

125/140

EECS 388
Second Hour Exam
Minden
Fall 2017

Answer each of the following problems on the paper provided. Neatness and organization will influence the grading of your exam. If you feel information you need to solve a problem is missing from the problem, state that and state the assumptions under which you will solve the problem. If the assumptions are reasonable and correct, the problem will be graded under those assumptions. You may use a laptop or tablet to access electronic versions of the technical documentation and lecture slides.

Otherwise, Closed neighbors.

Carefully read the questions, take your time, think, and then answer.

All questions are worth 10 points unless otherwise stated.

1. The LM3S1968 micro-controller has an internal temperature sensor. The relationship between temperature and sensor voltage is:

$$\text{SENSO} = 2.7 - ((T + 55) / 75)$$

Where T is the temperature in $^{\circ}\text{C}$ and SENS0 is the sensor output voltage. For a temperature of 30 $^{\circ}\text{C}$ what is the sensor output voltage?

$$2.7 - ((30+55)/75)$$
$$= \boxed{1.5667 \text{ Volts}}$$

37

2. Describe (Explain) the difference between `xTaskCreateStatic` and `xTaskCreate` in FreeRTOS.

While both `xTaskCreateStatic` and `xTaskCreate` create a new instance of a task, if a task is created using `xTaskCreate()`, the RAM required is allocated from the heap. Whereas, `xTaskCreateStatic` has it so the RAM is provided by the writer of the code, meaning the RAM will be allocated statically at compile time.

3. Consider the following switch statement with Foo = 6; and Baz = -2;

```
switch ( Foo ) {  
    case 1: { Baz++; break }  
    case 2: { Baz--; }  
    case 3: { Baz = (2 * Foo); break; }  
    case 4: { Baz = 1 }  
}
```

What is the final value of Baz?

The final value of Baz would be -2.

4. When a hardware value might change due to external circumstances or a value might change due to an interrupt, what type modifier do you attach to the variable that might change?

The modifier you would attach to the variable that might change is 'volatile'.

5. In a Pulse Width Modulator (PWM) what is the width (number of bits) of the (down) counter?

The width of the counter would be 16 bits.

6. What is the UART bit rate we use to communicate from the evaluation board to the PC?

The UART bit rate to communicate from the evaluation board to the PC would be 115200.

7. A timer is configured as a 16-bit down counter. The load value (initial value) is 1,500. The counter clock is 1.5 MHz. How long does it take for the counter to count down from the load value to zero (0)?

$$\frac{1}{1500000} = 6.67 \times 10^{-7}$$
$$\frac{1}{1500} = \frac{1}{X}$$

1.001 seconds

8. A 12-bit ADC has an input voltage range of 0.0 VDC to 5.0 VDC. For an input voltage of 3.75 VDC, what is the expected measurement value (reading) from the ADC? Express in decimal.

5
ADC conversion
0

.75 (in decimal)

$$\frac{3.75}{5} = .75 \quad \cancel{2^{11}}$$

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9. A GPIO output generates 3.3 VDC (Volts Direct Current). The load is 3,100 Ohms (3.1 KOhm). What is the design (expected) current?

$$\frac{3.3}{3100} = .00106 \text{ A}$$

10. The control, status, and data registers for GPIO ports are located in the micro-controller memory address space. That is, you access (read or write) those registers as if they were memory locations. What is the base (first) memory address of GPIO PortE?

The base memory address of GPIO PortE is 0x40024000.

11. When a task is executing in FreeRTOS, which state is it in?

It is in the running state if the task is being executed.

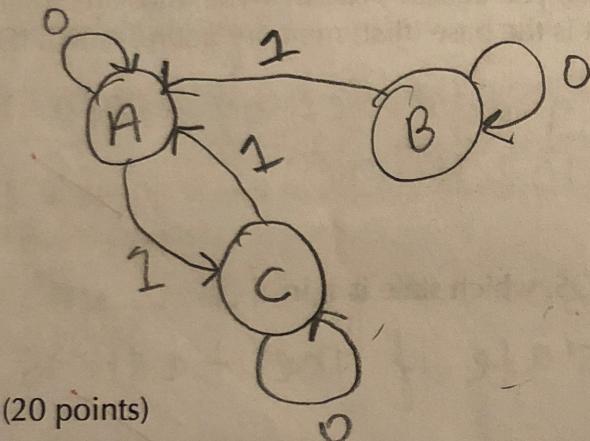
12. A finite state machine has three states and one input. The states are labeled A, B, and C. The input is either a 1 or a 0. The state transition table is:

State	Input 0 – Next State	Input 1 – Next State
A	A	C
B	B	A
C	C	A

12(a) Write a C enum statement that defines the states.

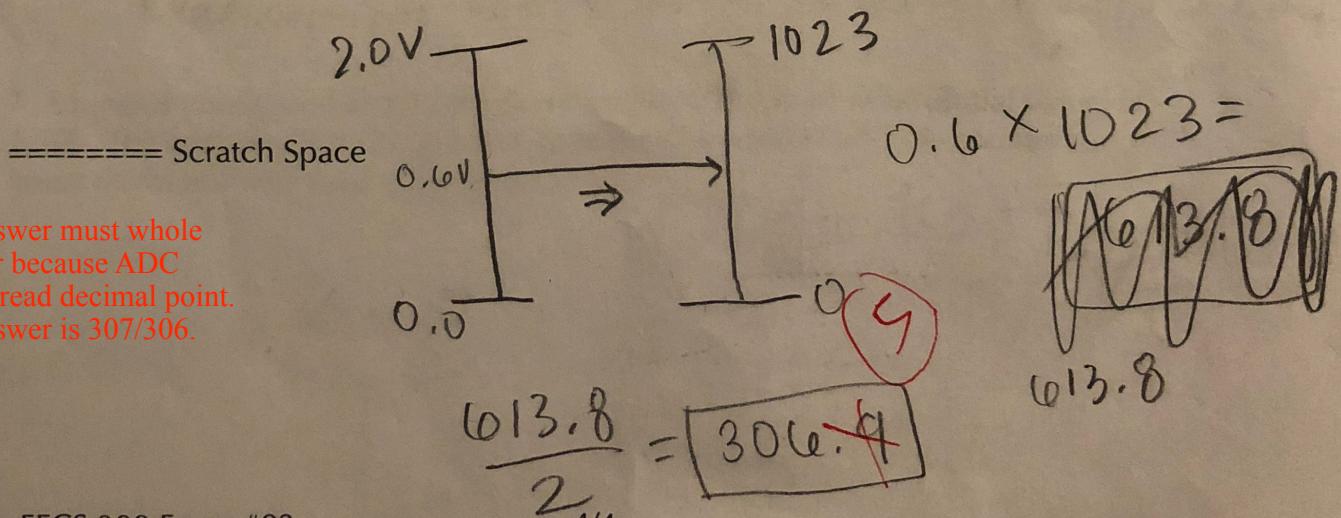
state {A, B, C}; /

12(b) Draw a state diagram for this finite state machine.



(20 points)

13. An ADC input voltage range is 0.0 – 2.0 VDC and converts the input voltage to an integer between 0 and 1,023 (10-bits). If the input voltage is 0.60 VDC (V_{in}), what value is read from the ADC after conversion?



The answer must whole number because ADC cannot read decimal point.
The answer is 307/306