

# Computer Architectures

January xx, 2019

## Programming

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  $\mu$  Vision 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 201901xx.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) The system has to start a repetitive count of 2 minutes by using TIMER1, meaning that
  - The count is restarted when the count elapses
  - When the timer count elapses, no interruption has to be triggered
  - The repetitive count is started as soon as the system boots.
- 2) During this system operation, the user can toggle the joystick in the UP direction.
  - Every time the joystick is toggled UP, the current value of the Timer Counter is recorded
  - After N values (where N is defined as a constant) are collected, the following function, written in Assembly language, needs to be invoked

`int overflow(int v[N], int n);`

which returns the values

- i. 0 if the sum of the N values is causing an overflow
    - ii. 1 if the sum of the N values is causing a carry
    - iii. Otherwise value 2 is returned
  - According to the result, LED 0, 1 or 2 have to be switched ON.
- 3) A prolonged operation of the joystick (i.e., it is kept pulled UP) for more than 3 seconds makes the LED7 flashing ON/OFF with a period of 700 ms (350ms ON/350 ms OFF) until the joystick is released.