## COS10004: Computer Systems Lab 9

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- 4. Provide a brief description of the following:
  - 4.1. what is the code in each file doing?
  - kernel7.asm : Flashing the LED light of GPIO18 with the number of times equals the factorial of a number
  - TIMER.asm: Delay time between processes
  - factorialj.asm: Calculating the factorial of a number
    - 4.2. what register holds the input to the program (and what is the input)?

Register r0 holds the input to the program (#4)

5. You are going to modify the code in kernel7.ASM by breaking up logical components into functions. Open up HOWTO\_Lab9.pdf from the task resources and follow the instructions on how to do this (or, if you want to do it your own way, go for it!).

## kernel7.asm:

;Calculate

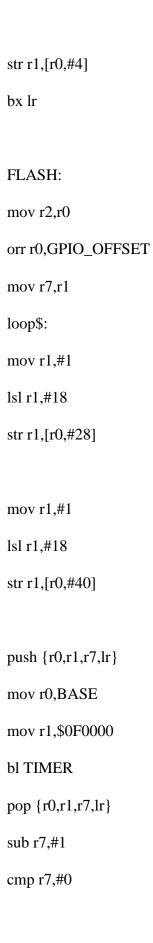
mov r1,#4;input

mov sp,\$1000; make room on the stack

mov r0,r1

bl FACTORIAL
mov r7,r0 ;store answer
BASE = \$3F000000 ;RP2 and RP3 ;GPIO_SETUP
mov r0,BASE
bl SETUP_LED
mov r0,BASE
mov r1,r7
bl FLASH
wait:
b wait
include "TIMER.asm"
include "factorialj.asm"
include "GPIO.asm"
TIMER.asm:
;TIMER - dumb timer
;r2=number of loops
TIMER:
wait1\$:
sub r2,#1

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cmp r2,#0
bne wait1$
bx lr
factorialj.asm:
FACTORIAL:
sub r1,r1,#1
cmp r1,#1
beq EXIT
mul r0,r0,r1
push {r1,lr}
;push onto the stack without changing the stack pointer
bl FACTORIAL ;call FACTORIAL
EXIT:
pop {r1,lr} ;pop off the stack
bx lr ;RETURN
GPIO.asm:
SETUP_LED:
GPIO\_OFFSET = $200000
orr r0,GPIO_OFFSET
mov r1,#1
lsl r1,#24
```



bne loop\$

bx lr

## TIMER2.asm:

Delay: ;this function has 2 parameters

TIMER\_OFFSET=\$3000

mov r3,r0 ;BASE - depends on Pi model

orr r3,TIMER\_OFFSET

mov r4,r1;\$80000 passed as a parameter

ldrd r6,r7,[r3,#4]

mov r5,r6

loopt1: ;label still has to be different from one

in \_start

ldrd r6,r7,[r3,#4]

sub r8,r6,r5

cmp r8,r4

bls loopt1

bx lr ;return