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Class: Computer Systems (Thursday afternoon)

Title: Lab 9

4 – TIMER.asm contains a function which runs a dumb timer. The input to this function, which is $0F0000, is stored in the register r2.

FACTORIALJ.asm contains a recursive function which calculates the factorial of a number. The input number to this function, which is 4, is stored in the register r1.

Kernel7.asm contains code to calculate the factorial of a number and make an LED flash that number of times via GPIO18.

5 – Decomposed code

TIMER.asm

```
TIMER:
    wait1$:
        sub r2,#1
        cmp r2,#0
        bne wait1$
    bx lr
```

factorialj.asm

```
FACTORIAL:
    sub r1,r1,#1
    cmp r1,#1
    beq EXIT
    mul r0,r0,r1
    push {r1,lr}
    bl FACTORIAL
    EXIT:
        pop {r1,lr}
    bx lr
```

gpio_setup.asm

```
SETUP:
    BASE=$3F000000
    GPIO_OFFSET=$200000
```

```
      mov r0,BASE
      orr r0,GPIO_OFFSET
      mov r1,#1
      lsl r1,#24
      str r1,[r0,#4]
      bx lr
```

gpio_on.asm

```
GPIO_ON:
      mov r1,#1
      lsl r1,#18
      str r1,[r0,#28]
      bx lr
```

gpio_off.asm

```
GPIO_OFF:
      mov r1,#1
      lsl r1,#18
      str r1,[r0,#40]
      bx lr
```

kernel7.asm

```
mov r1,#4
mov sp,#1000
mov r0,r1
bl FACTORIAL
mov r7,r0
bl SETUP
loop$:
      bl GPIO_ON
      mov r2,$0F0000
      bl TIMER
      bl GPIO_OFF
      mov r2,$0F0000
      bl TIMER
```

```
      sub r7,#1
      cmp r7,#0
      bne loop$

wait:
b wait

include “TIMER.asm”
include “factorialj.asm”
include “gpio_setup.asm”
include “gpio_on.asm”
include “gpio_off.asm”
```