```
;>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
;1DT301, Computer Technology I
;Date: 2019-09-17
;
;Author:
;   Student name 1:         Einar van de Velde
;   Student name 2:         Abdulla Mehdi
;
;Lab number:                1.
;Title:                     Task 6.
;
;Hardware:                  STK600, CPU ATmega2560.
;
;Function:                  Creates a Johnson Counter in an infinite loop.
;
;Input ports:               None.
;
;Output ports:              On-board LEDs connected to PORTB.
;
;Subroutines:               None.
;
;Included files:            m2560def.inc
;
;Other information:
;Changes in program:
;       File Created (2019-09-16)
;               Program is runnable (2019-09-17)
;
;<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
.include "m2560def.inc"

; Initialize SP, Stack Pointer (Stack pointer is NOT used)
ldi r20, HIGH(RAMEND)           ; R20 = high part of RAMEND address
out SPH,R20                     ; SPH = high part of RAMEND address
ldi R20, low(RAMEND)            ; R20 = low part of RAMEND address
out SPL,R20                     ; SPL = low part of RAMEND address

;----------------------------;
;                            ;
;----------------------------;
ldi r16, 0xFF                   ;Loads 255 at register 16
out DDRB, r16                   ;Initialize port B

ldi r21, 0b11111110             ;Turn the first LED0 on.
ldi r22, 0xFF                   ;All LEDs off.
ldi r23, 0x00                   ;All LEDs on.

;----------------------------;
;MAIN                        ;
```

```
;----------------------------;
MAIN:
   out PORTB, r21                ;Use Register 21 on Port B

   lsl r21                       ;Shift r21's LEDs to the Left
   call DELAY                    ;Call DELAY

   cp r21, r23                   ;Compare register 21 with 23
   breq SHIFT_LEFT               ;If 21 = 23 go to "SHIFT_LEFT" branch.

rjmp MAIN

;----------------------------;
; SHIFT_LEFT               ;
;----------------------------;
   SHIFT_LEFT:
      out PORTB, r23             ;Use Register 23 on Port B
      call DELAY                 ;Call DELAY
      ldi r21, 0b10000000

      ;--------------------;
      ; SHIFT_RIGHT       ;
      ;--------------------;
      SHIFT_RIGHT:
         out PORTB, r21
         asr r21                 ;Swap direction (Arithmetic Shift Right)
         call DELAY              ;Call DELAY

         cp r21, r22             ;Compare r21 = r22
         breq MAIN               ;if 21 = 23 go to "MAIN" Branch

      rjmp SHIFT_RIGHT
      ;--------------------;

   rjmp SHIFT_LEFT

;----------------------------;
;DELAY                     ;
;----------------------------;
   DELAY:
   ; Generated by delay loop calculator
   ; at http://www.bretmulvey.com/avrdelay.html
   ;
   ; Delay 500 000 cycles
   ; 500ms at 1 MHz

      ldi  r18, 4
      ldi  r19, 138
      ldi  r20, 86
```

```
    L1: dec  r20
        brne L1
        dec  r19
        brne L1
        dec  r18
        brne L1
         rjmp PC+1
    ret
;-----------------------------
```