8. Complete Program Examples

A. Blink LED

```
#define __SFR_OFFSET 0x00
#include "avr/io.h"

.global main

main:
    SBI DDRB, 5          ; Set PB5 (Pin 13) as Output

loop:
    SBI PORTB, 5         ; Turn on LED (Output HIGH)
    RCALL delay          ; Call delay subroutine
    CBI PORTB, 5         ; Turn off LED (Output LOW)
    RCALL delay          ; Call delay subroutine
    RJMP loop            ; Repeat continuously

delay:
    LDI R18, 82          ; Outer loop counter
outer:
    LDI R24, lo8(60000)  ; Inner loop counter (low byte)
    LDI R25, hi8(60000)  ; Inner loop counter (high byte)
inner:
    SBIW R24, 1          ; Subtract word (R25:R24)
    BRNE inner           ; Loop if not 0
    DEC R18              ; Subtract outer counter
    BRNE outer           ; Loop outer if not 0
    RET                  ; Return to caller
```

B. Reading Button and Controlling LED

```
#define __SFR_OFFSET 0x00
#include "avr/io.h"
```

```
.global main

main:
    ; Setup
    SBI DDRB, 5          ; PB5 (Pin 13) as Output (LED)
    CBI DDRD, 2          ; PD2 (Pin 2) as Input (Button)
    SBI PORTD, 2         ; Activate Pull-up on PD2

loop:
    SBIC PIND, 2         ; Skip next instruction if button pressed (LOW)
    RJMP led_off         ; If not pressed, turn off LED

led_on:
    SBI PORTB, 5         ; Turn on LED
    RJMP loop            ; Return to loop

led_off:
    CBI PORTB, 5         ; Turn off LED
    RJMP loop            ; Return to loop
```

C. Toggle LED with Button (Simple Debounce)

```
#define __SFR_OFFSET 0x00
#include "avr/io.h"

.global main

main:
    ; Initialization
    SBI DDRB, 5          ; PB5 as Output (LED)
    CBI DDRD, 2          ; PD2 as Input (Button)
    SBI PORTD, 2         ; Activate internal Pull-up
    CLR R20              ; R20 = LED status (0 = off)

wait_press:
    SBIC PIND, 2         ; Wait for button pressed (LOW)
    RJMP wait_press

    ; Button pressed - toggle LED
```

```
    SBRC R20, 0          ; Skip if bit 0 of R20 = 0 (LED off)
    RJMP turn_off

turn_on:
    SBI PORTB, 5         ; Turn on LED
    LDI R20, 1           ; Set status = on
    RJMP debounce

turn_off:
    CBI PORTB, 5         ; Turn off LED
    CLR R20              ; Set status = off

debounce:
    RCALL delay          ; Delay for debounce

wait_release:
    SBIS PIND, 2         ; Wait for button released (HIGH)
    RJMP wait_release
    RCALL delay          ; Delay debounce after release
    RJMP wait_press      ; Return to wait for press

delay:
    LDI R18, 50
d_outer:
    LDI R24, lo8(10000)
    LDI R25, hi8(10000)
d_inner:
    SBIW R24, 1
    BRNE d_inner
    DEC R18
    BRNE d_outer
    RET
```

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