



## Bioelectronics and Measurements (ARM Part) Term Exam **Solution** – 2013

Solve as Much as You Can – Maximum Grade for Both Parts 1 and 2: **75 Points**

### Part I. Complete the following sentences [1 point each]:

1. On the VLDISCOVERY kit with DAC configured as 12-bit mode and DOR=1000, the DAC output will be  **$1000 \times 3.3 / 4096$** ... volt.
2. A prescaler value of 0 in TIM5 divides the counter clock frequency by a factor of ... **1**
3. Selecting the Up/Down counting modes of TIM2 is done by writing to ... **CMS bits[0:1] in TIM2\_CR1**
4. To use a GPIO pin to drive a load at high current, it is configured to work in ... **OPEN-DRAIN** output mode
5. Output DAC voltage is available after the value of DHR changes by a period of ... **1 APB1 clock cycle +  $t_{\text{settling}}$**
6. Changing the auto-reload register value in TIM4 takes effect after **UPDATE EVENT**... when ARPE=1.
7. After an enabled System Tick Timer interrupt occurrence, the system starts executing code from address ... **0x0000\_003C** (interrupt vector)
8. In TIM3, counter is clocked by prescaler output only when ... **CEN in TIM3\_CR1 Register** bit is set.

### Part II. Mark the following statements as True (T) or False (F) [1 point each]:

9. It is possible to configure the STM32 ARM processor to boot from a USB flash memory. **(F)**
10. It is possible to disconnect the internal supply of ARM peripherals that are not used to save power. **(T)**
11. The DAC modules can work independently. **(T)**
12. It is possible to mask TIM3 overflow interrupt. **(T)**
13. It is possible to use Timer 1 overflow as the trigger to the DAC module. **(F)**
14. An interrupt request can also be generated by software by writing a '1' in the software interrupt register. **(T)**
15. It is possible to configure EXTI to receive external interrupts from both PA1 and PC1 simultaneously. **(F)**
16. SysTick timer can be reconfigured by software after booting. **(T)**
17. All interrupts are disabled after power on reset. **(F)**
18. General purpose timers TIM2-5 can have different clock sources independently. **(T)**

### Part III. Answer the following problem:

19. [8 points] Design an ARM project for your VLDOSCOVERY kit that detects a user button press to activate a LED and producing an analog voltage of 1.5 V for 3 seconds before returning to original state. In particular, write the steps that allow the following:
  - a. Configuring the GPIO connected to the User Button input. **Project #1 Q6**
  - b. Configuring a GPIO connected to a LED as output in a suitable mode. **Project #1 Q2**
  - c. Configuring the DAC module to generate a voltage of 1.5 volts. **Project #5 Q2**
  - d. Configuring a timer to generate an event at 3 s once (general purpose timer, SysTick, etc.).  
**Use General Purpose Timers as Project #4 Q4 or SysTick Timer as Project #3 Q2**

Please feel free to write the programming steps as pseudo-code or a list that is not necessarily a C code.

**Best of luck!**