Computer Architectures

Programming part T3.2 - January 30, 2019

PLEASE FILL THIS FORM

Student name_____

ID_____ Signature_____

Solution delivered in time: yes [] no[]

Code compiles: yes [] no []

Code works: yes [] no [] partly []

Please read accurately:

1) The ARM programming part of the exam has a duration of 2 hours
2) You have to develop an ARM project using the KEIL µVision IDE
3) Login in your LABINF area and use the available installation (v4.74) to edit, compile and SW debug your code
4) Use the provided LANDTIGER board and HW debugger to prototype your project
5) You are allowed to access the teaching portal page; this access will be granted by the LABINF infrastructure and any other web page access will be denied and all attempts will provoke the immediate ejection from the exam: LABINF personnel will monitor the network usage along the exam.
6) You can bring a single USB key and use your personal projects and notes.
7) Before the exam time ends you MUST upload a zipped folder of the developed project called 20190130.zip of your project including your project in the "elaborates" section of your Computer Architecture account, in the POLITO teaching portal. Late delivery will not be considered valid and always lead rejection.
8) The professors will reject delivered projects that produce errors during the compile phase; make sure your project compilation is free of errors.

Exercise 1 (max 30 points)

You are required to implement the following functionalities on the LANDTIGER board equipped with the LPC1768 chip.

1) Timer 3 starts at boot time and repeatedly counts for a time up to 1.3 minutes
    1. Every time the count elapses, the counter restarts from 0
    2. The timer is NOT triggering any interrupt

2) Button INT0, KEY2 and joystick DOWN switch are used build a unsigned value to be stored in an variable called VAR1; in particular:
    1. Initial value of VAR1 is 9
    2. After a KEY1 pressure, the current value of Timer 3 is captured and added to VAR1
    3. INT0 divides VAR1 by 4
    4. A prolonged pressure of Joystick DOWN (>3 seconds) concludes the number construction.

3) As soon as a value is generated, the following actions need to be performed:
    1. The following function, written in ASSEMBLY language, needs to be invoked

        unsigned int count_bits_to_1 (unsigned int VAR1);
        which returns the number of bits setup to value 1 in the VAR1 value

    2. After function execution, the process of filling VAR1 is restarted from point 2.1.

    3. LED configuration: every time the function is executed, the following led configuration needs to be reproduced according to the returned value
        1. if in the range 0 to 3, all leds are switched off.
        2. if in the range 4 to 11, the corresponding led is switched on (with LED number according to the schematic, i.e., if the returned value equals 5, LED5 is turned ON)
        3. If in the range 12 to 31, all leds are blinking with a period of 1.2 seconds (half time on, half time off)