# Embedded OS Implementation, Fall 2023

Homework #1 (due October 4th, 2023 (Wednesday) 12:00)

## Hello uCOS-II

#### Problem Definition:

- (a) Please draw the system flow of "Hello  $\mu$ C/OS-II (the modified main.c in Lab1)" and explain the process (functions). Note: Please start from the function "OSTaskCreateExt".
- (b) Consider two periodic tasks ( $\tau_1$ ,  $\tau_2$ ) and their delay time are 3 ticks and 5 ticks, respectively. Task priority of two tasks ( $\tau_1$ ,  $\tau_2$ ) are 1 and 2, respectively. Please add some code to the uCOS-II scheduler in the kernel level to observe how CPU is switched among tasks by means of context switches.

Tick	CurrentTask ID	NextTask ID	Number of ctx switch
##	*******	task(ID)(job number)	##
##	task(ID)(job number)	task(ID)(job number)	##

<sup>※</sup> If the task is Idle Task, print "task(priority)".

This project is executed on "Visual Studio". Please show the results by using it.

Tick	CurrentTask ID	NextTask ID	Number of ctx switches
0	******	task( 1)( 0)	_
ň	task( 1)( 0)	task( 2)( 0)	ň
ň	task( 2)( 0)	task(63)	Ĭ
š	task(63)	task( 1)( 1)	į.
3	task( 1)( 1)	task(63)	3
5	task(63)	task( 2)( 1)	4
5	task( 2)( 1)	task(63)	5
6	task(63)	task( 1)( 2)	6
6	task( 1)( 2)	task(63)	7
9	task(63)	task( 1)( 3)	8
9	task( 1)( 3)	task(63)	9
3 5 5 6 9 10	1 / (0)	task( 2)( 2)	0 1 2 3 4 5 6 7 8 9
10	task(63) task( 2)( 2)	task(63)	11
12	task(63)	task( 1)( 4)	12
12	task( 1)( 4)	task(63)	13
15	task(63)	task( 1)( 5)	14
15	task( 1)( 5) task( 2)( 3)	task( 2)( 3)	15
15	task( 2)( 3)	task(63)	14 15 16 17
18	task(63)	task(_1)(_6)	17
18	task( 1)( 6)	task(63)	18
20	task(63)	task( 2)( 4)	19
20	task(2)(4)	task(63)	20
21	task(63)	task(_1)(_7)	21 22
21	task( 1)( 7)	task(63)	22
24	task(63)	task( 1)( 8)	23 24 25
24 05	task( 1)( 8)	task(63) task( 2)( 5)	24 25
2J 95	task(63) task(_2)(_5)		25
2J 27	task(2)(3) task(63)	task(63) task( 1)( 9)	26 27
27	task(05)	task(1)(9) task(63)	28
10 12 15 15 18 20 21 24 25 27 27 30 30	task( 1)( 9) task(63)	task( 1)(10)	29 29
30		task( 2)( 6)	30
30	task( 2)( 6)	task(63)	31

## The output result is below: Output.txt

0	*******	task( 1)( 0)	0
0 0	task( 1)( 0)	task( 2)( 0)	0 1 2 3 4 5 6 7 8 9 10 11
0	task( 2)( 0)	task(63)	1
3	task(63)	task( 1)( 1)	2
3	task( 1)( 1)	task(63)	3
5	task(63)	task( 2)( 1)	4
5	task( 2)( 1)	task(63)	5
6	task(63)	task( 1)( 2)	6
0 3 3 5 5 6 6 9 9 10	task( 1)( 2)	task(63)	7
9	task(63)	task( 1)( 3)	8
9	task(_1)(_3)	task(63)	9
	task(63)	task(_2)(_2)	10
10	task(_2)(_2)	task(63)	11
12	task(63)	task( 1)( 4)	12
12	task(_1)(_4)	task(63)	13
15	task(63)	task( 1)( 5)	14
15	task( 1)( 5)	task(_2)(_3)	15
12 15 15 15 18	task(_2)(_3)	task(63)	13 14 15 16 17
18	task(63)	task(_1)(_6)	17
18	task(_1)(_6)	task(63)	18
20	task(63)	task(_2)(_4)	19
20	task(_2)(_4)	task(63)	20
21	task(63)	task(_1)(_7)	21
21	task(_1)(_7)	task(63)	22
24	task(63)	task(_1)(_8)	20 21 22 23 24 25
24	task(_1)(_8)	task(63)	24
25	task(63)	task( 2)( 5)	25
25	task(_2)(_5)	task(63)	26
27	task(63)	task(_1)(_9)	27
20 21 24 24 25 27 27 30	task( 1)( 9)	task(63)	28
30	task(63)	task( 1)(10)	29
30	task( 1)(10)	task( 2)( 6)	30
30	task( 2)( 6)	task(63)	31

### **Crediting:**

Your homework need to show the following information.

- The system flow and the explanation of the process(functions). (45%)
- The screenshot of the result. (10%)
- A report that describes your implementation (please attach the screenshot of the code and Mark the modified part). (45%)

#### Hints:

- 1. Call the function **OSTimeSet(0)** before the OS starts to initialize the start time.
- 2. Use **OSTimeGet()** to get the current tick in the system.
- 3. Use '/t' to format your code.
- 4. If your project size is too large for uploading, you can try to delete the ".vs" or the "Debug" folders

#### **Homework submit:**

Submit to Moodle

Submit deadline: October 4th, 2023 (Wednesday) 12:00

File name format: RTOS\_your student ID\_HW1.zip

RTOS\_ Student ID\_HW1.zip includes:

- \*\* The report (RTOS\_ your student ID\_HW1.pdf).
- \* Folder with executable μC/OS-II project (Myyyddxxx RTOS HW1).
- \* Standard input and output filenames in the project are necessary for the checker, please check before submitting.

```
#define INPUT_FILE_NAME "./TaskSet.txt" #define OUTPUT_FILE_NAME "./Output.txt"
```

\* Plagiarizing is strictly prohibited.

#### \* RTOS\_Myyyddxxx\_HW1.zip must be including files as follow:

```
C:\RTOS_Myyyddxxx_HW1
  RTOS_Myyyddxxx_HW1.pdf
_Myyyddxxx_RTOS_HW1
  -Micrium
    ∟Software
       -uC-CPU
         | cpu_cache.h
          cpu_core.c
          cpu_core.h
          cpu_def.h
         L-Win32
           └─Visual_Studio
               cpu.h
               cpu_c.c
       -
-
-uC-LIB
          lib_ascii.c
           lib_ascii.h
           lib_def.h
           lib_math.c
           lib_math.h
           lib_mem.c
           lib_mem.h
          lib_str.c
lib_str.h
       ucos-II
         –Ports
           └─Win32
             └─Visual Studio
                                                                              -Microsoft
                 os_cpu.h
                                                                                └─Windows
                  os_cpu_c.c
                                                                                    bsp_cpu.c
         L_Source
                                                                              —Windows
             os.h
                                                                                ∟Kernel
             os_cfg_r.h
                                                                                   app_cfg.h
cpu_cfg.h
             os_core.c
                                                                                    lib_cfg.h
             os_dbg_r.c
             os_flag.c
os_mbox.c
                                                                                  i_os2
                                                                                     app_hooks.c
             os_mem.c
                                                                                     main.c
             os_mutex.c
                                                                                     os_cfg.h
             os_q.c
             os_sem.c
os_task.c
                                                                                    i_vs
                                                                                        OS2.sln
             os_time.c
                                                                                        OS2.vcxproj
                                                                                        OS2.vcxproj.filters
OS2.vcxproj.user
             os_tmr.c
             os_trace.h
                                                                                        Output.txt
             ucos_ii.c
                                                                                        TaskSet.txt
             ucos_ii.h
```