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AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
ICHEP; Mechatronics Engineering Program

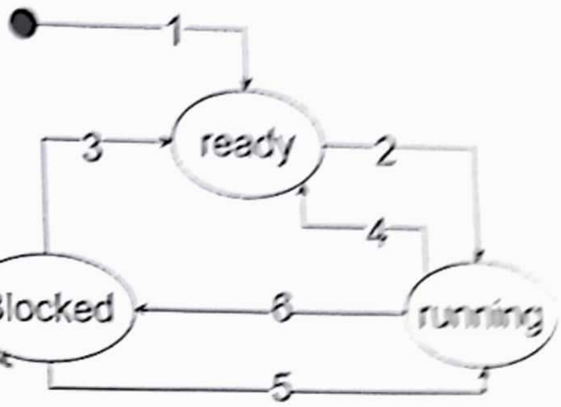
Course Code: CSE 347/345 *Time: 1 Hour*

Mid Term: Embedded System Design

The Exam Consists of **4** Questions in **5** Pages *Total Marks: 25 Marks*

Question 1: match a transition-number with the sentence that is suitable to change the task state as it shown:

A. Task is unblocked but is not the highest priority task 3
B. Task has the highest priority 2
C. Task no longer has the highest priority 4
D. Task is unblocked and its the highest priority task 5
E. Task is waiting for an event 6
F. Task is initialized and activated 1



Question 2: Complete the following sentences:

A. The figure below represents the code of a print_task_name.........task

Show_Name_of_Task

```
void Task( void *pvParameters )
{
char *pcTaskName;


    pcTaskName = ( char * ) pvParameters;

    for( ;; )
    {
        vPrintString( pcTaskName );


    }
}
```

B. The figure below represents the code of a delay task

```
void Task( void *pvParameters )
{
portTickType xLastWakeTime;

    xLastWakeTime = xTaskGetTickCount();

    for( ;; )
    {

        vPrintString( pcTaskName );

        vTaskDelayUntil( &xLastWakeTime, ( 10 / portTICK_RATE_MS ) );
    }
}
```

Question 3: Choose the correct answer:

1) context switching is:
   A. forcing the program counter to a specific address line to excute
   B. restoring saved context including its program counter value

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C. forcing link register to another return address

D. forcing the stack pointer to another context table address (TCB)

E. A&C

[✓ F.] B&D

2) The .... decides which thread should be executing by examining the priority assigned to each thread by the application designer

A. Systick handler

B. Kernel

[✓ C.] TCB

3) what is the register that its value should change to change the task TCB and do the context switching:

[✓ A.] Stack Pointer

B. Program Counter

C. Link Register

D. PSR

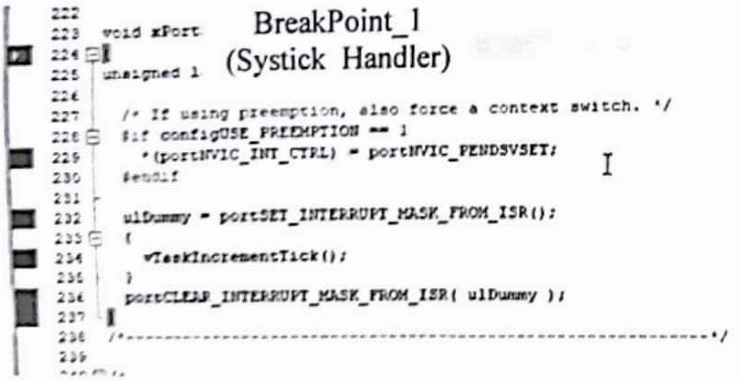
4) If you put a break points into Kernel and Systick handler as shown below, calling VtaskDelay() API would make the processor hit:

[✓ A.] BreakPoint_1 then another ready task

B. BreakPoint_2 then another ready task

C. BreakPoint_2 then BreakPoint_1 then another ready task

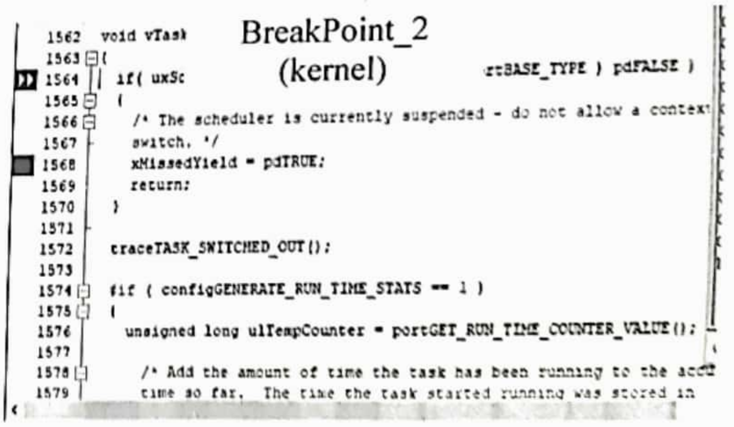
D. BreakPoint_1 then BreakPoint_2 then another ready task



```
void xPort
{
unsigned l

  /* If using preemption, also force a context switch. */
  #if configUSE_PREEMPTION == 1
    *(portNVIC_INT_CTRL) = portNVIC_PENDSVSET;
  #endif

  ulDummy = portSET_INTERRUPT_MASK_FROM_ISR();
  {
    vTaskIncrementTick();
  }
  portCLEAR_INTERRUPT_MASK_FROM_ISR( ulDummy );
}
/*-----------------------------------------------------------*/
```



```
void vTask
{
  if( uxSc                                    rtBASE_TYPE ) pdFALSE )
  {
    /* The scheduler is currently suspended - do not allow a context
    switch. */
    xMissedYield = pdTRUE;
    return;
  }

  traceTASK_SWITCHED_OUT();

  #if ( configGENERATE_RUN_TIME_STATS == 1 )
  {
    unsigned long ulTempCounter = portGET_RUN_TIME_COUNTER_VALUE();

      /* Add the amount of time the task has been running to the accu
      time so far.  The time the task started running was stored in
```

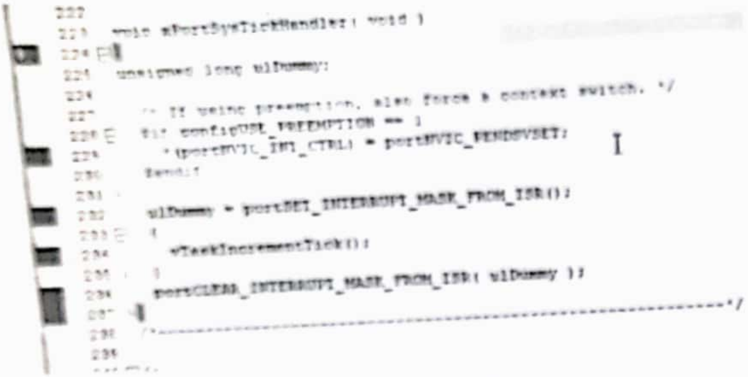
5) If you put a break points into Kernel and Systick handler as shown below, after preempting a continuous task at the end of its time slice the processor will hit:

A. BreakPoint_1 then BreakPoint_2 then another ready task

[✓ B.] BreakPoint_2 then BreakPoint_1 then another ready task

C. BreakPoint_1 then another ready task

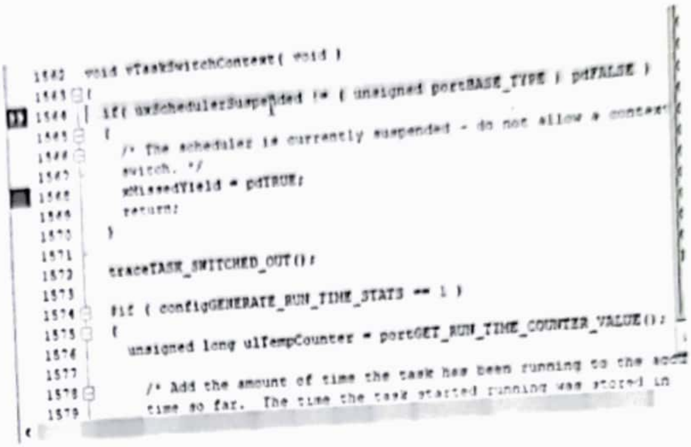
D. BreakPoint_2 then another ready task



```
void xPortSysTickHandler( void )
{
unsigned long ulDummy;

    /* If using preemption, also force a context switch. */
    #if configUSE_PREEMPTION == 1
        *(portNVIC_INT_CTRL) = portNVIC_PENDSVSET;
    #endif

    ulDummy = portSET_INTERRUPT_MASK_FROM_ISR();
    {
        vTaskIncrementTick();
    }
    portCLEAR_INTERRUPT_MASK_FROM_ISR( ulDummy );
}
/*-----------------------------------------------------------*/
```



```
void vTaskSwitchContext( void )
{
    if( uxSchedulerSuspended != ( unsigned portBASE_TYPE ) pdFALSE )
    {
        /* The scheduler is currently suspended - do not allow a contex
        switch. */
        xMissedYield = pdTRUE;
        return;
    }

    traceTASK_SWITCHED_OUT();

    #if ( configGENERATE_RUN_TIME_STATS == 1 )
    {
        unsigned long ulTempCounter = portGET_RUN_TIME_COUNTER_VALUE();

            /* Add the amount of time the task has been running to the acc
            time so far.  The time the task started running was stored in
```

BreakPoint_1
(Systick Handler)

BreakPoint_2
(kernel)

Question 4:

In a FreeRtos Project two short periodic tasks having the same priority was created:

- Task_1 toggles the Red LED every 1 seconds
- Task_2 toggles the Blue LED every 2 seconds
- Task_3 toggles the ~~Blue~~ LED every 3 seconds Green.

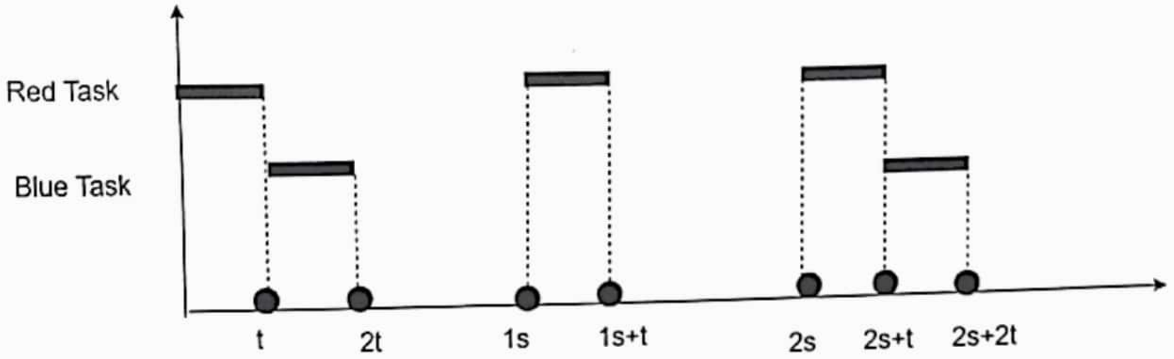
Draw its timing Diagram (for the first 4 seconds) for each of these cases:

- if the periodicity of each task was achieved using **vTaskDelay();**
- if the periodicity of each task was achieved using **vTaskDelayUntil();**

Knowing that t = execution time for each of the tasks

Question 4:

Write the code that achieves this timing diagram



t < time slice

You can use these functions to toggle the LEDS:

```
InitializeLeds();
ToggleRedLed();
ToggelBlueLed();
ToggleGreenLed();
```

```
void Task_1( void *pvParameters );
void Task_2( void *pvParameters );
void Task_3(void * pv_Parameters);

const char *pcTextForTask1 = "Red Task is running\n";
const char *pcTextForTask2 = "Blue Task is running\n";
const char *pcTextForTask3 = "~~InitTask~~ Green is running\n";

int main( void )
{ xTaskCreat(InitTask(), "Task_0", 240(void *) pcTextforTask0, 5, Null);
xTaskCreate( .RedTask(), "Task_1", 240, (void*)pcTextForTask1, ....1., NULL );
xTaskCreate( ..BlueTask(), "Task_2", 240, (void*)pcTextForTask2, ...2, NULL );
xTaskCreate( ..GreenTask() "Task_3", 240, (void*)pcTextForTask3, ...3.., NULL );
}
```

```
void InitTask(void)
{   PortF_initialization();                    portB_initialization();
    ~~Initializeleds();~~                      //Red LED in port B
                                               // Blue LED in Port B
                                               // Green LED in port B
```

```
        // Suspend ourselves.
      vTaskSuspend( NULL );
}


void BlueTask(void)
{
    TickType_t xLastWakeTime;

    xLastWakeTime = xTaskGetTickCount();

    while(1)
    {                                                        //oR use
      GPIO_PORTB_DATA_R ^= 0X04;  //Toggle Blue Led();
      vTaskDelayuntil( &lastWakeTime, 2/Port TICK_RATE_Ms);
    }
}


void RedTask(void)
{
      TickType_t xLastWakeTime;

      xLastWakeTime = xTaskGetTickCount();

      while(1)
      {                                                     //oR use
          GPIO_PORTB_DATA_R ^= 0xo2;  // ToggleRedLed();
          vTaskDelayUntil(&LastwakeTime, 1/ portTIck_RATE_Ms);
      }

}
void GreenTask (void) { TickType_t xLastWakeTime;
xLastWakeTime = xTaskGetTick Count ();
while (1){                                                   //oR use
      GPIo_PoRTB_DATA_R ^= 0x08;  //ToggleGreenLed
```

```
      vTaskDelayUntil(&LastWakeTime, 3/portTIck_RATE_Ms
      }
}
```