ECE 372A Practice Exam b - Solutions

1. What is the bitwise AND of 0x7A with 0xDE?

   0x11

   0x5A

   0xEB

   0xF0

2. What is the bitwise OR of 0x05 with 0x9A?

   0x1F

   0x95

   0x55

   0x9F

3. What is the bitwise XOR of 0xC9 with 0x23?

   0xEA

   0xE0

   0xC3

   0x9C

4. What is the value of ~ (0x3F)?

   0x88

   0xF0

   0xC0

   0x01

5. What is the value of (0x0F) & (0xF0)?0x11

   0xFF

   0x05

   0x00

6. What is the value of (0x77) | (0x88)?

   0xE2

   0xFF

   0xB1

   0x0F

7. What is the value of (0xE2) ^ (0x46)?

   0xA4

   0xDD

   0x25

   0x4E

8. PORTA = 0x7C. The following line of code produces what result?

   PORTA &= ~(1 << PORTA2);

   0x11

   0x5A

   0x78

   0xC8

9. Which line of code sets the 6th and 7th bits of PORTB to 1 without changing any other bits?

   PORTB = (1 << PORTB7) | (1 << PORTB0);

   PORTB |= (1 << PORTB7);

   PORTB |= (1 << PORTB6);

   PORTB |= (1 << PORTB6) | (1 << PORTB7);

10. Which SFR selects the direction for whether a pin will be configured as an input or an output?

    PORT

    DDR

    PIN

11. Which SFR is used to drive the pin when it is configured as an output?

    PIN

    DDR

    PORT

12. Which SFR is used to read the actual logic value on a pin?

    PIN

    PORT

    DDR

13. To enable the internal pull-up resistor the correct procedure is:

    Set PINxn to 1, then DDxn to 1.

    Set DDxn to 1, then PORTxn to 0.

    Set PORTxn to 1, then DDxn to 1.

    Set DDxn to 0, then PORTxn to 1.

14. What do the following 2 lines of code do?

```
DDRB  |=  (  1 << DDB6);
PORTB |= (  1 << PORTB6);
```

    Configures pin #12 on Arduino Board for an output, output is logic high;

    Configures pin # 51 on Arduino Board for an output, output is logic high;

    Configures pin #12 on Arduino Board for an input, internal pullup resistor is enabled;

15. Which of the following are components of a typical timer circuit?

    Output Compare Register

    Prescaler

    Clock

    Counting Register

    Push Button Switch

16. What options are there for matching an ATMEGA2560 timing system to the desired timing for the specific application?

    Change the prescaler value

    Use an external clock source

    Use 16 bit versus 8 bit timing system

    Change the PORT location

17. For a 16 Mhz clock, an 8 bit compare value of 100 and a prescaler of 1024 - What is the timer resolution?

    64 microseconds

    100 milliseconds

    1 microsecond

    0.1 milliseconds

18. For a 16 Mhz clock, an 8 bit compare value of 100 and a prescaler of 1024 - What is the time duration?

    5 microseconds

    1200 milliseconds

    6.4 milliseconds

    100 microseconds

19. If we want a 20 microsecond timer using a pre-scaler of 8 and a clock of 16 MHz, what value must go in OCR0A?

    250

    40

    20

    5

20. When using an interrupt service routine (ISR), the program main() is halted until the ISR has completed execution

    TRUE

    FALSE

21. Variables used in ISR routines should be declared as volatile during global variable definitions.

    TRUE

    FALSE

22. The group of memory locations set aside to hold the addresses of ISRs are listed in the

    Interrupt Vector Table

    General Purpose Register Table

    Port Pin Configuration Table

23. When configuring a Pin Change Interrupt, what two registers must be set up for your device

    Pin Change Interrupt Control (PCICR) and Pin Change Mask (PCMSKn) registers

    Pin Change Interrupt Control (PCICR) and the PORTn Data registers

    Pin Change Mask (PCMSKn) and the Timer/Counter registers

24. Write the line of code to properly configure the Pin Change Mask Register for a Pin Change Interrrupt of pin #15 on the Arduino board. Use one of the Pin Change Mask Registers below.

```
PCMSK1 |= (1 << PCINT9);
```

15.2.7 PCMSK2 – Pin Change Mask Register 2

Bit	7	6	5	4	3	2	1	0	
(0x6D)	PCINT23	PCINT22	PCINT21	PCINT20	PCINT19	PCINT18	PCINT17	PCINT16	PCMSK2
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- **Bit 7:0 – PCINT23:16: Pin Change Enable Mask 23:16**

Each PCINT23:16-bit selects whether pin change interrupt is enabled on the corresponding I/O pin. If PCINT23:16 is set and the PCIE2 bit in PCICR is set, pin change interrupt is enabled on the corresponding I/O pin. If PCINT23:16 is cleared, pin change interrupt on the corresponding I/O pin is disabled.

15.2.8 PCMSK1 – Pin Change Mask Register 1

Bit	7	6	5	4	3	2	1	0	
(0x6C)	PCINT15	PCINT14	PCINT13	PCINT12	PCINT11	PCINT10	PCINT9	PCINT8	PCMSK1
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- **Bit 7:0 – PCINT15:8: Pin Change Enable Mask 15:8**

Each PCINT15:8-bit selects whether pin change interrupt is enabled on the corresponding I/O pin. If PCINT15:8 is set and the PCIE1 bit in PCICR is set, pin change interrupt is enabled on the corresponding I/O pin. If PCINT15:8 is cleared, pin change interrupt on the corresponding I/O pin is disabled.

15.2.9 PCMSK0 – Pin Change Mask Register 0

Bit	7	6	5	4	3	2	1	0	
(0x6B)	PCINT7	PCINT6	PCINT5	PCINT4	PCINT3	PCINT2	PCINT1	PCINT0	PCMSK0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- **Bit 7:0 – PCINT7:0: Pin Change Enable Mask 7:0**

Each PCINT7:0 bit selects whether pin change interrupt is enabled on the corresponding I/O pin. If PCINT7:0 is set and the PCIE0 bit in PCICR is set, pin change interrupt is enabled on the corresponding I/O pin. If PCINT7:0 is cleared, pin change interrupt on the corresponding I/O pin is disabled.

25. Given the table for Clock Select Bit Decription and the Timer/Counter Control Register, write the 2 lines of code that sets the Timer for a pre-scaler of 1024.

```
TCR0B  |=  (1 << CS02)  | (1<< CS00);
TCR0B  &=  ~(1 << CS01);
```

Table 16-9. Clock Select Bit Description

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped)
0	0	1	$clk_{I/O}$/(No prescaling)
0	1	0	$clk_{I/O}$/8 (From prescaler)
0	1	1	$clk_{I/O}$/64 (From prescaler)
1	0	0	$clk_{I/O}$/256 (From prescaler)
1	0	1	$clk_{I/O}$/1024 (From prescaler)
1	1	0	External clock source on T0 pin. Clock on falling edge
1	1	1	External clock source on T0 pin. Clock on rising edge

TCCR0B – Timer/Counter Control Register B

Bit	7	6	5	4	3	2	1	0	
0x25 (0x45)	FOC0A	FOC0B	–	–	WGM02	CS02	CS01	CS00	TCCR0B
Read/Write	W	W	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

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PINOUT DIAGRAM

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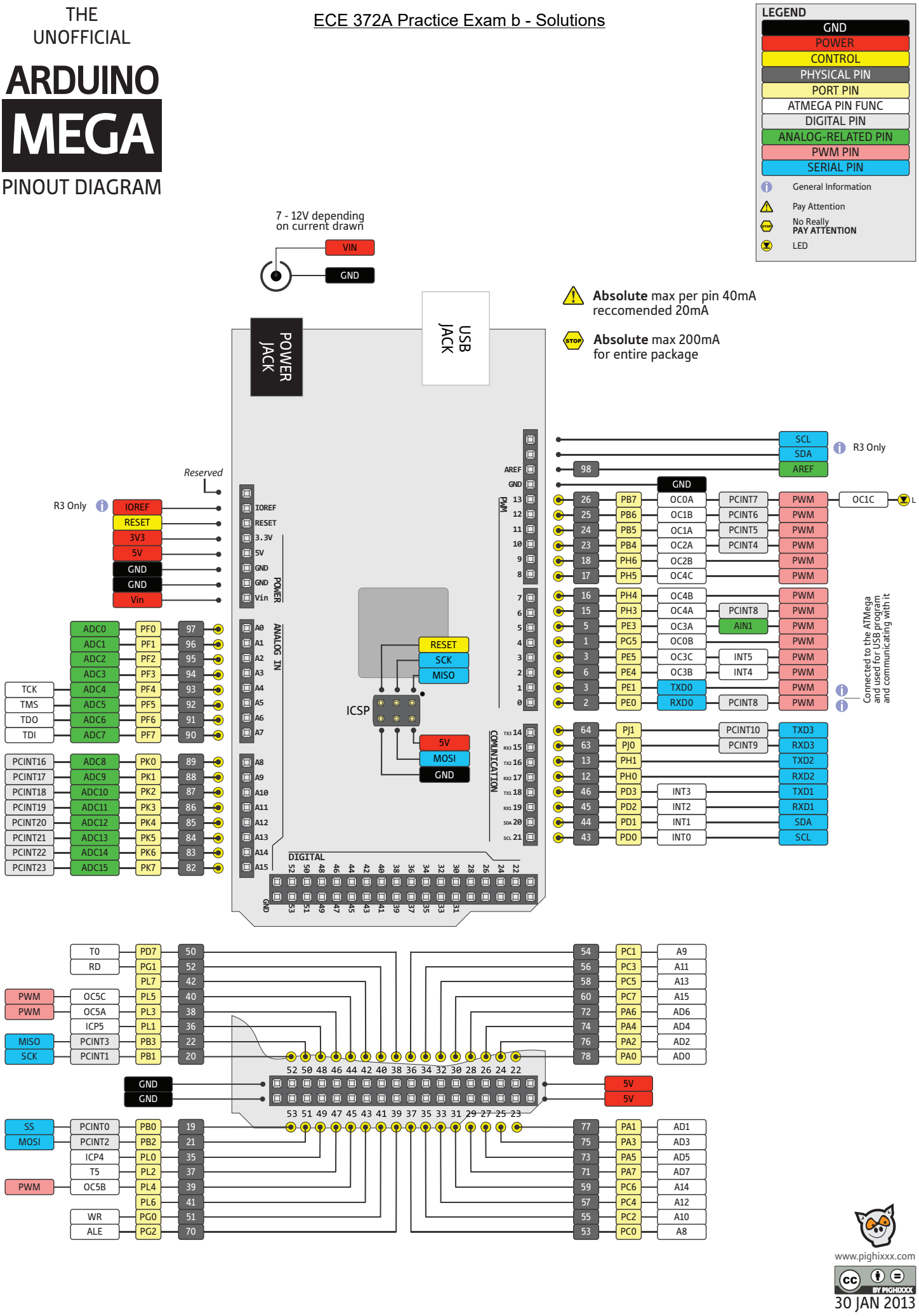

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