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ESE280-L03

Lab01: Introduction to the AVR128DB48 Curiosity Nano Microcontroller

Lab section #3

Bench #3

1. Are the directions of port pins of the AVR128DB48 microcontroller individually configurable (programmable)?

The port pins of the microcontroller are individually configurable.

2. In a conceptual sense, how is the simple software of the programs in this laboratory representa-
tive of the software of most embedded systems?

The simple software is representing assembly languages and C/C++.

3. What is the main difference between simulation and in-circuit emulation?

The simulation is running the microcontroller's program on a PC and it does not use the actual microcontroller. In-circuit emulation is you actually run the code with a real microcontroller.

4. When single stepping a program, does the yellow arrow point to the instruction just executed or
to the next instruction to be executed?

Single stepping a program means that you run the code line by line singly. The yellow arrow indicates the next instruction to be executed.

5. After you perform a single step operation, what does it mean if some bits in a register are solid
red?

The solid red means that it was 0 before and just turned 1.

6. After you perform a single step operation, what does it mean if some bits in a register are gray
    with red outline?

The bit just changed from 1 to 0.

7. After you perform a single step operation, what does it mean if some bits in a register are solid
    black?

The bit was 1 and still 1.

8. After you perform a single step operation, what does it mean if some bits in a register are solid
    gray?

The bit was 0 and still 0.

9. If you want to execute a single assembly language instruction, what icon do you click or what
    function key do you press?

You can press f11 key.

10.   What does duty cycle for a periodic signal mean? What is the duty cycle for the signal at PB3

for Task 1? What two different ways can you determine the duty cycle of the signal at PB3?

Duty cycle is a ratio of when the circuit is ON and OFF. The duty cycle for PB3 was about 50%. You can measure the periods with oscilloscope or you can calculate with the formula.

```asm
 1  ;
 2  ; blink_LED_with_delay.asm
 3  ;
 4  ; Created: 9/7/2023 9:57:15 AM
 5  ; Author : userESD
 6  ;
 7
 8
 9  ; Replace with your application code
10  start:
11      sbi VPORTB_DIR, 3   ;set direction of PB3 as output
12      sbi VPORTB_OUT, 3   ;set output value to 1
13
14  ;Turn LED ON and OFF
15  loop:
16      cbi VPORTB_OUT, 3   ;clear output value 0, turn LED ON  1 clock AVRxt
17      nop                 ;                                   1 clock
18      nop                 ;                                   1 clock
19      rcall delay_500ms
20      sbi VPORTB_OUT, 3   ;set output value 1, turn LED OFF   1 clock
21      rcall delay_500ms
22      rjmp loop           ;                                   2 clocks
23
24  ;Delay subroutine tuned to create a 1 Hz waveform when called by the code above
25  delay_500ms:
26      ldi r30, LOW(05000) ;values det. exper. using scope
27      ldi r31, HIGH(05000)
28  outer_loop:
29      ldi r16, $FF
30  inner_loop:
31      dec r16
32  brne inner_loop
33      sbiw r31:r30, 1
34  brne outer_loop
35      ret                 ;return to caller
```