desired level as indicated by level limit switch.
3. Close the I/P valve.

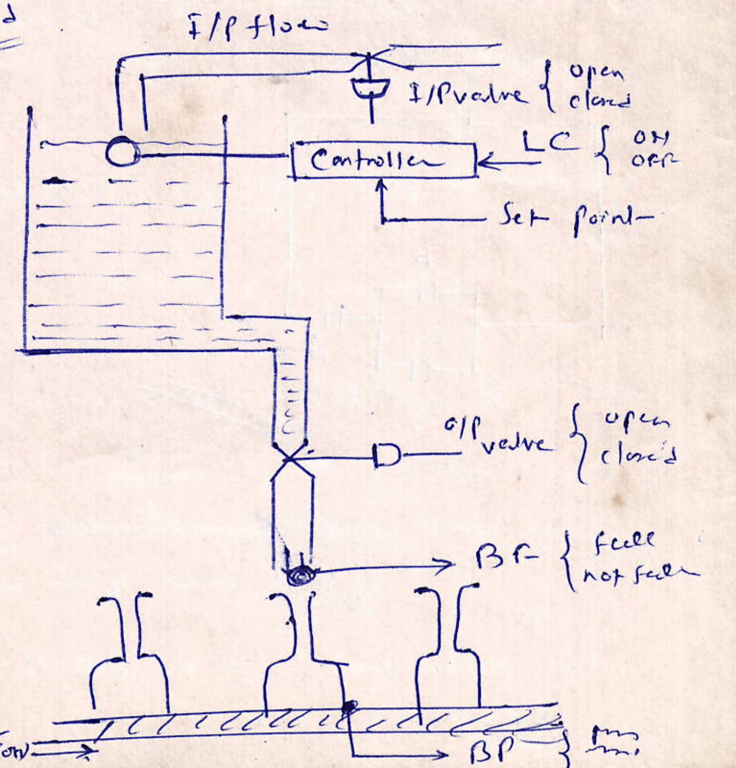
so here three control value.

1. Level measurement by level limit switch — ON/OFF
2. I/P valve — open/close
3. O/P valve — open/close

& hence O/P flow is specified & there is control on O/P flow is called Discrete State Control System

(9) Composite Discrete & Control System

Ex:- Bottle filling by liquid

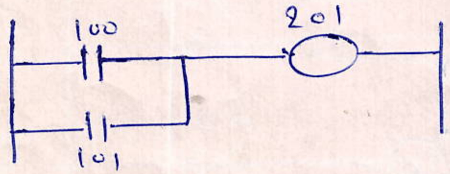


Composite = Combined of both
~~Cont~~ Continuous + Discrete

∴ Continuous Control system is a part of ~~Discrete~~ Composite / Discrete state Control system.

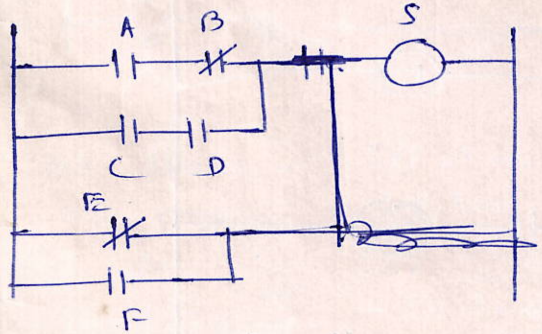
Q7 **Ladder Diagram**

1. LD 100, LD 101, OR, STO 201



2. LD A, LDN B, AD, LD C, LD D, AD, OR, STO S, LDN E, LD F, OR S

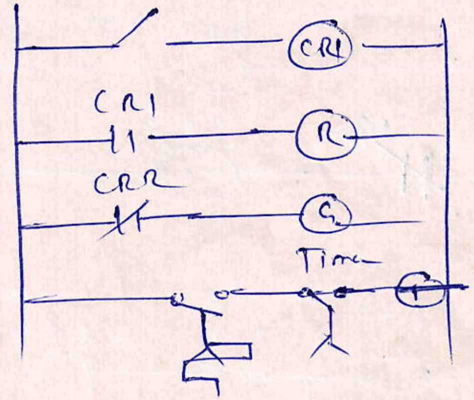
(?)



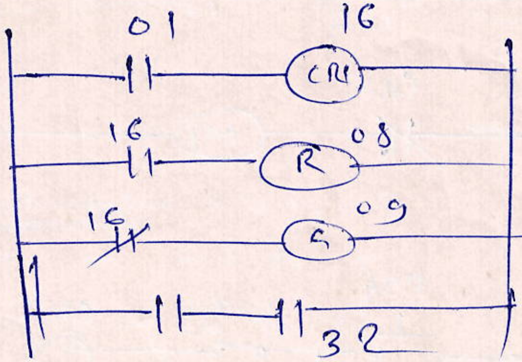
Programming of PLC

I/P channel = 00 to 07
→ O/P channel = 08 to 15
→ I/P Relays = 16 to 31
Timer = 32 to 39

Ex

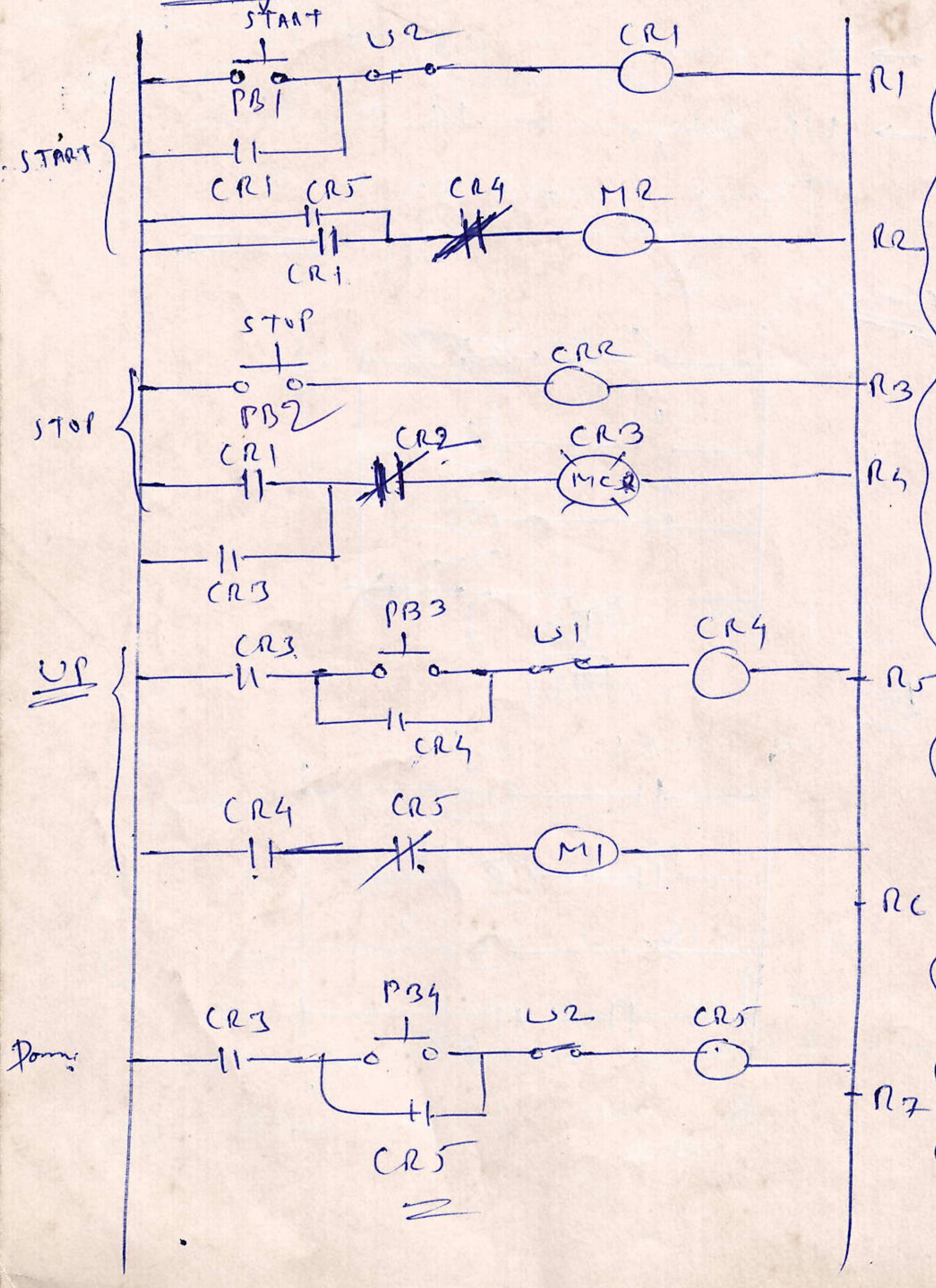


Ans

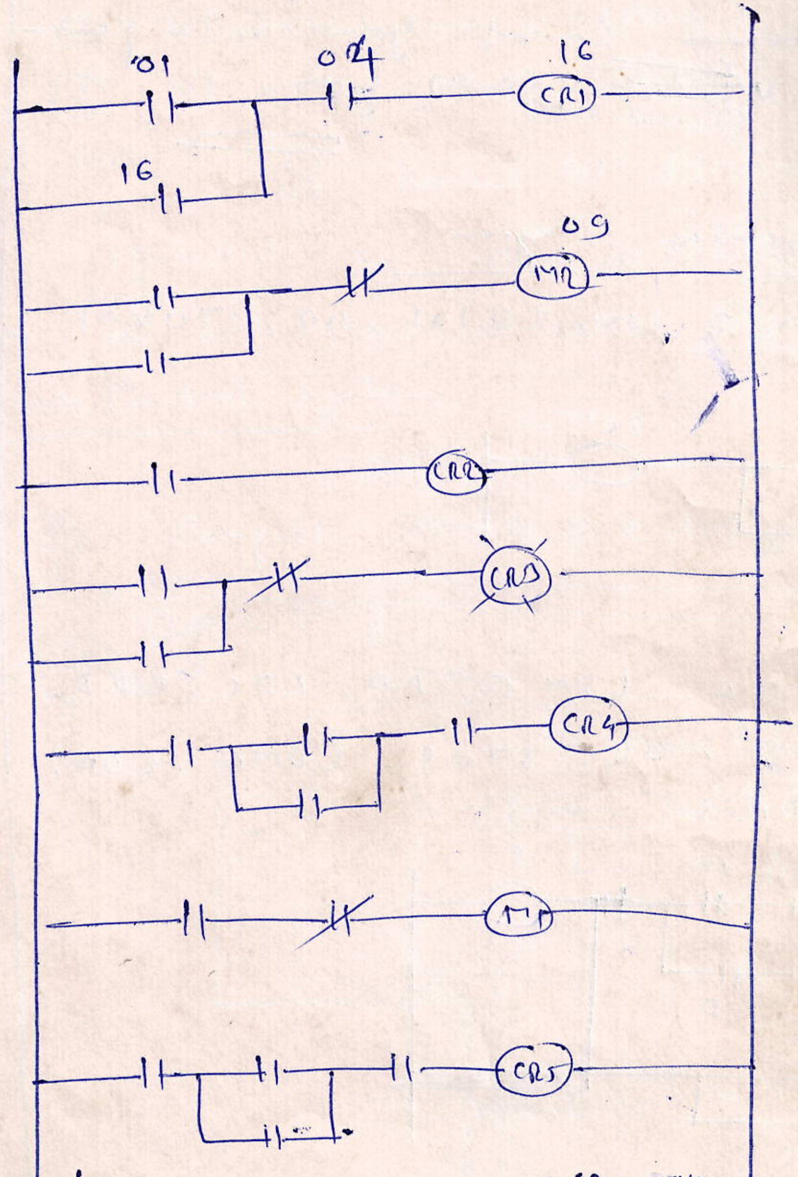


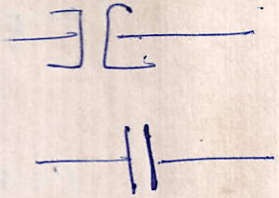
24 When, Start & stop both are NO

Physical ladder Diagram.



Program ladder Diagram





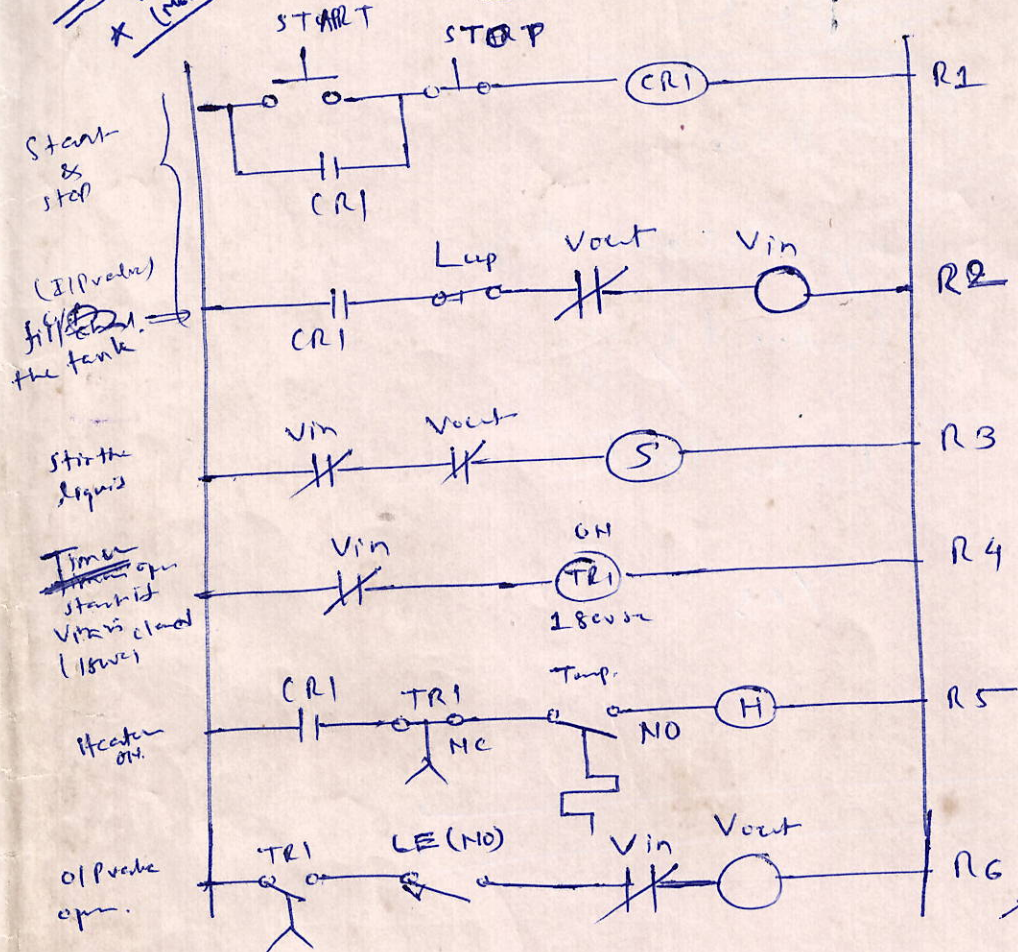
Ict		
(PB1) Start - 01	M1 - 08	CR1 - 16
(PB2) Stop - 02	M2 - 09	CR2 - 17
LS1 - 03		CR3 - 18
LS2 - 04		CR4 - 19
PB3 - 05		CR5 - 20
PB4 - 06		~~CRC - 21~~

26

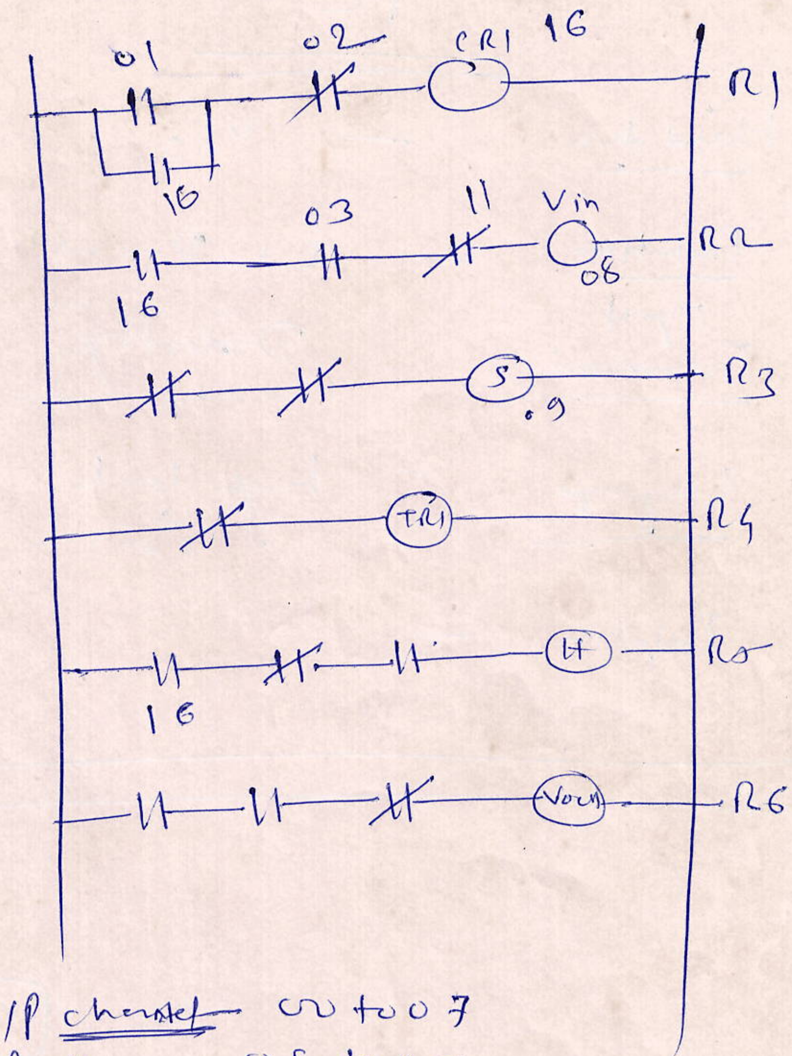
Ex. 8.4 / Figs. 8.22 (modified)

Physical Ladder Diagram "Discrete State" Control — Program Ladder Diagram

Start → NO, Stop – NC



Temp: 20°C



01 Start – I/P chanl

02 Stop – I/P chanl,

03 Vin – I/P chanel

switch 04 LE & 05 Lup – I/P chanell

Temp [illegible] 06 – I/P chanl.

TR1 – timer – 32

08 Vout – O/P chanl,

09 Stir – O/P chanl,

10 CR1 – O/P Relay

11 H – O/P chanl;

CR1 – I/P [illegible] 16

I/P chanel 00 to 07

O/P ch. – 08 to 15

I/P relay – 16 to 31

timer – 32 to 37

Also solve Another ex. Ex. 8.7 / Fig. 8.24

PLC

	PC	PLC
① Hard disk	Yes	No
② Instruction	LLD ...	Logical class day
③ Signal Transmission	Directly	Indirectly
④ Language	High level + Coder	Low level
⑤ Isolation		Yes

Isolation!
optoiso...