```
; BCD counter © Valerio Cocco

    device 16f84

; \***************** labels **********************\

; status regsiter
status equ 3 ; adress of the status register
rp0 equ 5 ; bank select
carry equ 0 ; carry flag - Indicates when an arithmetic carry or borrow has been generated out of the
↪  most significant ALU bit position.
zero equ 2 ; zero flag - Indicates that the result of an operation was zero.

; port a
porta equ 5
clock equ 0 ; clock signal in RA0
reset equ 1 ; reset in RA1
inhibit equ 2 ; inhibit in RA2
carryOut equ 3 ; carry out RA3
maske equ 1 ; 00000001 ; mask for the clock signal on RA0

portb equ 6
; TRIS (TRIState regsiter) Used to define the direction (in/out) of port or pin.
trisa equ 5 ; for port a
trisb equ 6 ; for port b

bcdOverfVal0 equ 10 ; 0000 1010
bcdOverfVal1 equ 0A0h ; 1010 0000
bcdMask equ 0Fh ; 0000 1111, mask for the first bcd digit

; variables
counter equ 10h ; 0c first aviable adress
currentValue equ 12h
oldValue equ 13h
edge equ 14h

; \***************** labels **********************\

    org  0 ; program start at adress 0

cold
    ; initialize ports
    bsf status,rp0 ; select bank 1
    bcf trisa,carryOut ; set carry on port a to out
    clrf trisb ; set port all to out

    bcf status,rp0 ; select bank 0

    ; read first value
    movf porta,w ; read port a in w
    andlw maske ; mask clock signal
    movwf oldValue ; write w regsiter to oldValue: first comparison value

resetCNT
    clrf counter ; init
    bcf porta,carryOut ; reset carry

    clrf portb
    bcf porta,carryOut ; output carry 0

mainloop
    ; output BCD
    movf counter,w
    movwf portb

    btfsc porta,reset ; reset in = 1?
```

```
    goto resetCNT ; yes ⟶ reset

    btfsc porta,inhibit ; inhibit = 1?
    goto mainloop ; yes ⟶ pause

    call checkEdge ; edge? no ⟶ w = 0,
    xorlw 2 ; w = 2 (rising redge)? set zero flag if w = 2
    btfss status,zero ; w = 2?
    goto mainloop ; no

    bcf porta,carryOut ; output carry 0

    ; increment BCD
    incf counter ; first digit
    movf counter,w
    andlw bcdMask ; mask first digit
    xorlw bcdOverfVal0 ; overlfow on first digit?
    btfss status,zero
    goto mainloop ; no
    ; yes
    movf counter,w
    xorlw bcdOverfVal0 ; set first nibble to 0
    addlw 10h ; increment second nibble
    movwf counter

    xorlw bcdOverfVal1 ; overflow on second digit?
    btfss status,zero
    goto mainloop; no
    ; yes
    clrf counter
    bsf porta,carryOut

    goto mainloop

checkEdge
    ; read current value
    movf porta,w
    andlw maske ; mask clock signal on RA0
    movwf currentValue
    xorwf oldValue,w ; compare with oldValue
    movwf edge

    ; oldValue := currentValue
    movf currentValue,w
    movwf oldValue

    ; edge = 0 if currentValue = oldValue
    movf edge ; set zero-flag if edge = 0
    btfsc status,zero ; edge 0?
    retlw 0 ; no ⟶ no new edge

    movf currentValue ; set zero-flag if currentValue = 0
    btfss status,zero ; currentValue = 0? or zero = 1?
    retlw 2 ; no ⟶ rising edge
    retlw 1 ; yes ⟶ falling edge
```

```
; BCD to seven segment display © Valerio Cocco

    device 16f84

; \***************** labels **********************\
pcl equ 2 ; program counter

status equ 3 ; status register
rp0 equ 5 ; bank select
```

```
carry equ 0 ; carry flag - Indicates when an arithmetic carry or borrow has been generated out of the most significant ALU bit position.
zero equ 2 ; zero flag - Indicates that the result of an operation was zero.

; input: port A input
porta equ 5
trisa equ 5
ra6 equ 6
bcdmask equ 0Fh ; 00001111

; output: port B
portb equ 6
trisb equ 6

; variables
bcdin equ 10h
; \***************** labels **********************\

    org 0

cold
    ; init
    bsf status,rp0 ; select bank 1
    clrf trisb ; set port b to output, RB0 is LSB
    bcf trisa,ra6 ; set RA6 to output: digit 0 select
    bcf status,rp0 ; select bank 0

    bsf porta,ra6

mainloop
    movf porta,w
    andlw bcdmask
    movwf bcdin
    call bcdToSsd
    movwf portb
    bcf porta,ra6 ; output portb to digit 0
    bsf porta,ra6 ; lock output from protb to digit
    goto mainloop

bcdToSsd ; Sevent Segtment Display
    movf bcdin,w

    addwf pcl ; unsave: undefined behavior if bcdin > 9
    retlw 3Fh ; 0
    retlw 06h ; 1
    retlw 5Bh ; 2
    retlw 4Fh ; 3
    retlw 66h ; 4
    retlw 6Dh ; 5
    retlw 7Dh ; 6
    retlw 07h ; 7
    retlw 7Fh ; 8
    retlw 6Fh ; 9
    ; retlw 0 ; A
    ; retlw 0 ; B
    ; ...
```

```
; frequency divider © Valerio Cocco

    device 16f84

; \***************** labels **********************\
status equ 3 ; status register
rp0 equ 5 ; bank select
```

```
carry equ 0 ; carry flag - Indicates when an arithmetic carry or borrow has been generated out of the
↪  most significant ALU bit position.
zero equ 2 ; zero flag - Indicates that the result of an operation was zero.

porta equ 5
output equ 1 ; out an ra1
trisa equ 5

currentValue equ 10h
oldValue equ 11h
edge equ 12h

mask equ 00000001b
; \***************** labels **********************\

cold
    bsf status,rp0 ; select bank 1
    bcf trisa,output
    bcf status,rp0 ; select bank 0

    ; read initial value
    movf porta,w
    andlw mask
    movwf oldValue

mainloop
    call checkEdge
    xorlw 2 ; rising edge?
    btfss status,zero
    goto mainloop ; no
    ; yes
    movlw 10b
    xorwf porta
    goto mainloop

checkEdge
    movf porta,w
    andlw mask
    movwf currentValue
    xorwf oldValue,w
    movwf edge

    ; oldValue := currentValue
    movf currentValue,w
    movwf oldValue

    ; edge = 0 if currentValue = oldValue
    movf edge ; set zero-flag if edge = 0
    btfsc status,zero ; edge 0?
    retlw 0 ; no ⟶ no new edge

    movf currentValue ; set zero-flag if currentValue = 0
    btfss status,zero ; currentValue = 0? / zero = 1?
    retlw 2 ; no ⟶ rising edge
    retlw 1 ; ja ⟶ falling edge
```