

Tarea #5: Microprocesadores, II-2024
Roger Daniel Piovet Gorcón CIS990

Memoria de cálculo (Output compare)

Para un periodo de interrupción $f_{oc} = 50\text{Hz}$, el periodo T_{oc} viene dado por:

$$T_{oc} = \frac{1}{f_{oc}} = 20\mu\text{s} \quad (1)$$

Para la Dragon 12+2 con el Debug 12, se cumple:

$$\text{SysClk} = 48\text{MHz}$$

$$\text{BusClk} = \frac{\text{SysClk}}{2}$$

$$\Rightarrow \text{BusClk} = 24\text{MHz} \quad (2)$$

T_{oc} viene dado por:

$$T_{oc} = \frac{\text{PRS} \cdot T_{cN}}{\text{BusClk}} \quad (3)$$

Donde $N=4$, ya que se utilizará el canal 4 del Módulo Timer al operar como comparador de salida. Asumiendo un divisor $\text{PRS}=1$, el valor de carga T_{c4} para lograr la frecuencia de interrupción f_{oc} viene dada por:

$$T_{c4} = \frac{T_{oc} \cdot \text{BusClk}}{\text{PRS}} \quad (4)$$

$$\Rightarrow T_{c4} = T_{oc} \cdot \text{BusClk} \quad (4)$$

(1) y (2) en (4)

$$T_{C4} = (20 \text{ ms}) \cdot (24 \text{ MHz}) \\ \Rightarrow T_{C4} = 480$$

Estructuras de datos

- * MAX_TCL: Variable tipo byte
- * Tecla: Variable tipo byte
- * Tecla: Variable tipo byte
- * Tecla_IN: Variable tipo byte
- * Cont_TCL: Variable tipo byte
- * Patron: Variable tipo byte
- * Est_Pres_TCL: Variable tipo word
- * Mem_Array: Arreglo que almacena variables tipo byte
- * EstPres_PantallaMUX: Variable tipo word
- * Dsp1: Variable tipo byte
- * Dsp2: Variable tipo byte
- * Dsp3: Variable tipo byte
- * Dsp4: Variable tipo byte
- * LEDS: Variable tipo byte
- * Cont_Dig: Variable tipo byte
- * Brillo: Variable tipo byte
- * BIN1: Variable tipo byte
- * BIN2: Variable tipo byte
- * BCD: Variable tipo byte

- * BCD1: Variable tipo byte
- * BCD2: Variable tipo byte
- * IniDsp: Tabla que almacena constantes tipo byte
- * Punt_LCD: Variable tipo word
- * CharLCD: Variable tipo byte
- * Msg_L1: Variable tipo word
- * Msg_L2: Variable tipo word
- * EstPres_SendLCD: Variable tipo word
- * EstPres_TareaLCD: Variable tipo word
- * EstPres_LeerPB1: Variable tipo word
- * Est_Pres_TCM: Variable tipo word
- * Minutos_TCM: Variable tipo byte
- * Banderas_1: Variable bandera tipo byte
 - bit 0: ShortP0
 - bit 1: LongP0
 - bit 2: ShortP1
 - bit 3: LongP1
 - bit 4: Array_OK

* Banderas-2: Variable
bandera tipo byte

- bit0: RS

- bit1: LCD-OK

- bit2: Fin Send LCD

- bit3: Second-Line

* Est_Pres_LDTst: Variable tipo
word

* Segment: Tabla que almacena
constantes tipo byte

* Teclas: Tabla que almacena
constantes tipo byte

* MSG1:

"_INB.-ELECTRICA - "EOB | -Fin-Base1ms = \$FF

* MSG2:

"_---UCR-2024---"EOB | * Tabla-Timers-Base10ms:

* MSG3:

"_PROCESADORES - "EOB | Tabla que almacena variables
tipo byte.

* MSG4:

"_---IE0623---"EOB | -Fin-Base10ms = \$FF

* Tabla-Timers-BaseT:

Tabla que almacena variables
tipo word

- Counter-Ticks

- Timer 260us

- Timer 40us

- Timer 1ms

- Timer 10ms

- Timer 100ms

- Timer 1s

- Fin-BaseT = \$FFFF

| Constante tipo word

* Tabla-Timers-Base1ms:

Tabla que almacena variables
tipo byte.

- Timer-Dígito

- Timer-Reb-PB0

- Timer-Reb-PB1

- Timer-Reb-TCL

- Timer 2ms

| Constante tipo byte

* Tabla-Timers-Base10ms:

Tabla que almacena variables

tipo byte.

- Timer-SHPO

- Timer-SHP1

- Fin-Base10ms = \$FF

| Constante tipo byte

* Tabla-Timers-Base100ms:

Tabla que almacena variables

tipo byte.

- Timer-LED-Testigo

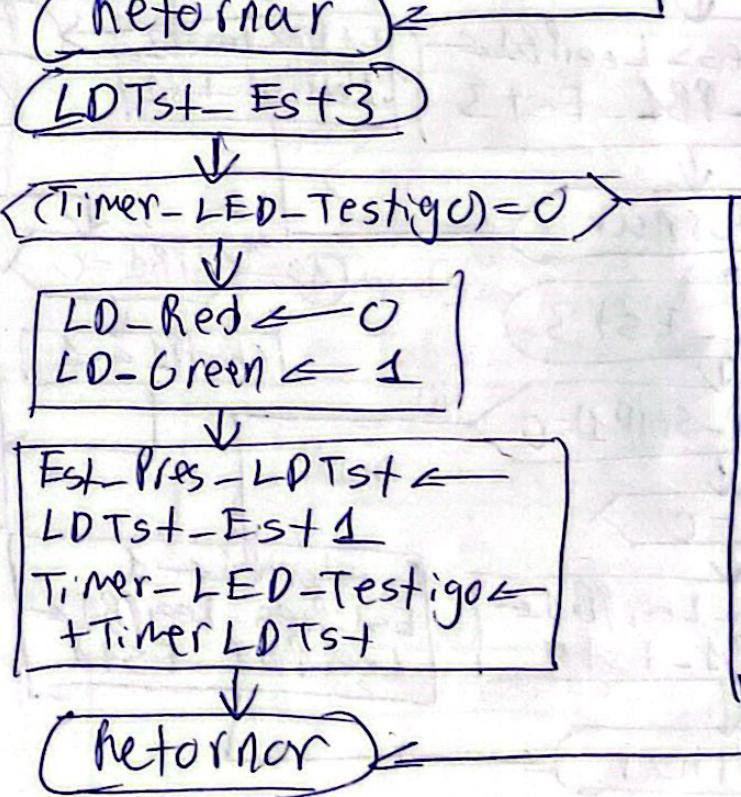
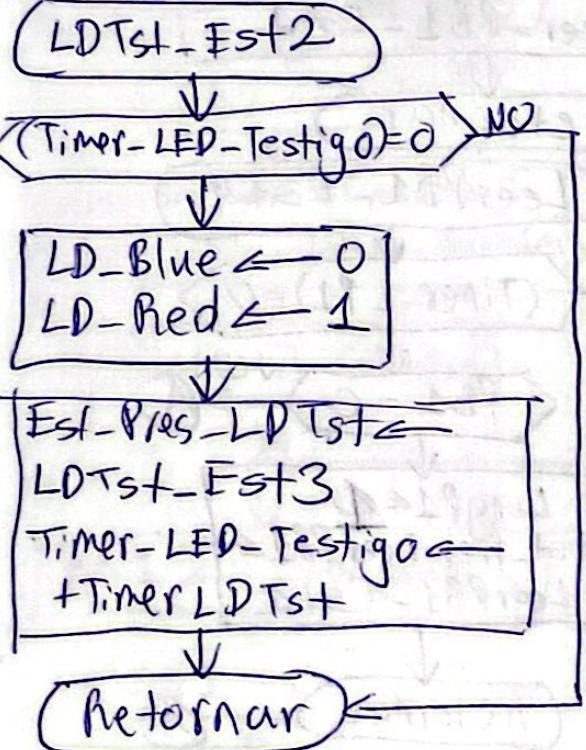
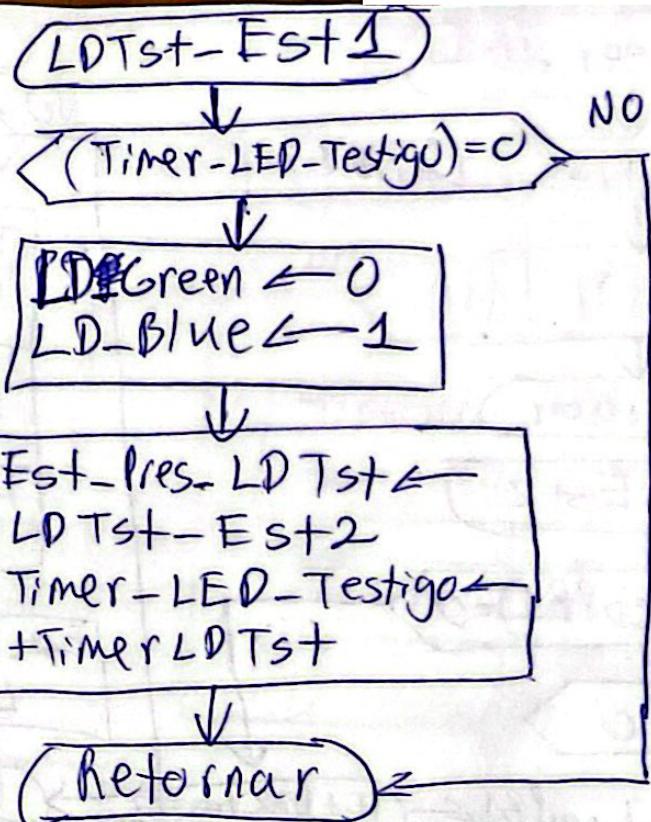
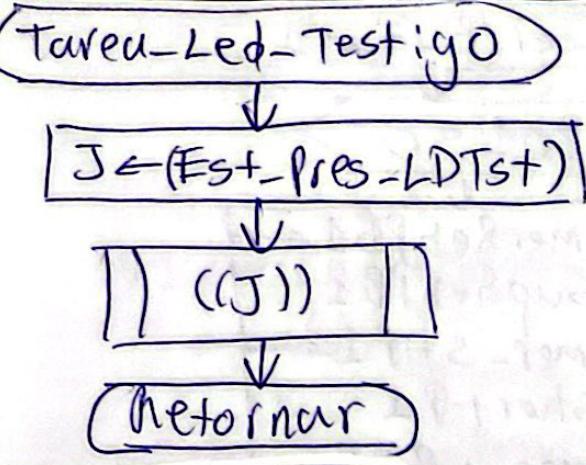
- Fin-Base100ms = \$FF

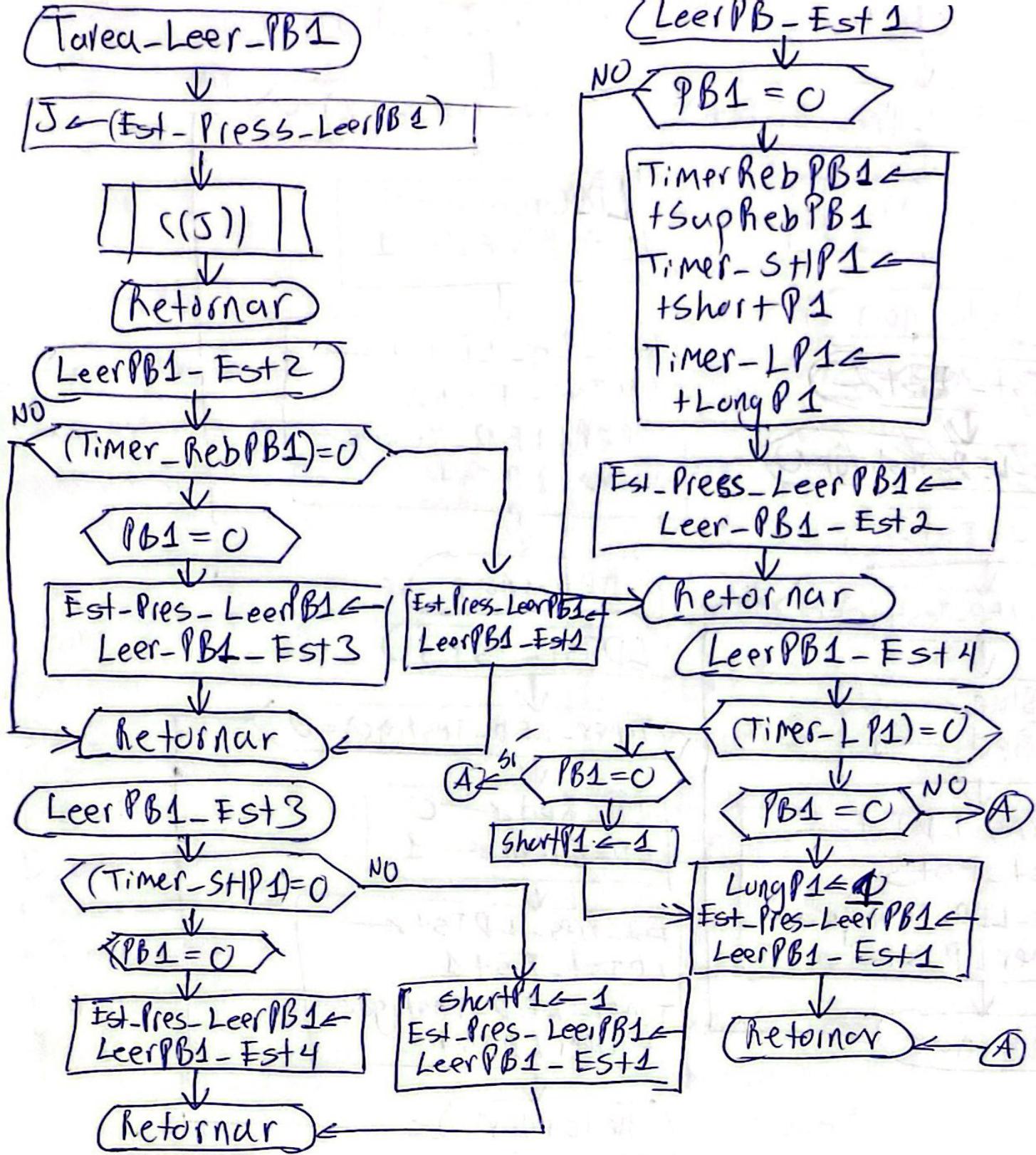
* Tabla-Timers-Base 1S
variables
- tipo byte.
- TIMER - LPO
- TIMER - LP1
- Segundos TCM
- Fin-Base 1S = \$FF
L constante tipo byte

Valores: (Valor de carga /
Valor por defecto)

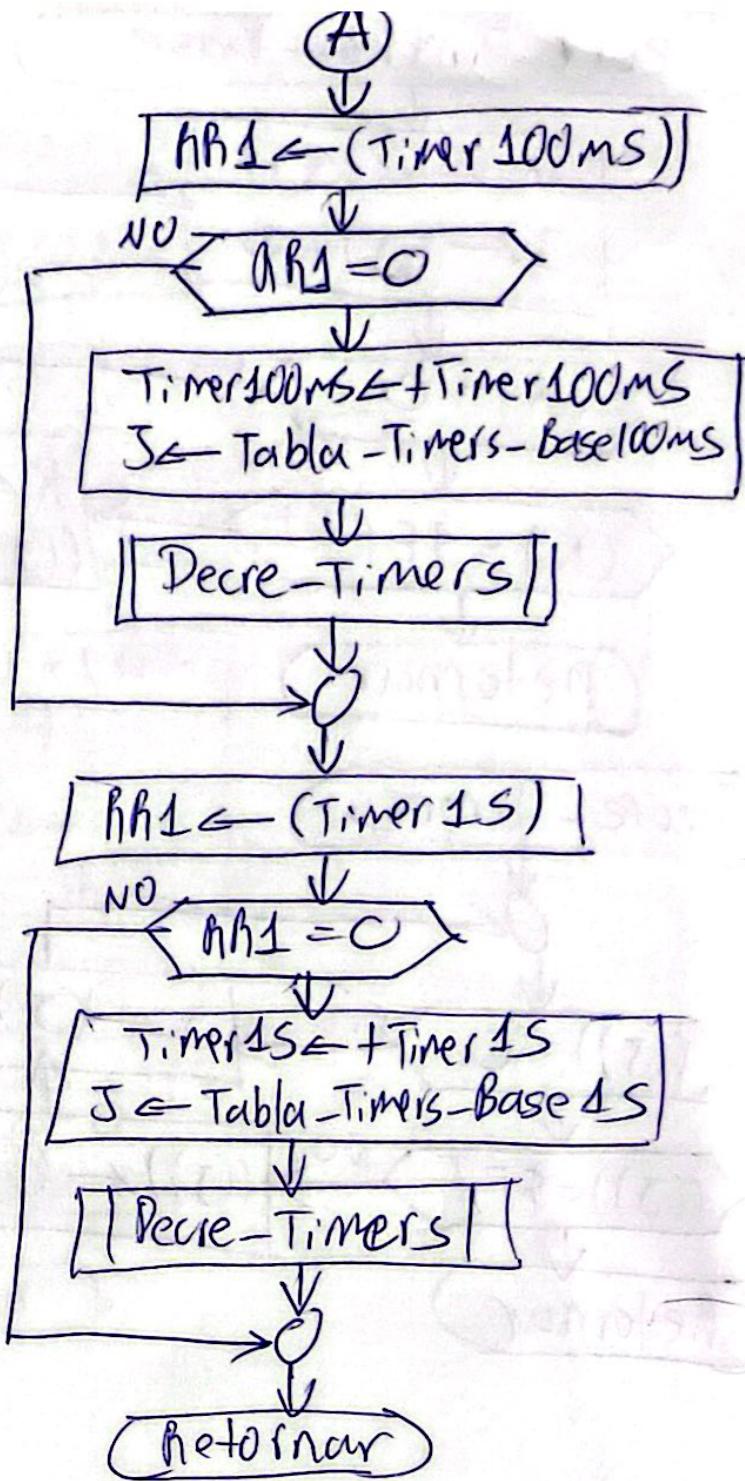
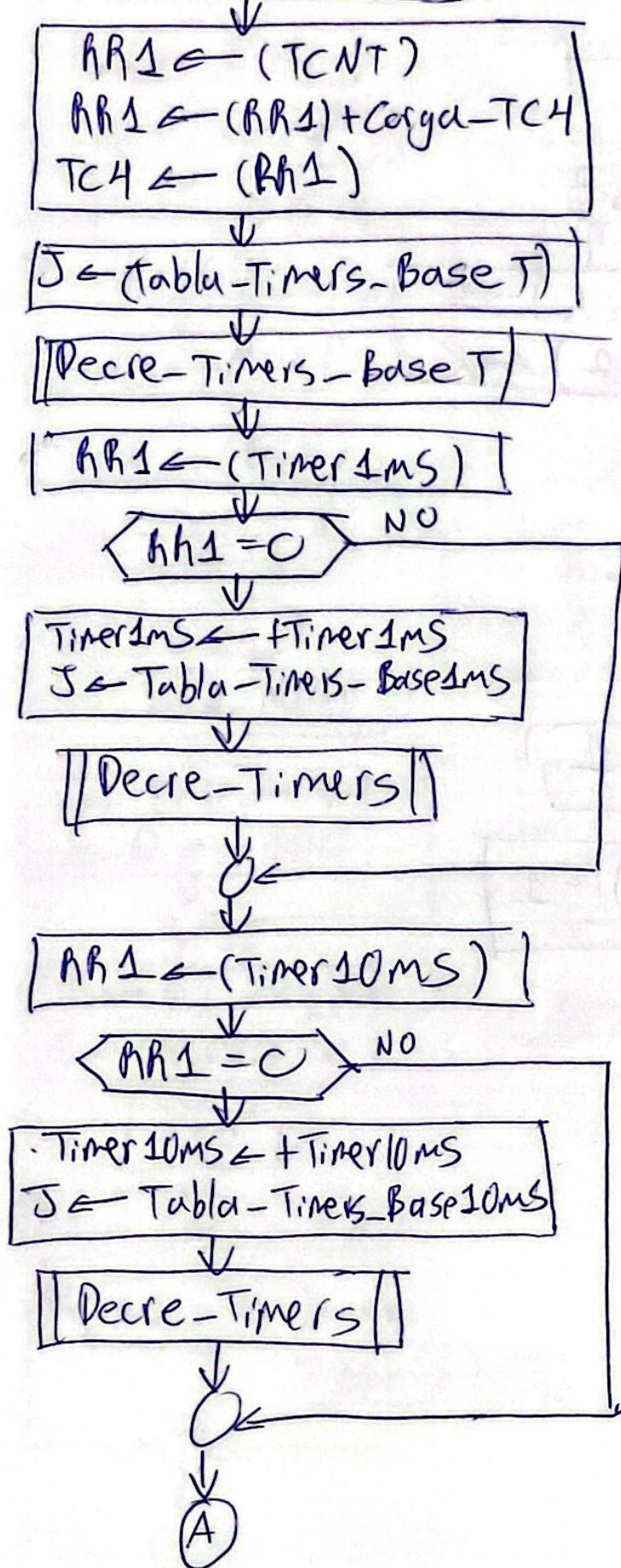
+SupRebTCL: 50
+TimerDigito: 2
MaxCountTicks: 100
DIG1: \$01
DIG2: \$02
DIG3: \$04
DIG4: \$08
+Timer12ms: 2
+Timer200us: 13
+Timer400us: 2
EOB: \$FF
Clear-LCD: \$01
ADD-L1: \$80
ADD-L2: \$C0
+SupRebPB0: 50
+SupRebPB1: 50
+ShortP0: 10
+ShortP1: 10
+LongP0: 1
+LongP1: 1

| PortPB: PTIH
| +Minutos TCM: 1
| +Segundos TCM: 15
| ShortP0: \$01
| LongP0: \$02
| ShortP1: \$04
| LongP1: \$08
| Array-OK: \$10
| RS: \$01
| LCD-OK: \$02
| F1AndLCD: \$04
| Second-Line: \$08
| +TimerLDTst: 5
| LD-Red: \$10
| LD-Green: \$20
| LD-Blue: \$40
| Carga-TC4: 430
| InicioLD: \$55
| TemporalLD: \$AA
| +Timer1ms: 50
| +Timer10ms: 500
| +Timer100ms: 5000
| +Timer1s: 50000
A continuación se muestran
los diagramas de flujo
asociados a la Tarea #5,
y no se incluyen los diagramas
de flujo de la Tarea #4.

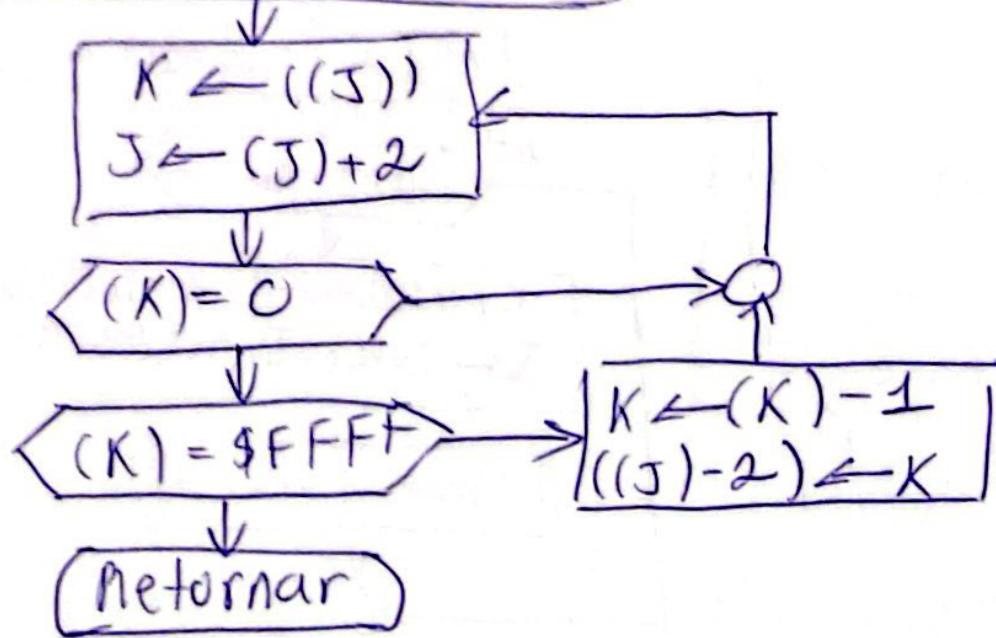




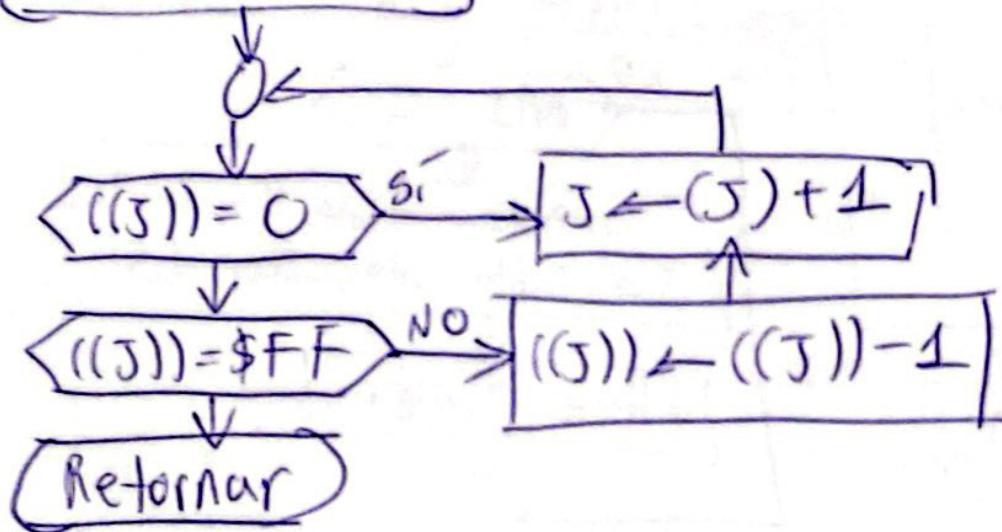
Maquina - Tiempos



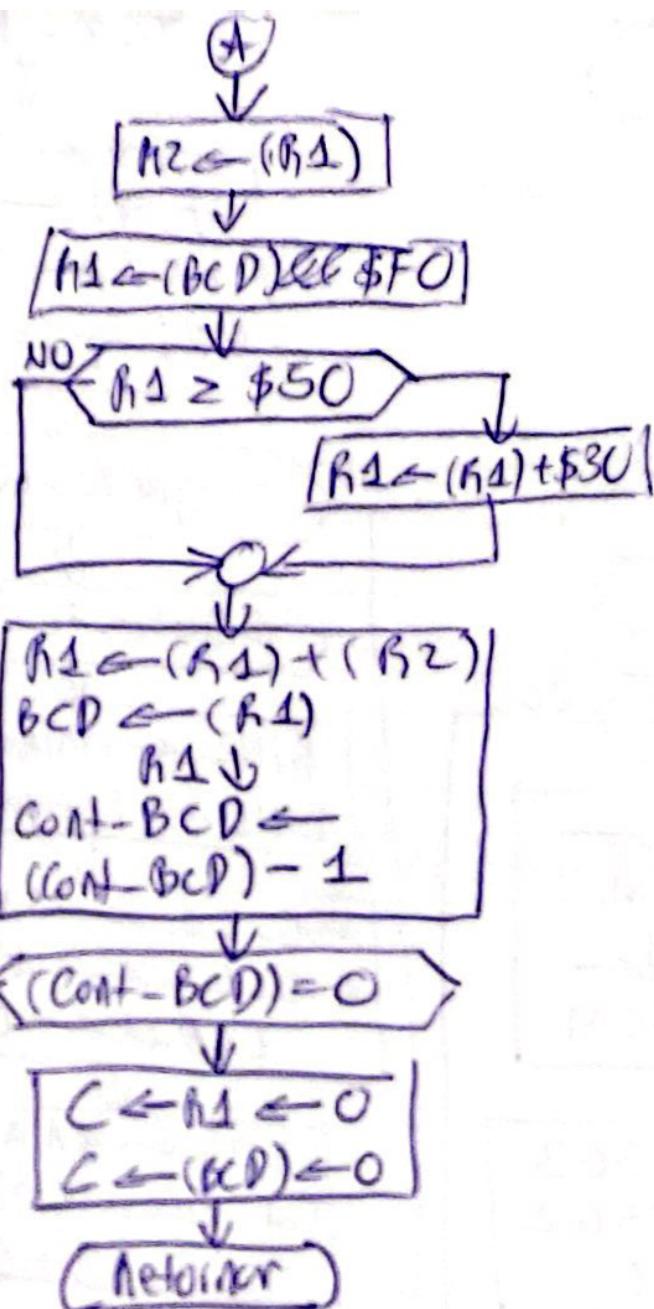
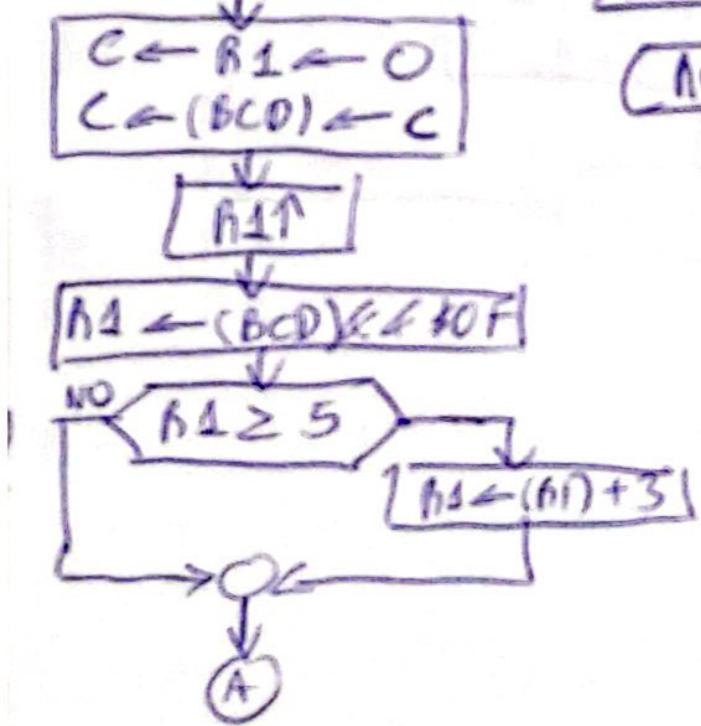
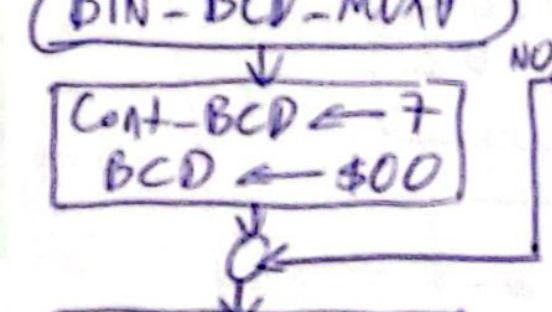
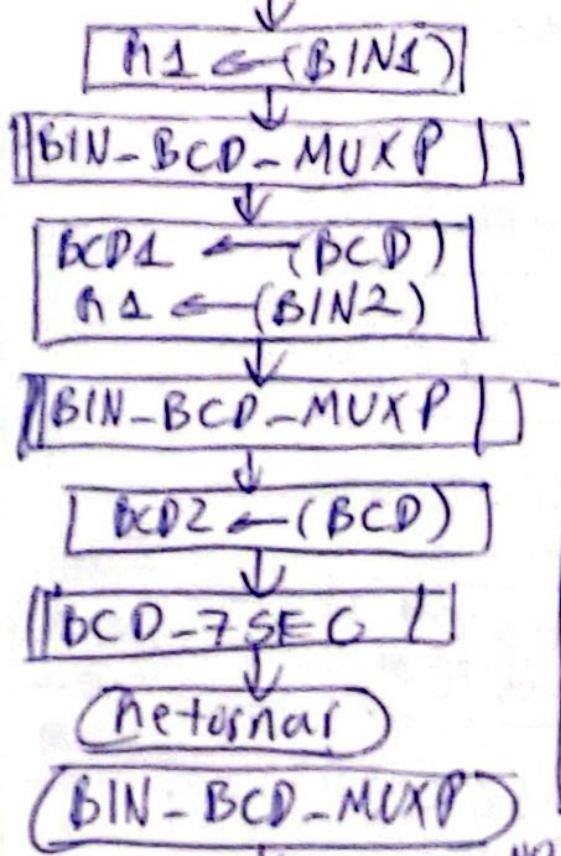
Decre-Timers - Base T



Decre-Timers



Tarea - Conversión



Tarea-TCM



J ← Est-Pres-TCM



((J))



Retornar

TCM-Est+1



ShortP1 = 0 NO

Minutos TCM ←
+ Minutos TCM
Segundos TCM ←
+ Segundos TCM

MSG-L1 ← MSG3

MSG-L2 ← MSG2

LCD-OK ← 0

Est-Pres-TCM ←
TCM-Est+2

Retornar

(TCM-Est+2)



LEDs ← \$55

ShortP1 ← 0

BIN2 ← (Minutos TCM)

BIN1 ← (Segundos TCM)

NO

(Segundos TCM) = 0

↓

Minutos TCM = 0 NO

BIN2 ← + Minutos TCM

BIN1 ← + Segundos TCM

MSG-L1 ← MSG1

MSG-L2 ← MSG2

LCD-OK ← 0

Minutos TCM ←

(Minutos TCM) - 1

Segundos TCM ←

4 × + Segundos TCM

LEDs ← \$AA

Est-Pres-TCM ←

TCM-Est+1

↓

Retornar

BCD-7SEG



$J \leftarrow \text{Segment}$



$R1 \leftarrow (\text{BCD}2)$

$R1 \leftarrow (R1) \cdot \FO

$O \rightarrow R1 \rightarrow C$



$PSP1 \leftarrow ((J) + (R1))$



$R1 \leftarrow (\text{BCD}2)$

$R1 \leftarrow (R1) \cdot \OF



$DSP2 \leftarrow ((J) + (R1))$



$R1 \leftarrow (\text{BCD}1)$

$R1 \leftarrow (R1) \cdot \FO

$O \rightarrow R1 \rightarrow C$



$PSP3 \leftarrow ((J) + (R1))$



$R1 \leftarrow (\text{BCD}1)$

$R1 \leftarrow (R1) \cdot \OF



$DSP4 \leftarrow ((J) + (R1))$

(Retornar)

Taren-Pantalla Mux

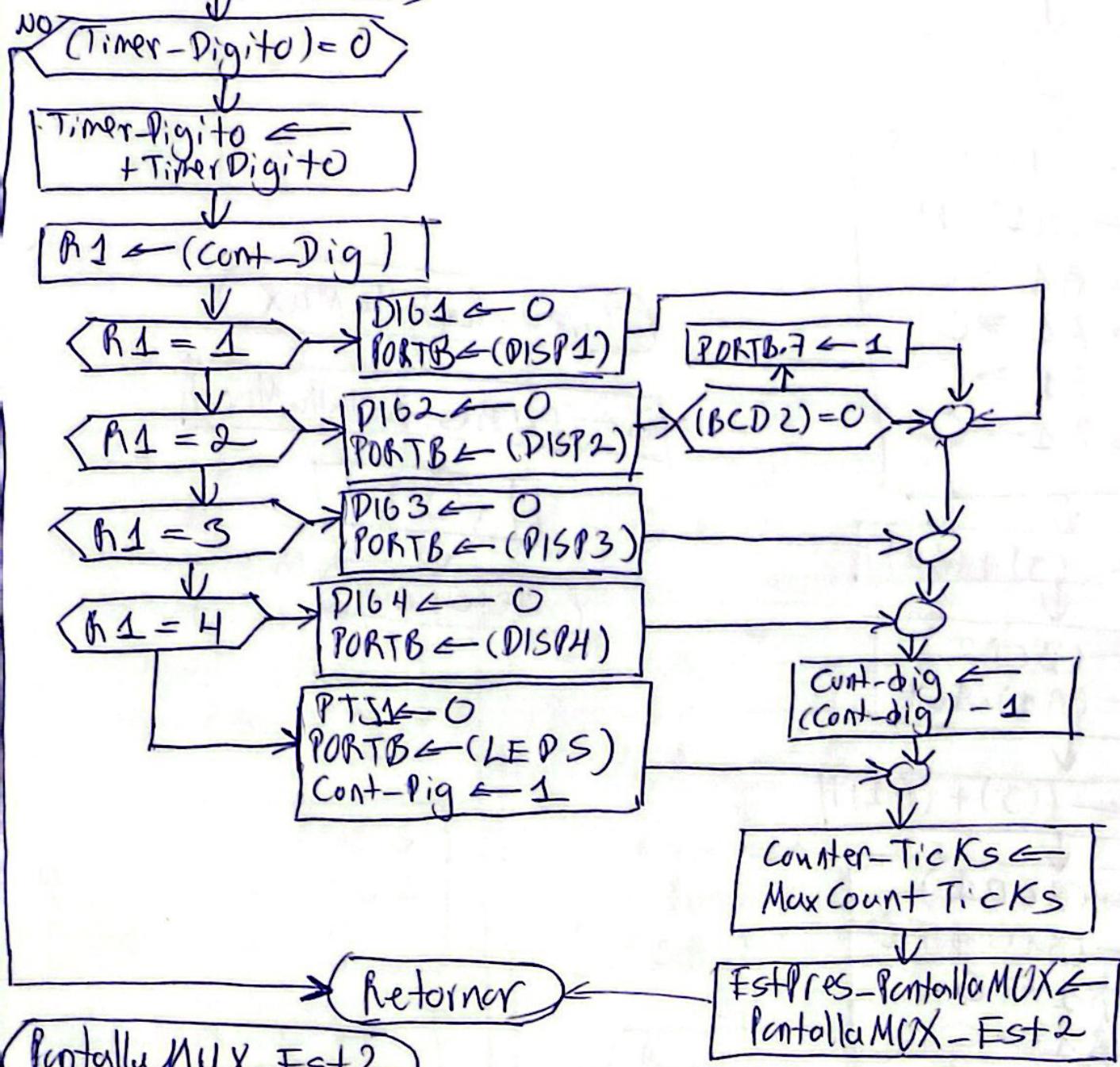


$J \leftarrow (\text{Est Pres - Pantalla Mux})$

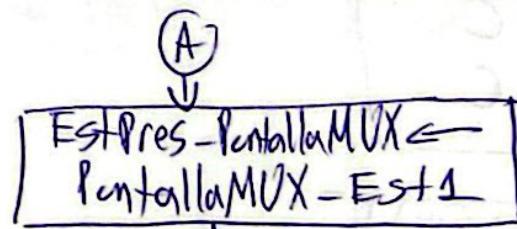
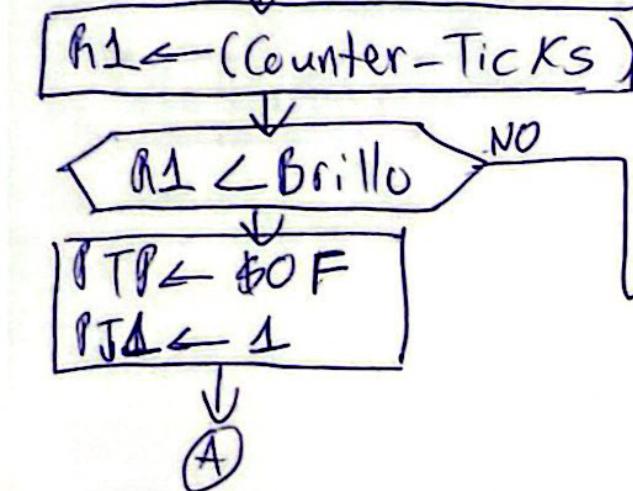
$\boxed{((J))}$

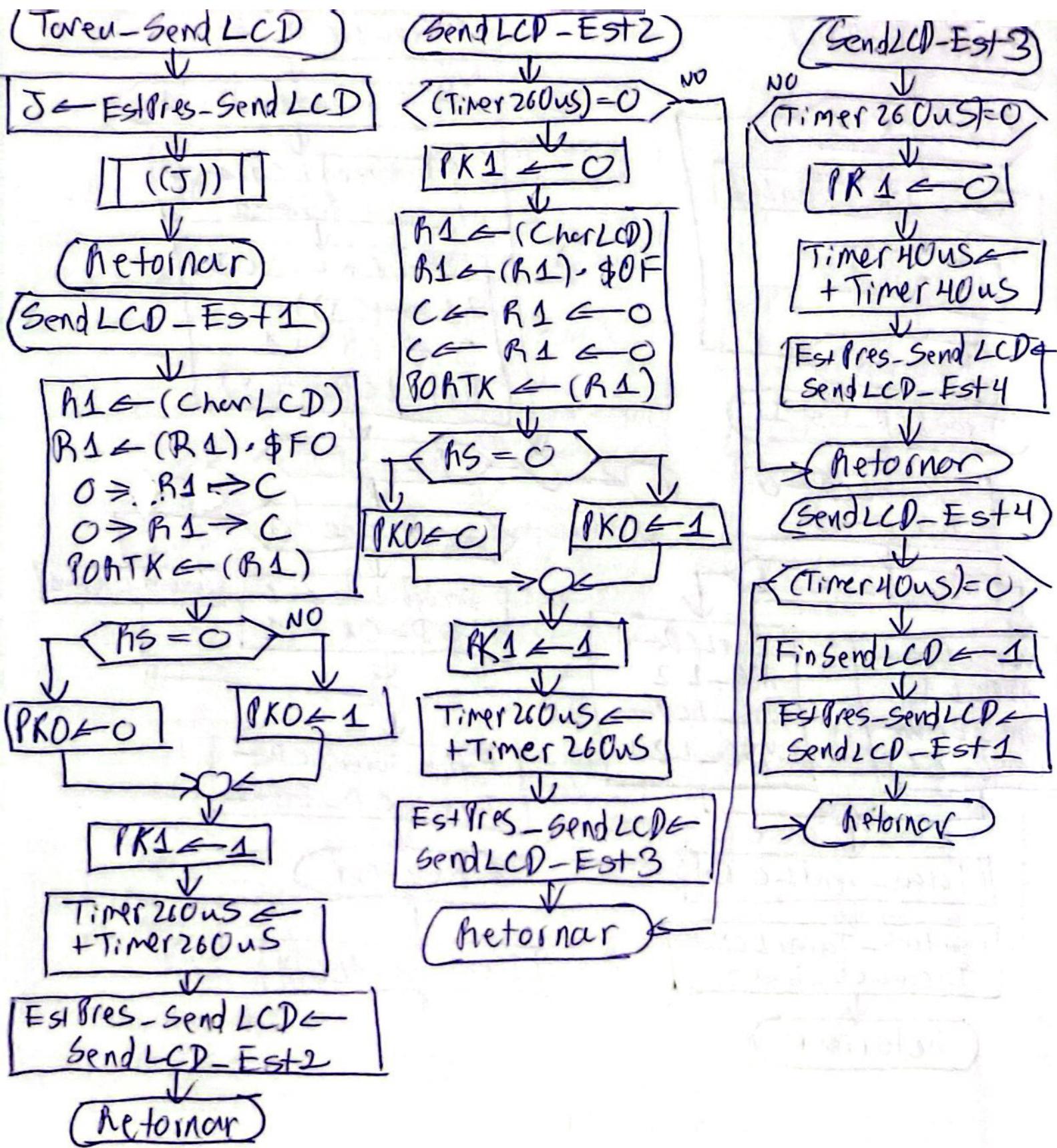
(Retornar)

Pantalla MUX - Est 1



Pantalla MUX - Est 2





Tarea-LCD



LCD-OK = 1

Si

J ← EstPres-TareaLCD



((J))

Retornar

TareaLCD-Est1



FinSendLCD = 0
RS ← 0



Second-Line = 1

CharLCD ← ADD-L1
Punt-LCD ← (MSG-L1)

CharLCD ← ADD-L2
Punt-LCD ← (MSG-L2)



Tarea-SendLCD



EstPres-TareaLCD ←
TareaLCD-Est2



Retornar

TareaLCD-Est2

No

FinSendLCD = 1

FinSendLCD ← 0

RS ← 1

J ← (Punt-LCD)

R1 ← ((J))

J ← (J) + 1

Punt-LCD ← (J)

Si

R1 = \$FF

Second-Line = 0

Second-Line ← 0
LCD-OK ← 1

Si

Si

EstPres-TareaLCD ←
TareaLCD-Est1

Retornar

Tarea-SendLCD

A

MAIN

↓

```

DDRPA ← $7F
PTP ← $0F
DDRB ← $FF
DDRJ ← $02
PTJ ← $02
DDRA ← $FO
POCH ← $01

```

↓

```

TC4 ←
Carga-TC4
TSCR1 ← $90
TSCR2 ← $07
TIOS ← $10
TIE ← $10

```

↓

```

EstPres-LDTst ←
LDTst-Est1
Timer-LEP-Testigo
← $00

```

↓

```

EstPres-LeerPB0 ←
LeerPB0-Est1
TIMER-SHP0 ← $00
TIMER-L90 ← $00
Timer-deb-PB0 ← $00

```

A

A

```

EstPres-LeerPB0 ←
LeerPB0-Est1
TIMER-SHP1 ← $00
Timer-LP1 ← $00
Timer-deb-PB1 ← $00

```

↓

```

Est_Pres-TCM ←
TCM-Est1
SegundosTCM ← $00
MinutosTCM ← $00

```

```

EstPres-PantallaMUX ←
PantallaMUX-Est1
Timer-Digito ← $00
Counter-Ticks ← $00
Cont-Dig ← 1
Brillo ← 90
LEDS ← InicioLD
BIN2 ← +MinutosTCM
BIN1 ← +SegundosTCM

```

B

```

Banderas-1 ← $00
Banderas-2 ← $00

```

```

Timer1ms ← +Timer1ms
Timer100ms ← +Timer100ms
Timer1s ← +Timer1s
Timer10ns ← +Timer10ns

```

B

B

```

RH1 ← (TCNT)
RH1 ← (RH1) +
Carga-TC4
TC4 ← (RH1)

```

```

SP ← $3BFF
I ← O

```

Init-LCD

O

Tarea-Led-Testigo

Tarea-Leer-PB1

Tarea-TCM I

Tarea-Conversion

Tarea-PantallaMUX

Tarea-LCD II

