ASSIGNMENT 5

Contents

SIMULATION ASSIGNMENT

- Modify the python code in P_RM.py to use firstfit instead of the current algorithm. Please follow the steps in This document.
- -Schedule the following task set on three processors using your modified algorithm.

PROGRAMMING PART

- -Create a task "matrixtask" containing the following functionality
- -Create a queue and send the content of (double **)c to the queue in matrixtask with before the vTaskDelay() call (hint: place the c variable in a struct). (More information Here).
- -Create a reader task which reads the content of the queue in case there is something in the queue.
- -In case the queue has some content it should save the data in a local (double **) variable.
- -Print out the content of the (double **)c variable in case the content is updated. The data transferred from c should be a 10x10 matrix with the value 390 in each slot.
- A screenshot of the execution

SIMULATION ASSIGNMENT

The assignment is to modify a real-time simulator to verify feasibility of a set of tasks.

Modify the python code in P_RM.py to use firstfit instead of the current algorithm. Please follow the steps in This document.

-Hint: Instead of scheduling the task to the CPU with the lowest utilization chose the first one which has a lower utilization than Urm(x+1) where x is the already scheduled tasks on the CPU

-Hint2: have a look at the def packer(self) function in the file P_RM.py

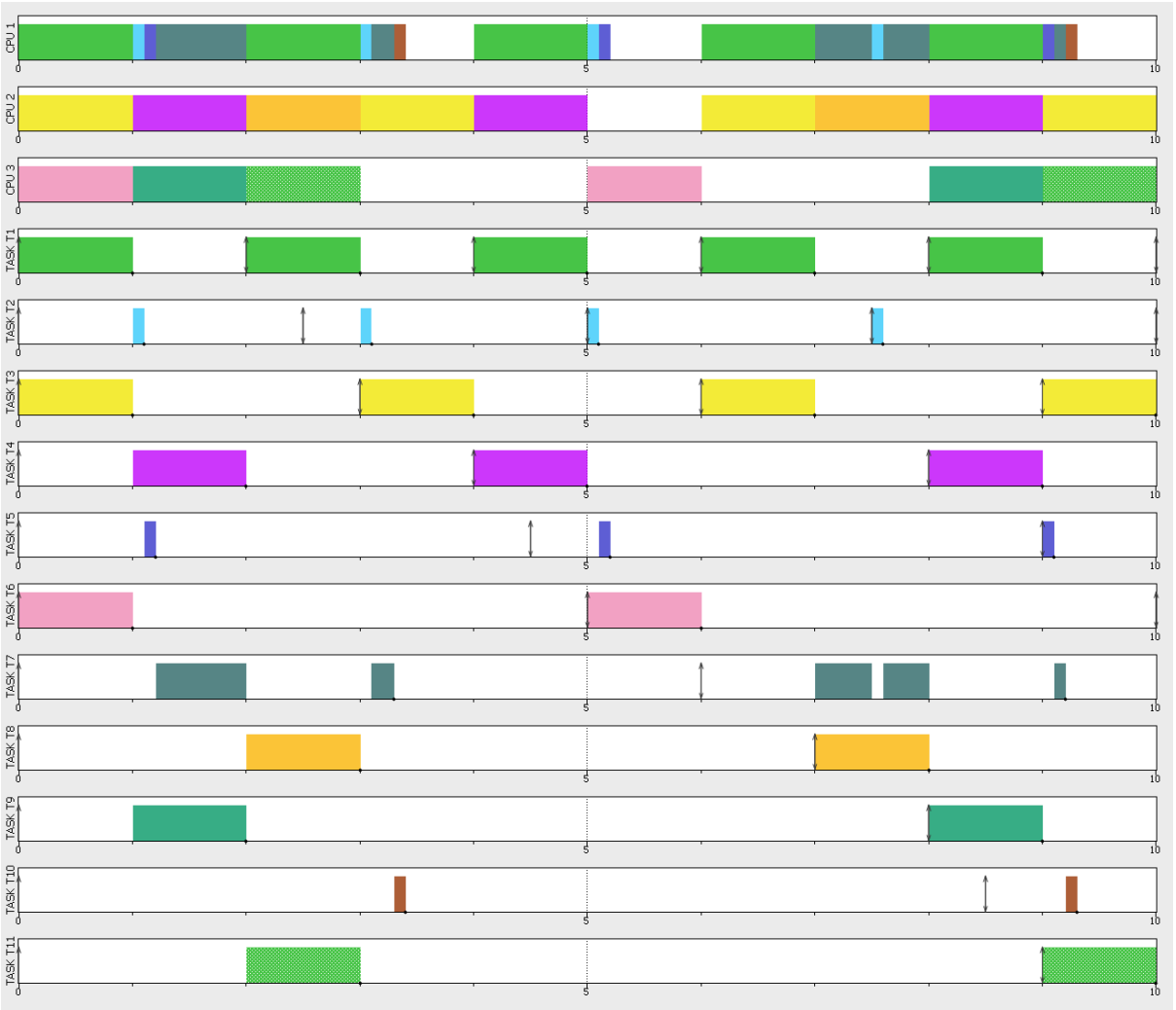
```
def packer(self):
      # First Fit
      cpus = [[cpu, 0] for cpu in self.processors]
      numCPUs = len(cpus)
      print "CPU num: ", numCPUs
      taskNUM = [0] * numCPUs
      Urm = 0.0
      U = 0.0
      for task in self.task_list:
            #m = cpus[0][1]
            j = 0
            # Find the processor with the lowest load.
            for i, c in enumerate(cpus):
                  Urm = (taskNUM[i]+1.0) * ((pow(2.0, 1/(taskNUM[i]+1.0))) - 1.0)
                  U = (c[1] + (task.wcet / task.period))
                  print "CPU U = ",c[1]
                  print "U after scheduling = ",U
                  print "Urm = ", Urm
                  if U < Urm:
                  j = i
                  break
            taskNUM[j] = taskNUM[j] + 1
            print "CPU scheduled = ",j
            print "Tasks = ", taskNUM

            # Affect it to the task.
            self.affect_task_to_processor(task, cpus[j][0])

            # Update utilization.
            cpus[j][1] += float(task.wcet) / task.period
      return True
```

-Schedule the following task set on three processors using your modified algorithm.

T1(2,1) T2(2.5,0.1) T3(3,1) T4(4,1) T5(4.5,0.1) T6(5,1) T7(6,1) T8(7,1) T9(8,1) T10(8.5,0.1) T11(9,1)

General | Scheduler | Processors | Tasks

id	Name	Task type	Abort on miss	Act. Date (ms)	Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)	Followed by
1	TASK T1	Periodic	Yes	0.0	2.0	-	2.0	1.0	
2	TASK T2	Periodic	Yes	0.0	2.5	-	2.5	0.1	
3	TASK T3	Periodic	Yes	0.0	3.0	-	3.0	1.0	
4	TASK T4	Periodic	Yes	0.0	4.0	-	4.0	1.0	
5	TASK T5	Periodic	Yes	0.0	4.5	-	4.5	0.1	
6	TASK T6	Periodic	Yes	0.0	5.0	-	5.0	1.0	
7	TASK T7	Periodic	Yes	0.0	6.0	-	6.0	1.0	
8	TASK T8	Periodic	Yes	0.0	7.0	-	7.0	1.0	
9	TASK T9	Periodic	Yes	0.0	8.0	-	8.0	1.0	
10	TASK T10	Periodic	Yes	0.0	8.5	-	8.5	0.1	
11	TASK T11	Periodic	Yes	0.0	9.0	-	9.0	1.0	



PROGRAMMING PART

```
#define SIZE 10
#define ROW SIZE
#define COL SIZE
static boolean matrix_running = FALSE;
static boolean ap_running = FALSE;
static int matrix_period = 0;
int volatile size_2 = 0;
typedef struct Cmatrix_ {
    double **c;

} Cmatrix;
;
QueueHandle_t Qhandle;
```

-Create a task "matrixtask" containing the following functionality

-Create a queue and send the content of (double **)c to the queue in matrixtask with before the vTaskDelay() call (hint: place the c variable in a struct). (More information Here).

```
static void matrix_task() {
    int i;
    double **a = (double**) pvPortMalloc(ROW * sizeof(double*));
    for (i = 0; i < ROW; i++)
       a[i] = (double*) pvPortMalloc(COL * sizeof(double));
    double **b = (double**) pvPortMalloc(ROW * sizeof(double*));
    for (i = 0; i < ROW; i++)
       b[i] = (double*) pvPortMalloc(COL * sizeof(double));
    double **c = (double**) pvPortMalloc(ROW * sizeof(double*));
    for (i = 0; i < ROW; i++)
       c[i] = (double*) pvPortMalloc(COL * sizeof(double));
    double sum = 0.0;
    int j, k, l;
    for (i = 0; i < SIZE; i++) {
       for (j = 0; j < SIZE; j++) {
             a[i][j] = 1.5;
             b[i][j] = 2.6;
       }
    }

    while (1) {
       matrix_running = TRUE;
       matrix_period = 0;
       long simulationdelay;
       for (simulationdelay = 0; simulationdelay < 1000000000;simulationdelay++) ;
       for (i = 0; i < SIZE; i++) {
             for (j = 0; j < SIZE; j++) {
                   c[i][j] = 0.0;
             }
       }
       for (i = 0; i < SIZE; i++) {
             for (j = 0; j < SIZE; j++) {
                   sum = 0.0;
                   for (k = 0; k < SIZE; k++) {
                         for (l = 0; l < 10; l++) {
                               sum = sum + a[i][k] * b[k][j];
                         }
                   }
                   c[i][j] = sum;
             }
       }
       vTaskDelay(100);
       matrix_running = FALSE;
       Cmatrix dataSent;
```

```
fflush(stdout);
dataSent.c = (double**) pvPortMalloc(ROW * sizeof(double*));
for (i = 0; i < ROW; i++) {
      //printf("sent");
      fflush(stdout);

      dataSent.c[i] = (double*) pvPortMalloc(COL * sizeof(double));
      //printf("sent");
      fflush(stdout);

      for (j = 0; j < SIZE; j++) {
            dataSent.c[i][j] = c[i][j];
      }
}
xQueueSend(Qhandle, &dataSent, (TickType_t ) 0);
size_2 = uxQueueMessagesWaiting(Qhandle);
printf("matrix_period %d _ q size %d __\n",
            matrix_period * portTICK_PERIOD_MS,
            size_2);
fflush(stdout);    } }
```

-Create a reader task which reads the content of the queue in case there is something in the queue.

-In case the queue has some content it should save the data in a local (double **) variable.

-Print out the content of the (double **)c variable in case the content is updated. The data transferred from c should be a 10x10 matrix with the value 390 in each slot.

```
int volatile size_1 = 0;

static void read_task() {
    while (1) {
       if (size_1 >= size_2 && size_1 >0) {
            //read
            Cmatrix result;
            xQueueReceive(Qhandle, &result, 0);
            printf("read\n");
            fflush(stdout);
            for (int i = 0; i < ROW; i++) {
                  for (int j = 0; j < SIZE; j++) {
                        printf("c[%d][%d]= %f ",i,j,result.c[i][j]);

                  }
                  printf("\n");
                  fflush(stdout);
            }


       }
        size_1 = uxQueueMessagesWaiting(Qhandle);

       vTaskDelay(100);
    }
}
xTaskHandle matrix_handle;
xTaskHandle read_task_handle;
```

A screenshot of the execution